



Heat Pump Market: Latest Trends and How to Engage Customers

Green Energy Contractor Conference
November 29, 2018

Overview

Theme of the day:
strategic electrification

Discussion:

- CT's heat pump market
- Technical perspective
- Regional overview
- Financing & engagement opportunities



Heat Pump Trends & Consumer Engagement

EVERSOURCE



UI



SCG



CNG

Deep Decarbonization

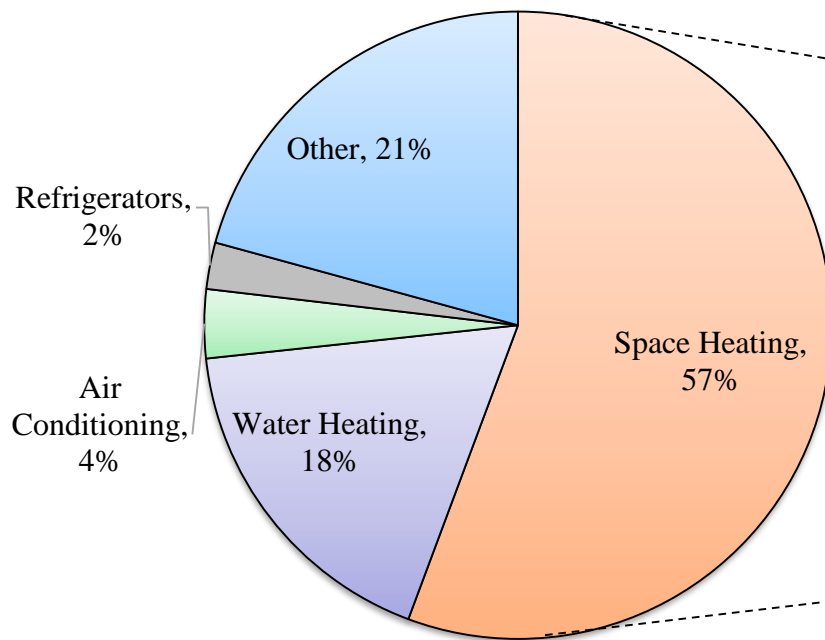
Public Act 08-98 – An Act Concerning Global Warming Solutions

Reduce statewide GHG emissions by 80% below 2001 levels by 2050

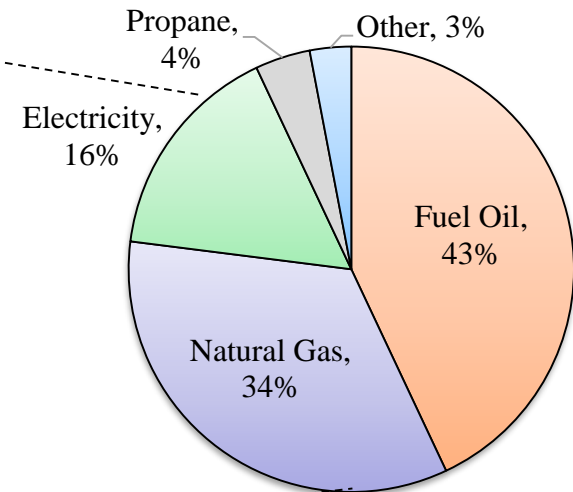


Home Energy Consumption: A Primer

Average Northeast Household Energy Consumption by End-Use



Primary Energy Source for Space Heating by % of Total Households



Three Key Strategies for Strategic Electrification



Advanced Electric Technologies

- Electric Vehicles (EV)
- Air-Source Heat Pumps (Ducted & Ductless)
- Ground-Source Heat Pumps (GSHP)
- Variable Refrigerant Flow (VRF)

Deep Energy Efficiency

- Passive Design principles
- Air-tight thermal envelope
- Well-insulated/Minimal thermal bridging
- DHW & HVAC systems suited for smaller energy loads

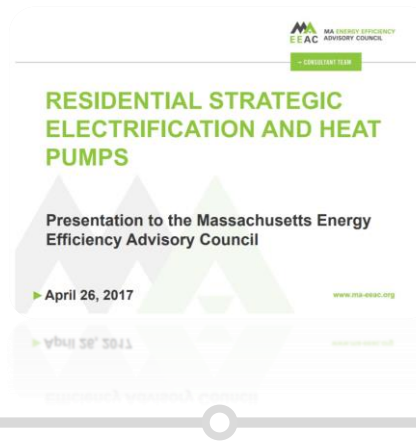
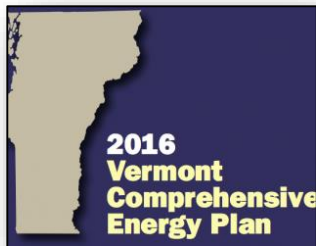
Grid Integration

- Control strategies to allow for demand response and load shifting capabilities
- Grid-responsive building design to maintain thermal comfort while shifting operational loads and run-times

Regional Efforts: Strategic Electrification & Heat Pumps

2016

VT integrates strategic electrification into statewide *Comprehensive Energy Plan*

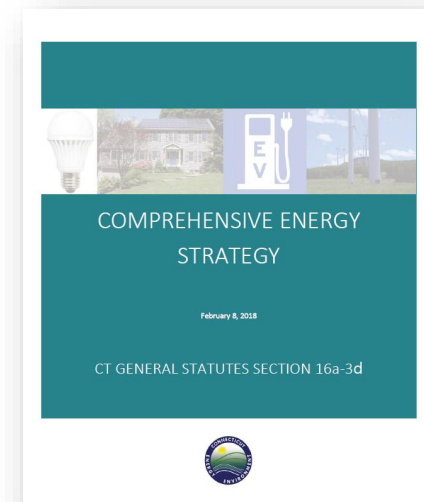


2017

MA Energy Efficiency Advisory Council presentation *Residential Strategic Electrification & Heat Pumps*

2018

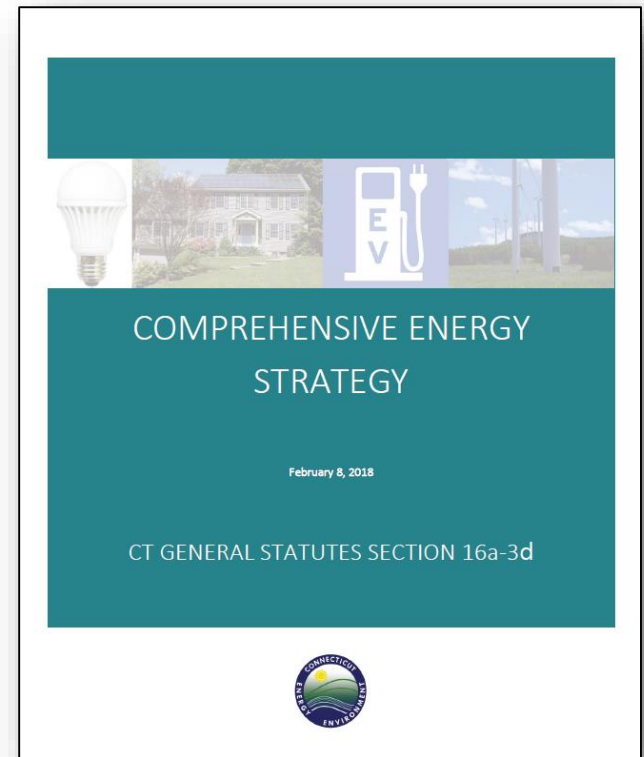
CT DEEP publishes *Comprehensive Energy Strategy* (CES) with plans to transition to cleaner thermal fuels and technologies through strategic electrification



Policy Support for Heat Pumps: CT Comprehensive Energy Strategy

Transition to cleaner thermal fuels and technologies

- To continue the state's progress toward meeting Global Warming Solutions Act goals and improve air quality, decarbonization of thermal systems is necessary.
- DEEP recommends encouragement of renewable thermal technologies (RTT), and in particular heat pumps, that in the summer can provide efficient cooling and in the winter can cost-effectively displace conventional heating fuels/sources



Strategic Electrification of Homes



Key Concepts

- Decarbonization
- Strategic Electrification



Key Strategies

- Fuel switching to displace or replace fossil fuel heating
- Low heating loads make heat pumps more advantageous
- Enhanced incentives for “all-electric” EE homes



Key Technologies

- Heat Pumps (Air-Source, Ground-Source, Water Heaters)
- High Performance Building Envelope
- Balanced Mechanical Ventilation (HRV/ERV) Systems

CT Ductless Heat Pump Program

- In 2017, Energize CT transitioned to offering instant discount rebates to qualifying DSHPs through participating HVAC Distributors.
- In 2018, the program has 57 active Memorandums of Understanding
 - Equipment installation information required.
- Field support reps “circuit riders” provide training to sales associates and store managers about program guidelines
- Energize CT has partnered with manufacturers and Distributors to promote the installation of ductless heat pump systems via training to installation contractors.

SAVE \$300-\$500 INSTANTLY
on an ENERGY STAR® Ductless Split Heat Pump

ENERGY STAR
SINGLE UNIT INDOOR SYSTEM
\$300 PER HOME
for 20 SEER¹ / 10 HSPF²

ENERGY STAR
MULTI UNIT INDOOR SYSTEM
\$500 PER HOME
for 18 SEER / 9 HSPF

UP TO \$500 REBATE*

1 SEER - Seasonal Energy Efficiency Ratio
2 HSPF - Heating and Seasonal Performance Factor

* An additional \$100 mail-in rebate is available for homes with existing electric radiant heating (EMRH) or Home Energy Solutions (HES) equipment prior to installation. HES Rebates will provide the \$200 rebate form. Instant discount is available to all qualified residential installations in Central Connecticut (CJ) or Downstate electric service territory with a maximum of 2 systems per home.

For more information call
877 WISE USE
(877-947-3873)
or visit
EnergizeCT.com

ASK OUR SALES AND SERVICE TEAM FOR DETAILS.

SPECIAL PRICING BROUGHT TO YOU BY

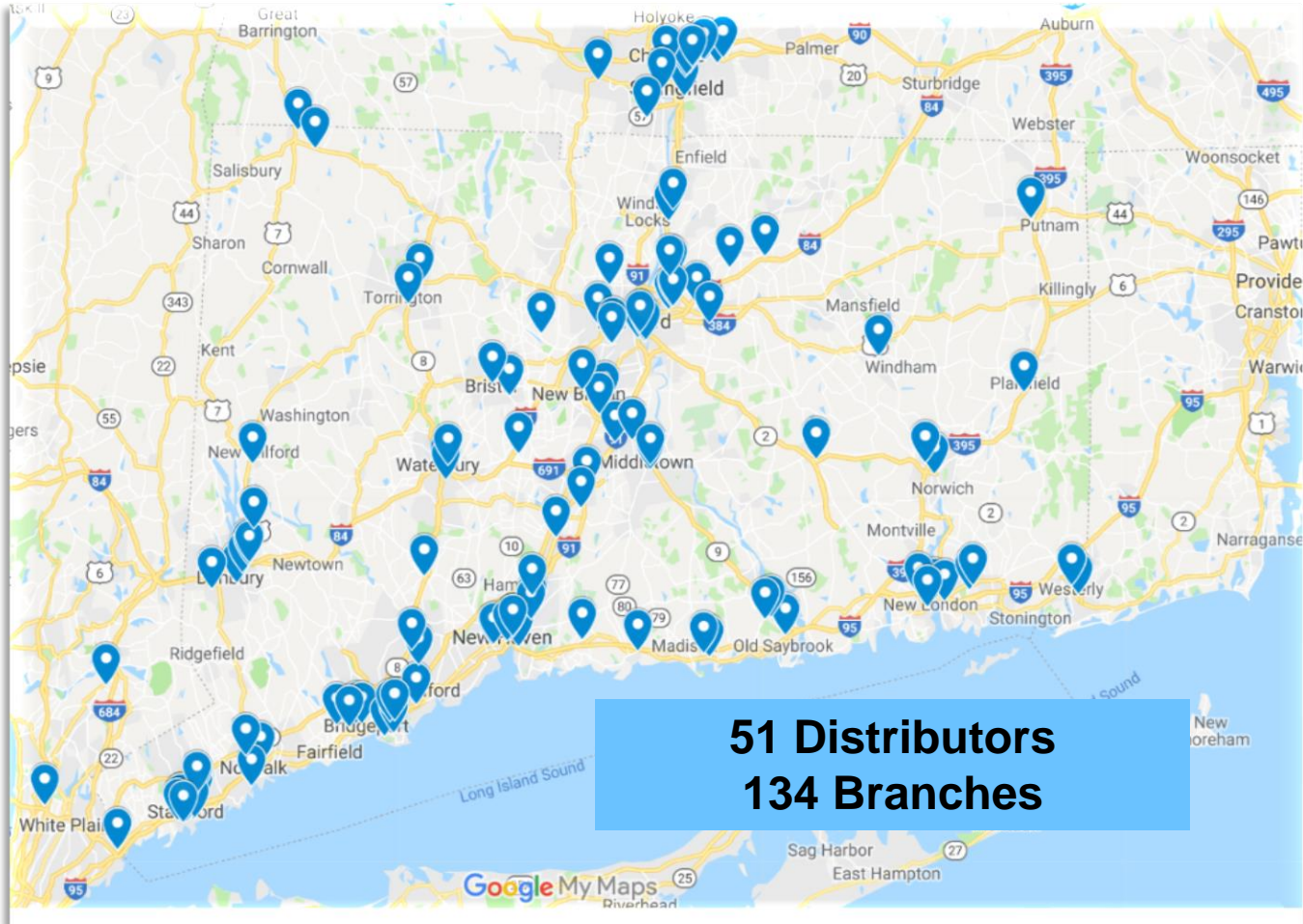




Energize Connecticut helps you save money and use clean energy. It is an initiative of the State of Connecticut, the Connecticut Green Bank, Eversource, UI, and CHS, with funding from a charge on customer energy bills. Information on energy-saving programs can be found at EnergizeCT.com or by calling 877 WISE USE.

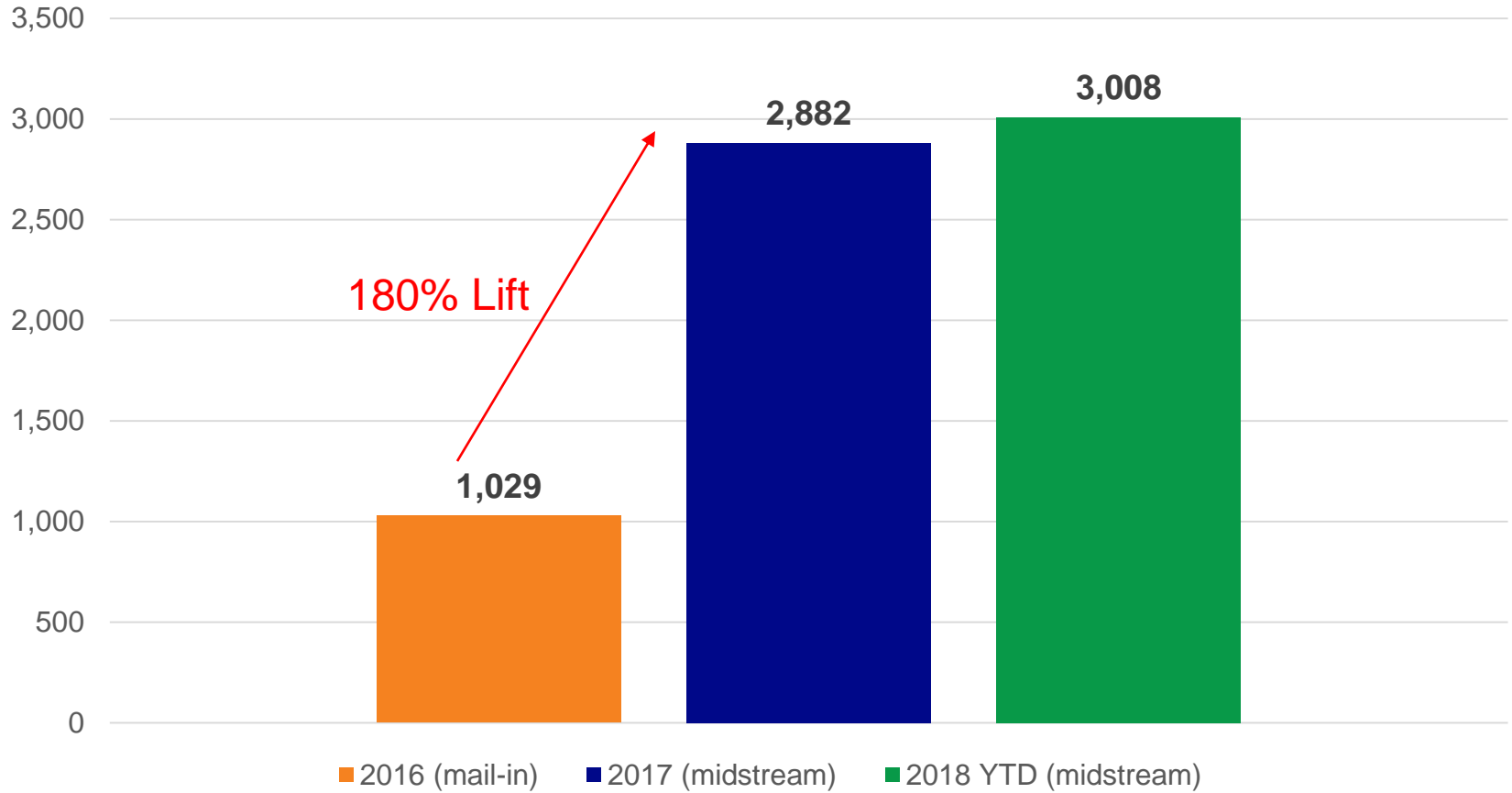
Equipment Type	Qualification Criteria	Incentive Amount
Ductless Heat Pump	ENERGY STAR certified Single Indoor Unit: 20 SEER, 12.5 EER, 10 HSPF	A \$300 instant discount to licensed contractors at participating distributor locations
Ductless Heat Pump	ENERGY STAR certified Multi-Indoor Unit: 18 SEER, 12.5 EER, 9 HSPF	A \$500 instant discount to licensed contractors at participating distributor locations
Central Air Source Heat Pump System	16 SEER, 12.5 EER, 10 HSPF ENERGY STAR and AHRI certified	\$500 mail-in rebate per system

Distributor Participation



Ductless Heat Pump Results

Ductless Heat Pump Rebates



HEAT PUMP TRENDS & HOW TO EDUCATE CUSTOMERS

Bordering CT



Energize CT

\$300/home – 20/12.5/10 - single
\$500/home – 18/12.5/9 – multi
*\$700 bonus for electric heat
** Upstream starting 1/17

Smart E-Loan

4.99% for 5/7 or 10 year term



Rhode Island

\$300 per – 20 SEER/12 HSPF
\$100 per – 18 SEER/10 HSPF

Mass Save

\$300 per – 20 SEER/12 HSPF
\$100 per – 18 SEER/10 HSPF
* Stay tuned for Central HP

Heat Loan

0% Loan/7 years

MassCEC

\$500/system ccASHP – Single
\$500/ton ccASHP – Multi

Muni-Helps

\$250 18 SEER/9 HSPF

* Ashburnham, Boylston, Chicopee, Holden, Hull, Ipswich, Marblehead, Peabody, Princeton, Russell, Shrewsbury, South Hadley, Sterling, Templeton, West Boylston

New York

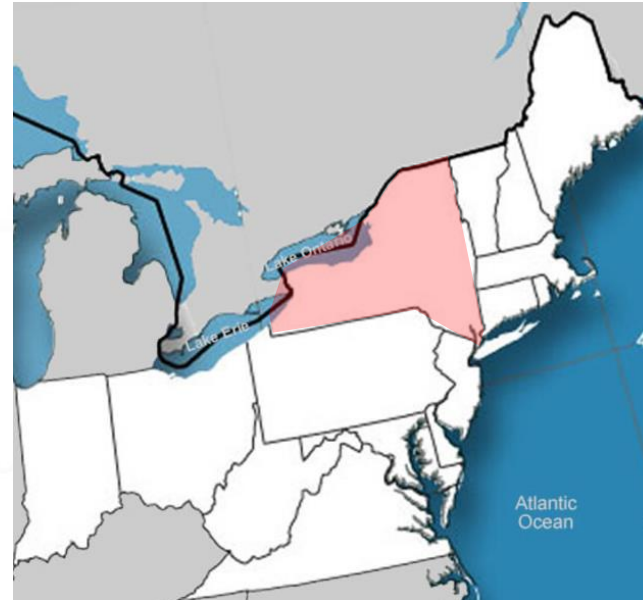


NYSERDA

Announced: Aug 17, 2017

\$500 Contractor rebate

- ccASHP in any home.
- Entire state except Long Island
- Contractors must sign up to participate.
- Marketing available in September (\$50k per contractor or distributor, cost share)

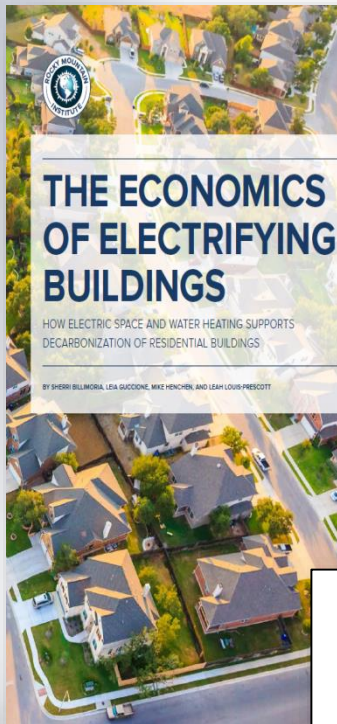






Participating Utilities

- Central Hudson Gas & Electric Corporation
- Con Edison
- National Fuel
- National Grid -Niagara Mohawk Power
- National Grid-Long Island (KeySpan Gas East Corporation)
- National Grid New York (Brooklyn Union Gas Company)
- NYSEG (New York State Electric and Gas Corporation)
- Orange and Rockland Utilities, Inc.
- RG&E (Rochester Gas and Electric Corporation)



COOLING & HEATING

2017 COMPREHENSIVE ENERGY STRATEGY

Draft Executive Summary: July 26th, 2017

CT GENERAL STATUTES SECTION 16a-3d

Connecticut Department of Energy and Environmental Protection



Strategic
Investment



RENEWABLE
ENERGY
STRATEGY

Office of Energy Resources

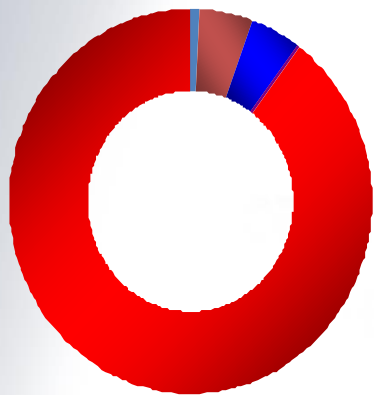


One Center Plaza, Suite 100
Boston, MA 02108
(617) 554-4647
www.ener.gov.ct

Strategic Electrification – Only works with this



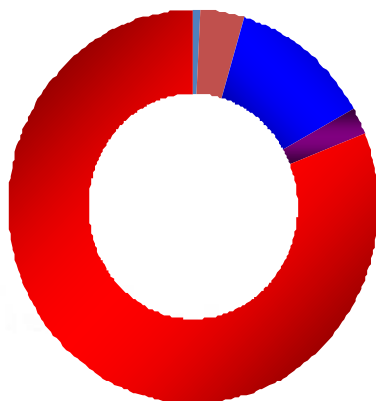
WORLDWIDE USAGE – HUGE OPPORTUNITY



JAPAN

90%

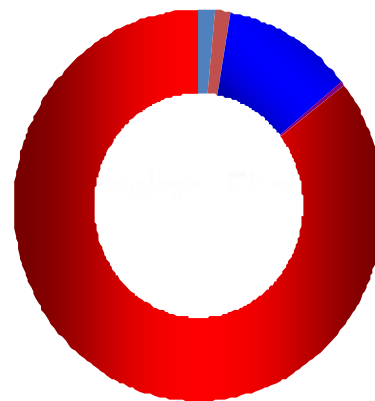
7.2M Systems



CHINA

86%

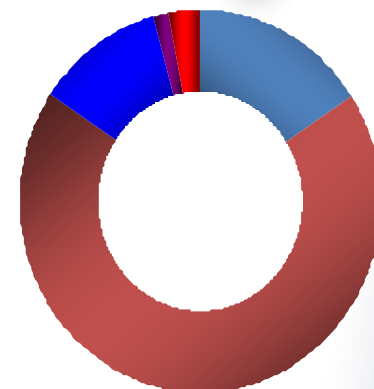
16.7M Systems



EUROPE

81%

7.6M Systems



USA

8%

0.7M Systems

- Window
- Unitary
- Chillers
- Moveble
- Ductless

Ductless is a small percent of the U.S. HVAC market but current building & energy usage trends indicate **tremendous growth opportunity.**

Product Life Cycle



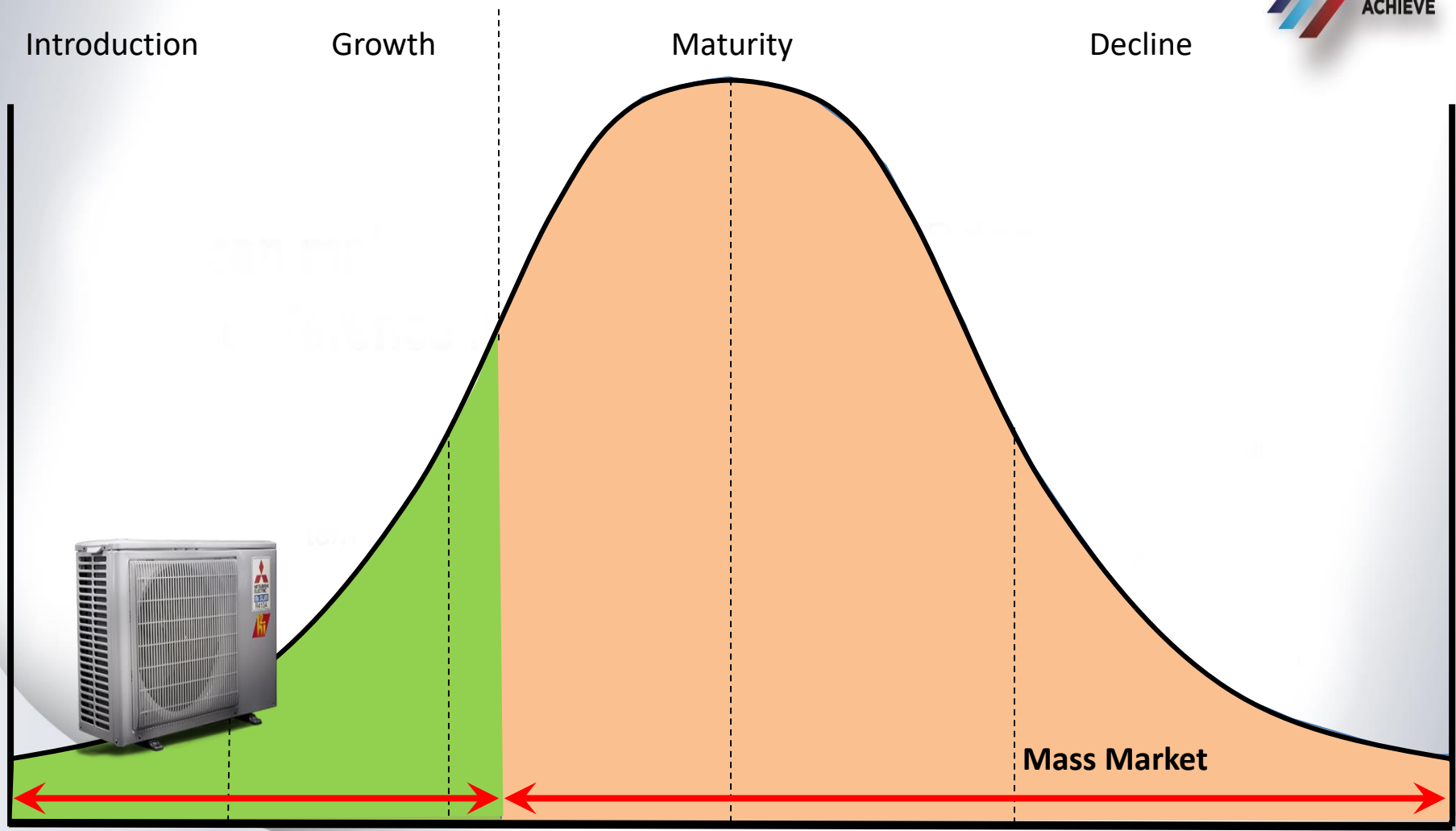
Introduction

Growth

Maturity

Decline

Product Sales



Time

Mass Market

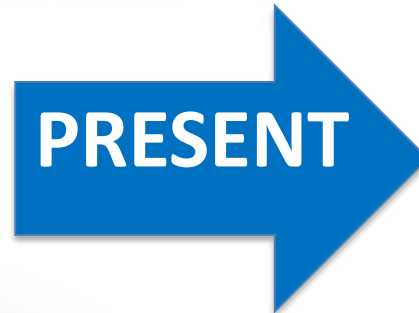
An Evolution has Occurred



1:1 Only
Ductless Only
Spot Cooling Only
Niche Applications
Little Brand Awareness



Multi-Zone
Ducted and Ductless
Zone Comfort Solutions
Whole House Applications
Dominant Brand Awareness

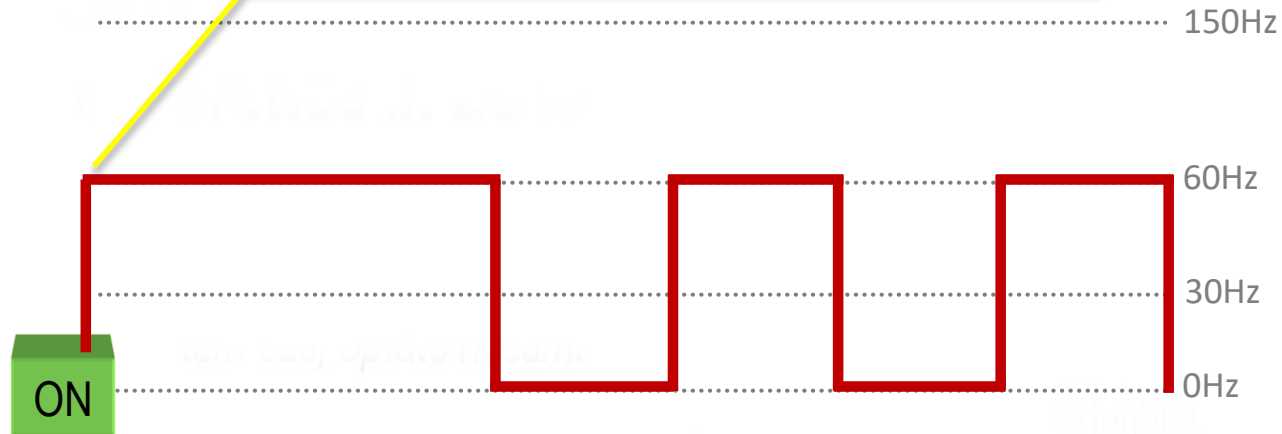


COOLING & HEATING

Conventional Compressor



- High starting current results in energy loss
- On/off cycling results in temp fluctuations and lower efficiency
- Additional strain on system
- Noisier

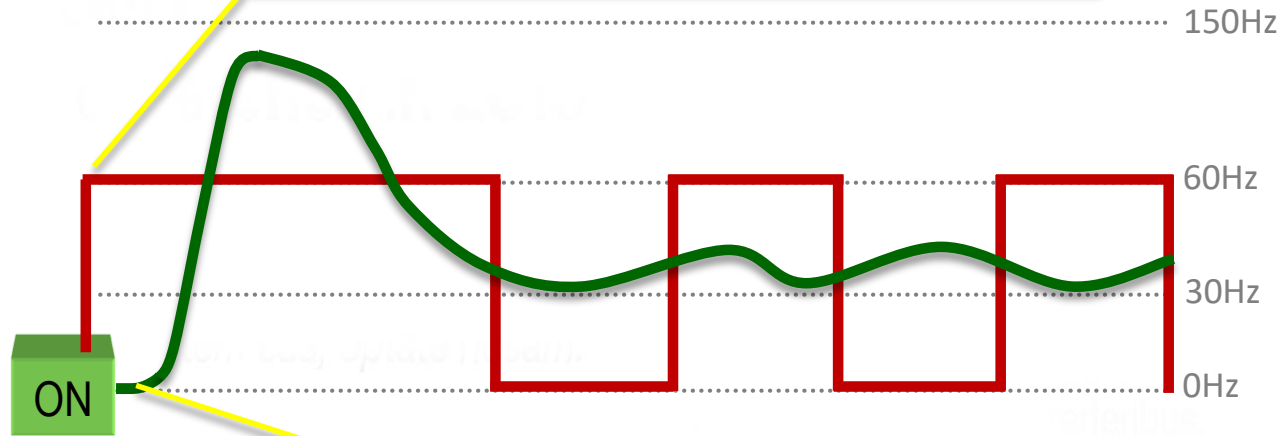


— Conventional compressor

INVERTER Technology



- High starting current results in energy loss
- On/off cycling results in temp fluctuations and lower efficiency
- Additional strain on system
- Noisier



- Starts current at lower level
- Ramps up to high rotation for faster heating/cooling
- Throttles back to maintain temperature
- Energy efficient and quieter



INVERTER compressor

Conventional compressor



COOLING & HEATING

Hartford Heating Season

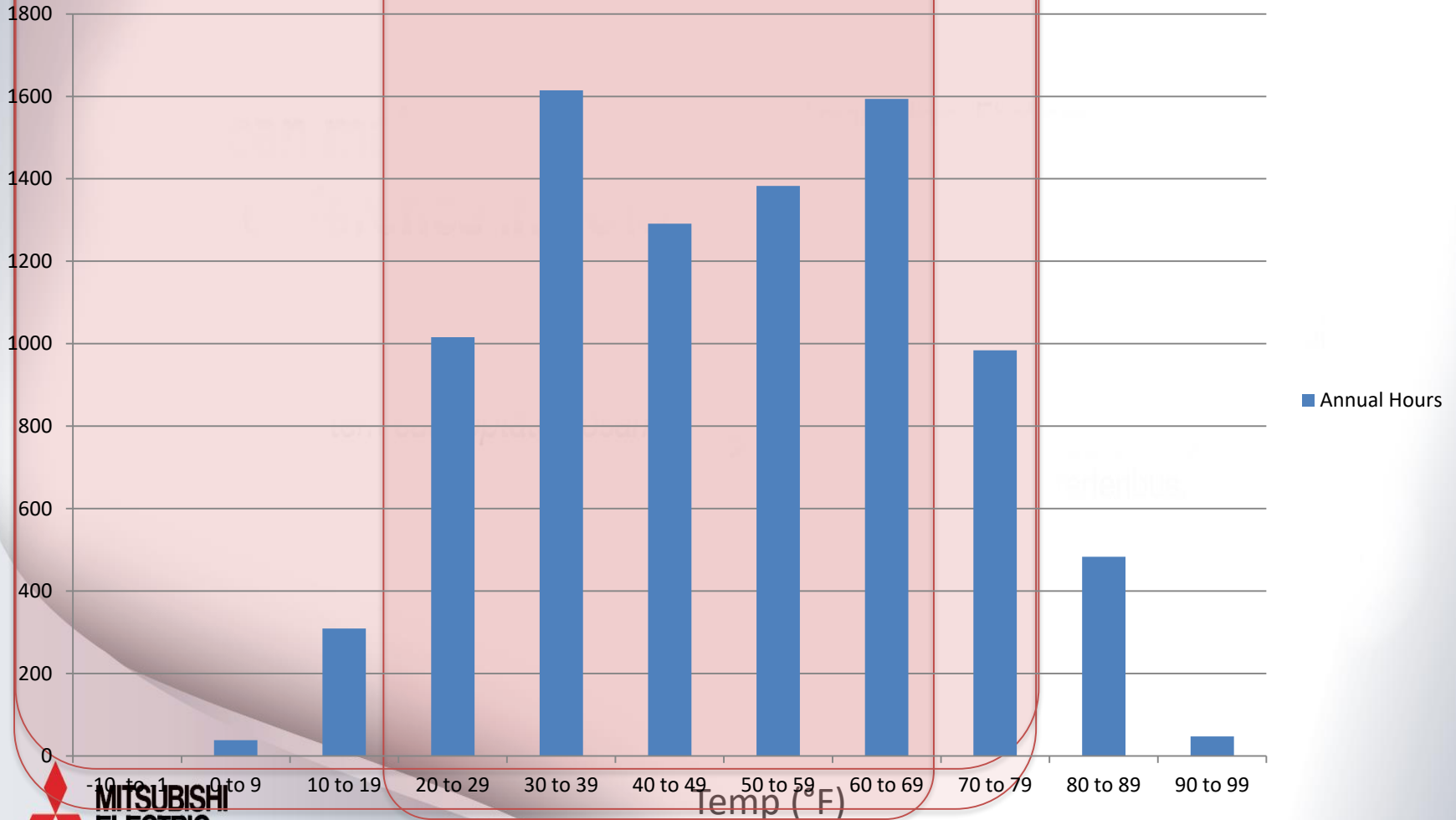


Annual Hrs

100% less ccASHP than electricity/propane

7,216 Heating Hours

Annual Hours



COOLING & HEATING

Source: Engineering Weather Data, Michael Kjelgaard,

ccASHP



WHY HYPER-HEATING MATTERS

In regions with sub-zero weather, traditional heat pumps can't bring in enough heat. H2I units deliver heat even when outdoor temperatures are as low as -13° F, eliminating the need for supplemental heating sources. Hot Start technology provides warm air instantly, eliminating drafts.

47° F



ccASHP



WHY HYPER-HEATING MATTERS

In regions with sub-zero weather, traditional heat pumps can't bring in enough heat. H2i units deliver heat even when outdoor temperatures are as low as -13° F, eliminating the need for supplemental heating sources. Hot Start technology provides warm air instantly, eliminating drafts.



ccASHP



WHY HYPER-HEATING MATTERS

In regions with sub-zero weather, traditional heat pumps can't bring in enough heat. H2i units deliver heat even when outdoor temperatures are as low as -13° F, eliminating the need for supplemental heating sources. Hot Start technology provides warm air instantly, eliminating drafts.



Applications

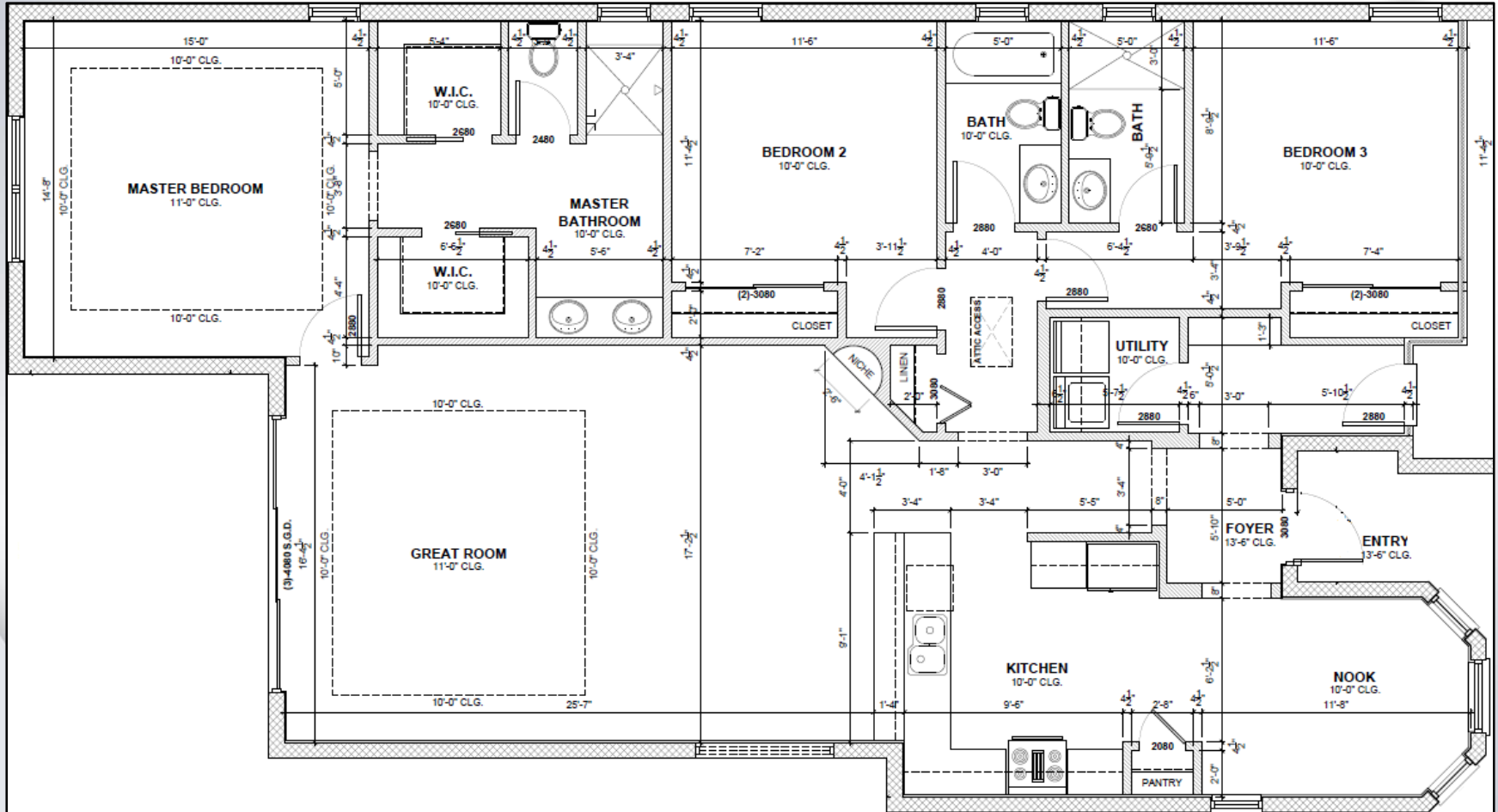
- Single family homes & condos
- Hot and Cold spots
- Additions & renovations
- New construction



Solution is an opinion

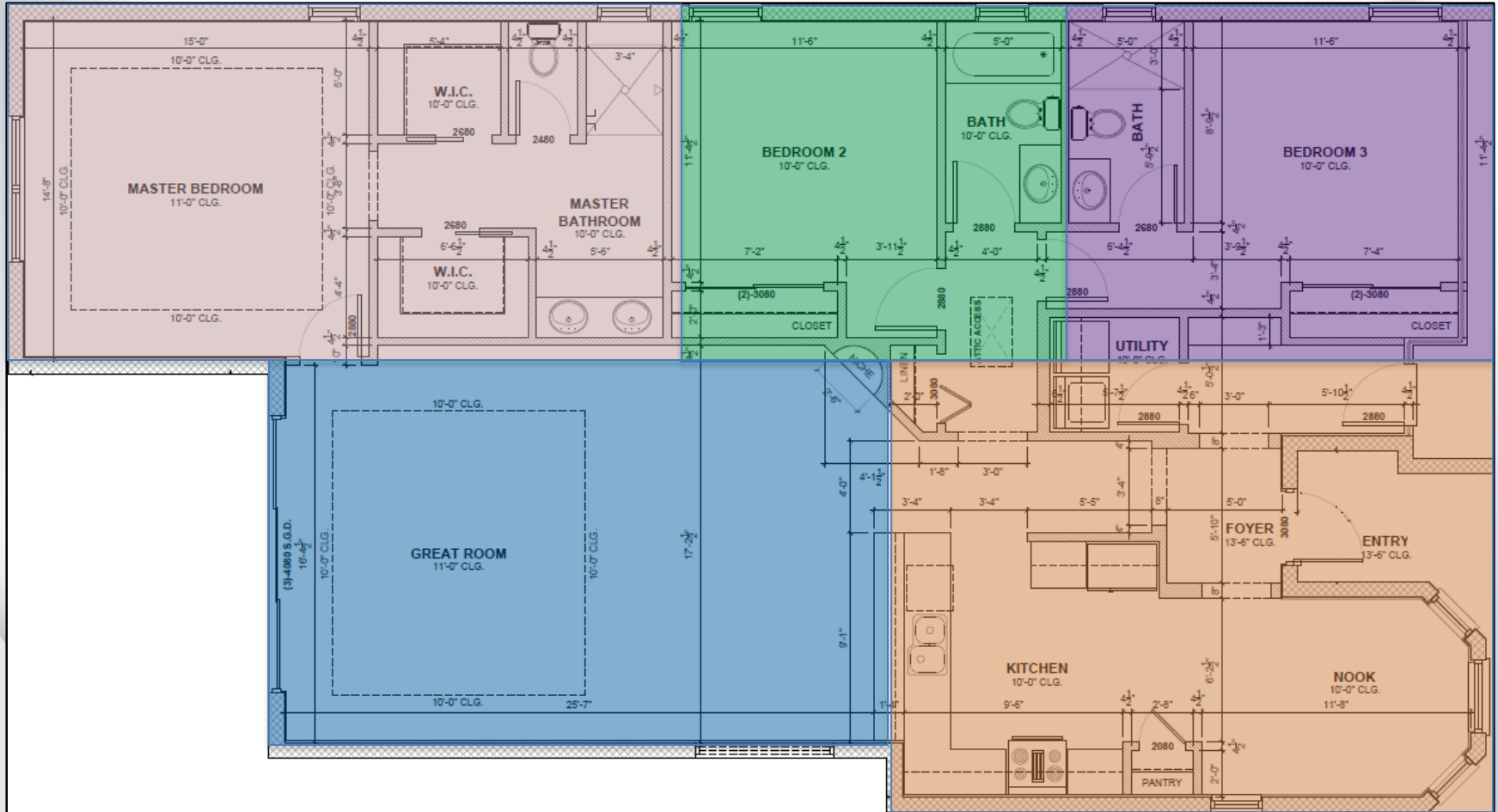


Whole Home Solution



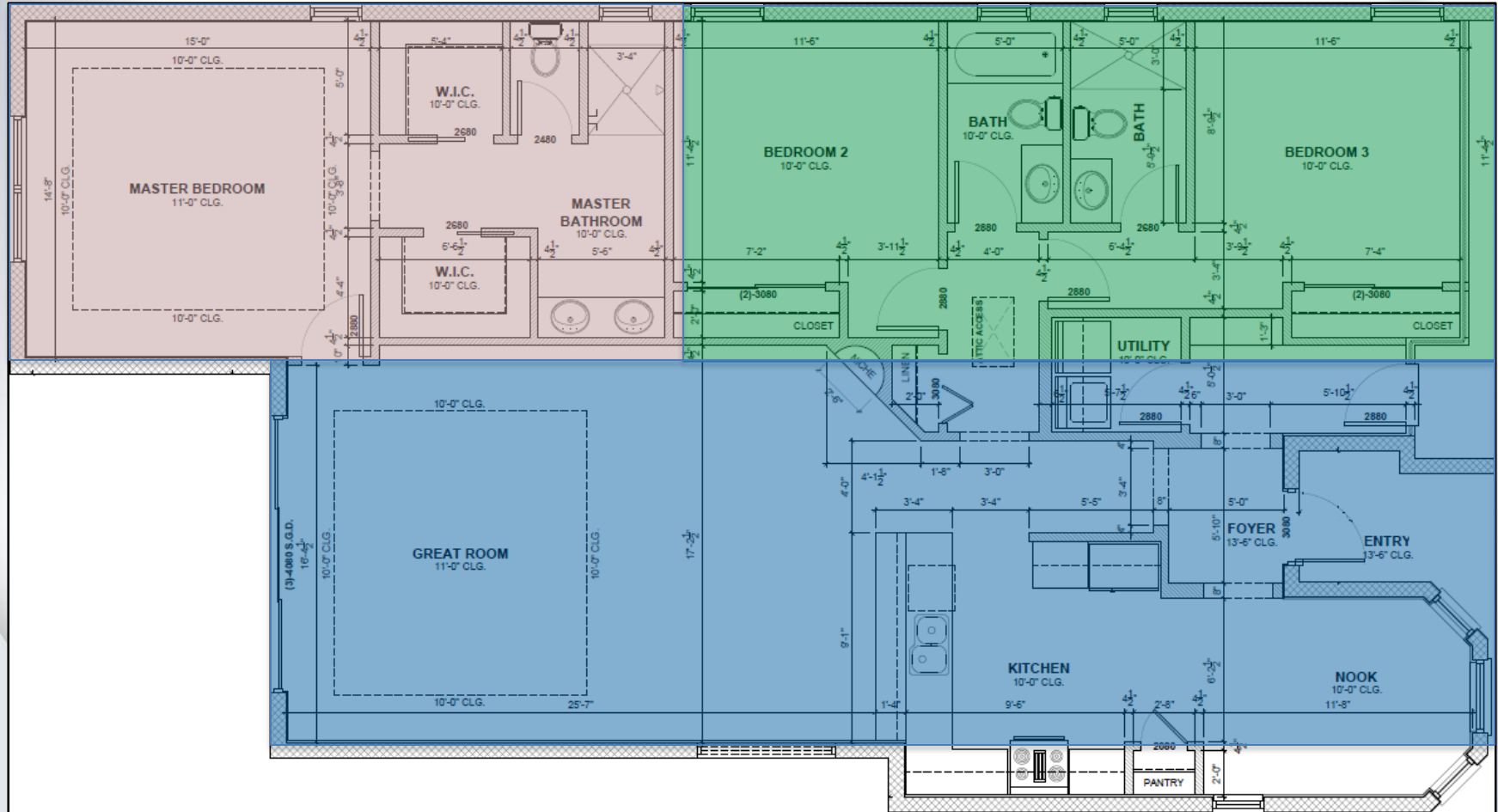
Whole Home Solution

5 single zone systems



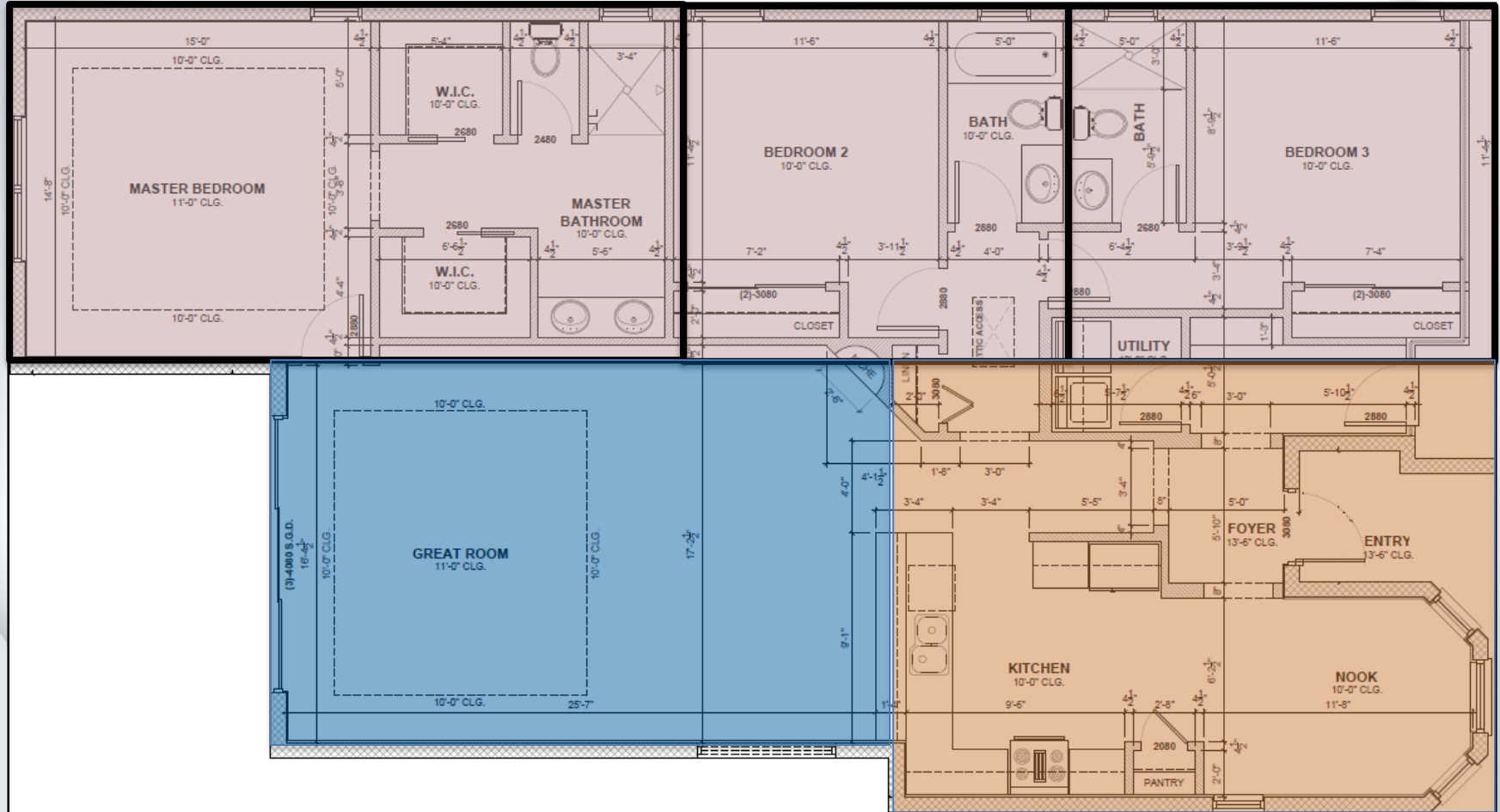
Whole Home Solution

3 single zone systems



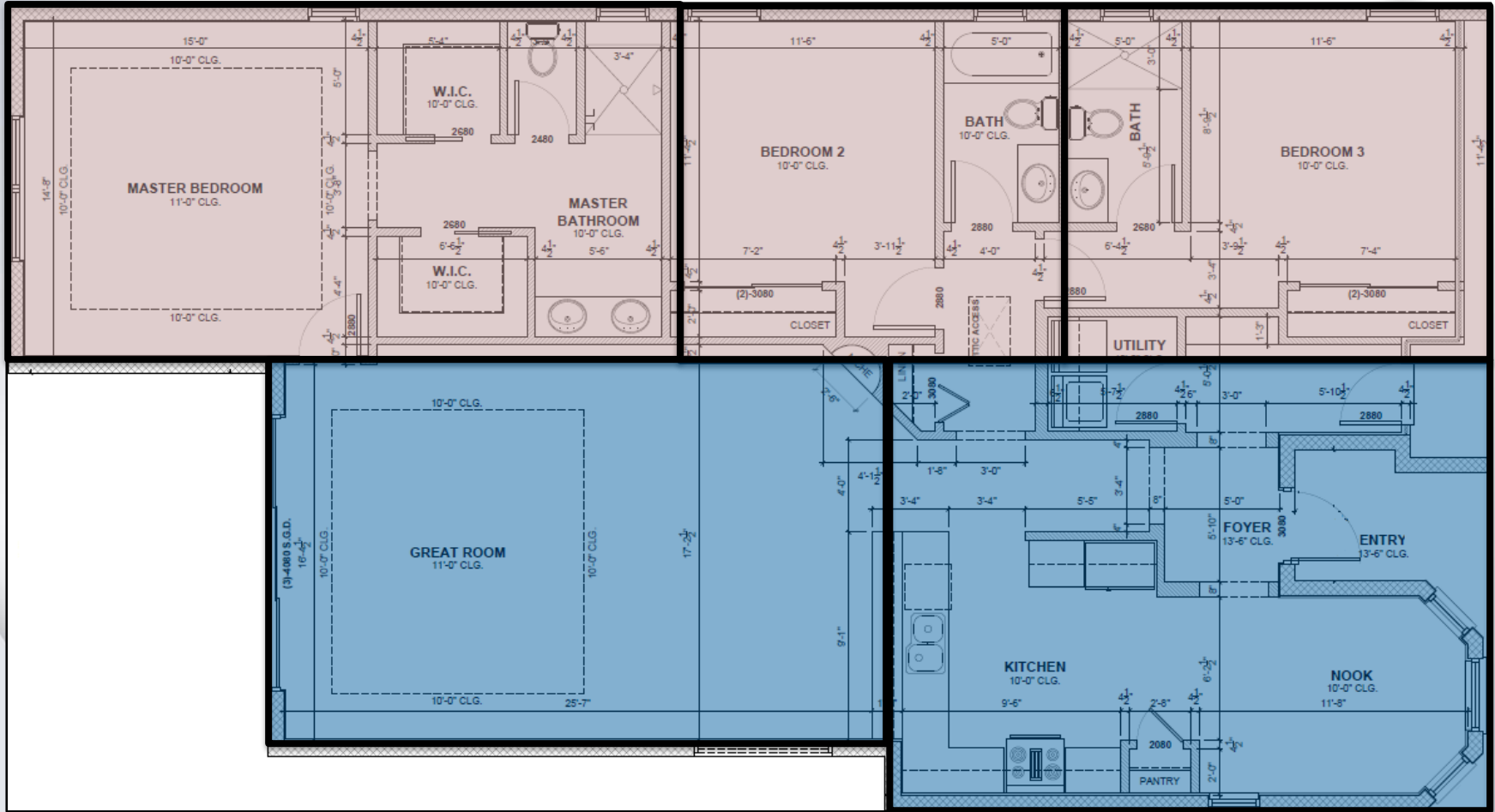
Whole Home Solution

3 zone system and 2 single zone systems



Whole Home Solution

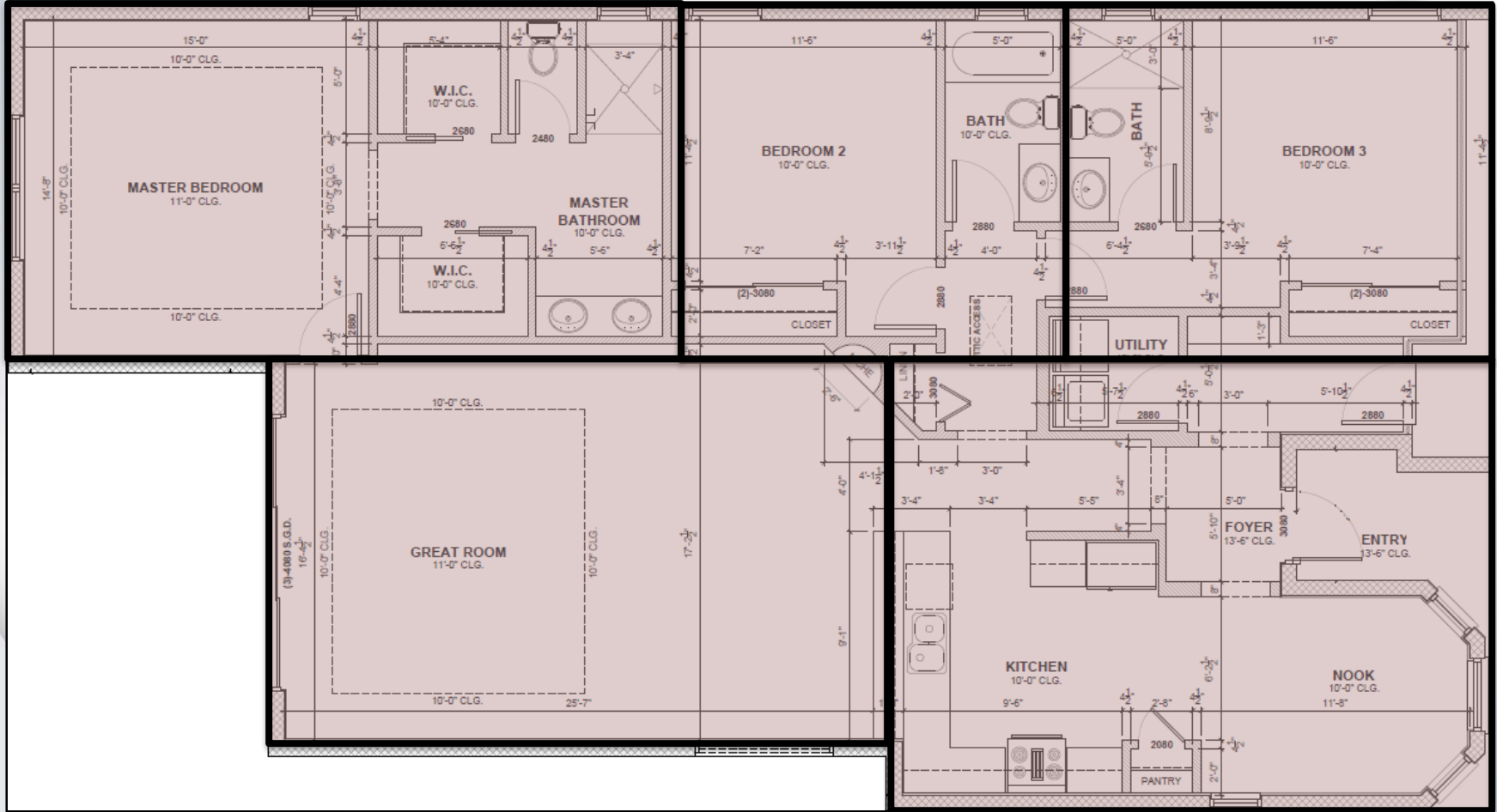
3 zone system and 2 zone system



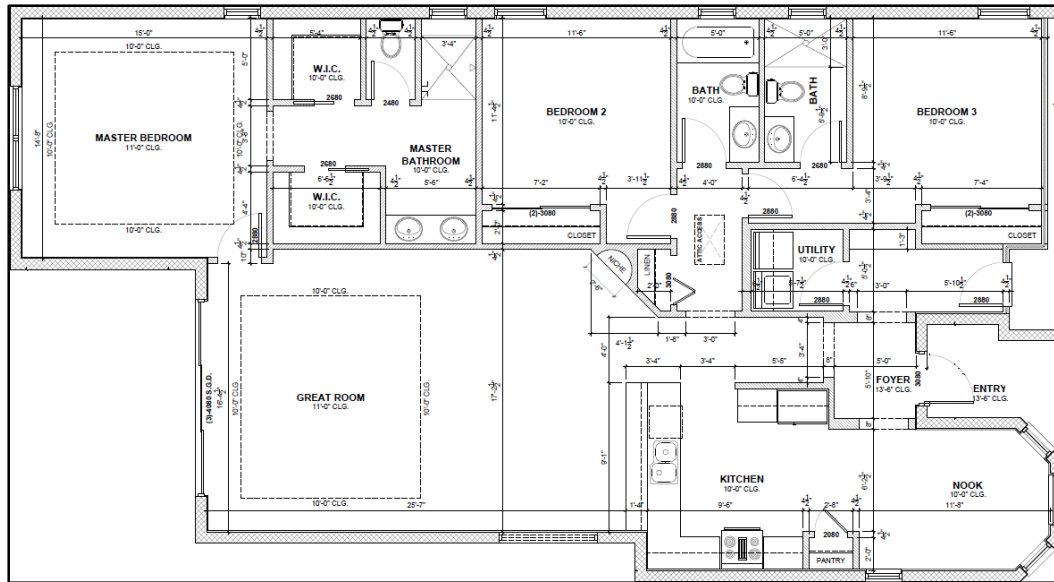
COOLING & HEATING

Whole Home Solution

5 zone system



Whole Home Solution



Which solution was right?



OUR LARGEST DEALERS DO SOMETHING OTHER THAN HVAC

THANK YOU



Heat Pump Trends, Strategies and Resources

Dave Lis, Northeast Energy Efficiency Partnerships
November 29, 2018

Northeast Energy Efficiency Partnerships



“Assist the Northeast and Mid-Atlantic region to reduce building sector energy consumption 3% per year and carbon emissions 40% by 2030 (relative to 2001)”

Mission

We seek to accelerate regional collaboration to promote advanced energy efficiency and related solutions in homes, buildings, industry, and communities.

Approach

Drive market transformation regionally by fostering collaboration and innovation, developing tools, and disseminating knowledge



THE FUTURE IS ELECTRIC!



Action Plan to Accelerate Strategic Electrification in the Northeast

Requires massive market transformations



- Assumed Market shares in 2035 according to NEEP's "Plausibly Optimistic" scenario reflects;
 - **Residential Heat Pumps-**
 - 89% for delivered fuel systems
 - 68% sales share of today's natural gas systems sales
 - **Cars and Light trucks-**
 - 70% of Sales

NEEP's Regional ASHP Initiative



- Launched in 2013
- Regional ASHP Market Transformation Strategy
- Regional Working Group
- Annual In-person Workshop



ASHP Market Transformation Strategies



- 1. Increase consumer education and awareness**
- 2. Increase installer/builder awareness of, and confidence in, ASHP through expanded training and education**
- 3. Reduce upfront costs of installed systems through robust and aligned promotional programs and the support of alternative business models**
- 4. Mobilize state and local policymakers to expand support for ASHPs**
- 5. Promote advanced control technologies to allow automated coordination among multiple heating systems**
- 6. Enable the promotion of climate-appropriate ASHPs through improved performance metrics**
- 7. Develop more accurate tools to predict energy, cost and GHG savings associated with ASHP installation through collection and analysis of real world performance data**

Highlights of Regional Policy/Program - Buildings



VERMONT

- Incentives for ASHPs and HPWHs through Efficiency VT and utilities
- **GMP leasing ASHPs and HPWHs for RES compliance**

NEW HAMPSHIRE

- Developed first-in-nation **RPS carveout for renewable thermal**
- ASHP and HPWH rebates from individual utilities

MAINE

- Significant uptake in residential ASHP/HPWH through Efficiency Maine rebate and financing programs (**over 20,000 rebates FY14-FY16**)

NEW YORK

- New York REV
- NYSERDA developing rebate program for GSHP; targeting heat pump cost reductions
- NYSERDA Clean Energy Investment Plan



MASSACHUSETTS

- Integrating renewable thermal energy into Alternative Portfolio Standard
- ASHP, GSHP, and HPWH rebates via state and utility programs
- Solarize Mass Plus will include heat pumps, EVs, and storage
- Strategic electrification and DR included in efficiency programs with expanded cost-benefit test.

CONNECTICUT

- Heat pump rebates available through Energize CT

RHODE ISLAND

- Exploring **workforce development programs** to drive heat pump uptake (e.g. engaging delivered fuel dealers)

Key Market Barrier/Opportunities

- Sizing/Installation crucial to system performance.
- New systems, new applications challenge longstanding tools and practices.



Installation Guide



Guide To Installing Air-Source Heat Pumps in Cold Climates

A Companion to NEEP's Guide to Sizing & Selecting Air-Source Heat Pumps in Cold Climates



Introduction

High-quality installations of air-source heat pump (ASHP) systems generate referrals, increase sales, reduce callbacks and improve customer comfort and satisfaction. Installation practices also have a major impact on efficiency and performance of an ASHP system. Efficient ASHPs have seen significant sales growth in colder climates in recent years. The recent generation of cold-climate ASHPs, combined with insights from large-scale installation programs and installers, has led to a better understanding of the full range of practices to ensure maximum system performance and customer satisfaction. This guide provides a list of these best practices, as well as homeowner education and system setup guidance, to help ensure efficient air-source heat pumps and happy customers in cold climates.

Heat pumps should always be installed by licensed, trained professionals. Always follow manufacturer's specification and installation instructions, and all applicable building codes and regulations. All installers should attend a manufacturer's training or preferred installer program.

ASHPs come in a number of configurations, and in some cases the following guidance may be specific to one or more of those system types. There are many variations and terms used, but these guidelines will focus on the following broad categories: "ductless ASHP" refers to any non-ducted cassette type indoor unit (including wall-mount air handlers, floor mounted consoles, in-ceiling cassettes, etc.); "mini-duct ASHP" refers to remote air handlers that are typically designed for compact, concealed-ceiling or short-duct configurations; and "centrally ducted ASHP" refers to whole-house systems with central air handlers. The icons shown here are used below to indicate when guidance is specific to a certain system type. All items without icons are generally applicable to all ASHP configurations.

Applies to:



Ductless ASHP



Mini-Duct ASHP



Centrally ducted ASHP

Installation Best Practices: Categories

- Line Set
- Recommended Tools
- Refrigerant Tubing
- Refrigerant Charge
- Condensate Drain
- Outdoor Unit Installation
- Indoor Unit Installation
- Placement of Indoor Unit
- Ducting Considerations

Sizing and Selecting Guide



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

Leading HVAC manufacturers report significant growth in the installation of air-source heat pumps in some of the colder regions of the U.S., including the Northeast.¹ Many of the systems being installed today are “ductless” and variable-capacity. The systems are being installed in a variety of different residential applications, from limited zoned solutions to more comprehensive whole house solutions. System sizing and selection practices have not always kept up with this varied and dynamic landscape of ASHP installations, especially for colder climate installations. System performance, including energy efficiency of the systems, can be negatively impacted by poor sizing and system selection, as is customer comfort. This document was developed to assist installers in sizing and selecting ASHPs for cold climate applications, while maintaining high efficiency, performance, and customer satisfaction. NEEP's Assessment Report – Air-Source Heat Pump Installation Practices in Cold-Climates – provided insight into current sizing and selecting practices and informed the development of this Guide.

There are many types of equipment and a wide variety of common applications for ASHP installations in cold climates. Combinations of single and multi-zone, mini-split, “ductless” or “mini-duct” systems, or more conventional centrally ducted air-handler systems, may be installed in existing or new homes. The purpose may be conventional: provide all the required heating and cooling for a house or a large section of a house, or for a single zone or addition. But it may be less conventional: many mini- and multi-split systems are installed in homes to provide a partial offset to a conventional heating system that uses an expensive or carbon-intensive fuel. When the objective of installing an ASHP is reducing operating costs or emissions, conventional approaches to sizing and selection may need revising. Standard approaches don't fit many of these applications, and may even prevent installers from offering the most cost-effective, optimal solutions to their customers.

This guide is organized into five main application types to allow users to more easily match guidance to their specific installation. The applications are:

Application Sheets

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

Heating (or Heating & Cooling) Displacement

Application Description	Customer primarily desires to reduce heating (and/or cooling) cost for central area of home. Heating is supplemental when the existing heating equipment is not at or near the end of its service life. The main tradeoff is between initial cost vs. savings and comfort in remote zones.
Suggested ASHP System Configuration (Single/Multi-Zone Ductless, Mini-Duct, Centrally Ducted)	For this application located to serve system, ducting and savings (if make sense but
Suggested Treatment of Existing HVAC System	Left in place, per of house air for
Sizing Strategy Overview	Place first zone (as appropriate to heating load) design heating cooling load for
Load Calculation	See "Getting Load
Equipment Selection Considerations	Heating capacity Under-sizing can even though no outdoor temper
Oversizing Concerns / Tradeoffs	Cooling oversize is over 100% of capacity, or a la

Further Guidance

- Consider floor mount unit serving first floor, especially when low loads. For effective distribution to individual rooms (bedrooms) or ensure duct connections are sealed with mastic and insulated higher, set central or backup heating thermostat(s) appropriately.
- Also note that when a heat pump satisfies a whole-house there weather strategy should include some supplemental heat to pre where possible.

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

Full Heating System Replacement

Application Description	Typical poor device are to suit
Suggested ASHP System Configuration (Single/Multi-Zone Ductless, Mini-Duct, Centrally Ducted)	For this mini above
Suggested Treatment of Existing HVAC System	Exist ducts regist are to
Sizing Strategy Overview	Size of design heat
Load Calculation	Use full
Equipment Selection Considerations	Heating with a robust
Oversizing Concerns / Tradeoffs	Potential oversize to cool

Further Guidance

- Consider floor mount unit serving first floor, especially when low loads. For effective distribution to individual rooms (bedrooms) or ensure duct connections are sealed with mastic and insulated higher, set central or backup heating thermostat(s) appropriately.
- If existing ducts are utilized, first ensure that the area existing zone dampers, remove and seal any return by
- When sizing for existing, whole-house HVAC replacement will be smaller than) existing heating equipment capacity losses.
- Note the measurements of existing central equipment (and/or cooling) load.
- Ensure adequate primary or auxiliary heat in basement

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

Isolated Zone

Application Description	One room or zone that is other a newly finished basement room had poor thermal comfort.
Suggested ASHP System Configuration (Single/Multi-Zone Ductless, Mini-Duct, Centrally Ducted)	For this application, typical of
Suggested Treatment of Existing HVAC System	Left in place, provides primary distribution to isolated zone is
Sizing Strategy Overview	Size for the larger of the entire for the heating load if client n
Load Calculation	See "Getting Load Calculation
Equipment Selection Considerations	Heating: use manufacturer with adequate heating capacity substitute for detailed manu
Oversizing Concerns / Tradeoffs	Potential cooling oversize is if capacity is over 100% of design to cooling capacity, or a large

Further Guidance

- Note that an "isolated zone" in a house that is otherwise fully heated by an efficiency and reduce installed cost be careful not to size such a system large distribution from the central system, and the primary reason for the ASHP is system before sizing the ASHP unit. Otherwise, it may be beneficial to reduce
- If client need for new system is driven by an existing comfort issue, ensure it bypasses, existing duct disconnections or leaks, etc.) are addressed before inst professional is strongly recommended.

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

New Construction or Gut Rehab

Application Description	House is well insulated and relatively air tight (meets or exceeds code codes).
Suggested ASHP System Configuration (Single/Multi-Zone Ductless, Mini-Duct, Centrally Ducted)	For this application, typical configuration could include one, two or three ductless and/or mini duct, or a single central air handler. Ducts, when entirely within the insulated boundary of the home. Smaller or very tight may do well with only 1/2 ductless and/or mini-duct zones. Large tight energy codes may require more zones and/or ducted systems.
Suggested Treatment of Existing HVAC System	Follow ACCA Manual J or equivalent load calculations.
Sizing Strategy Overview	Size for the larger of the estimated heating or cooling load. Match by design temperature with 100-110% of the estimated heating load, per auxiliary heat. Or, design for auxiliary heat at a balance point of 20°F
Load Calculation	Use full ACCA Manual J or equivalent.
Equipment Selection Considerations	Heating: use manufacturer published performance at design condit with adequate heating capacity. Cooling: may use AHRF rated capacity substitute for detailed manufacturer's specifications in a cold climate
Oversizing Concerns / Tradeoffs	Potential cooling oversize is mitigated by variable-speed equipment, capacity is over 100% of design cooling load. Look for equipment with to cooling capacity, or a larger turn-down ratio (a lower minimum cap

Further Guidance

- Consider floor mount unit(s) serving first floor, especially in open plan areas. To avoid oversizing ductless units for a and for effective air distribution to rooms with low loads (such as bedrooms) use a single mini-duct system when possible (or ensure duct connections are sealed with mastic and insulated to a minimum of R-6). Thermally isolated areas (e.g. garage) may need separate zone(s) for comfort.
- In extremely tight, low-load buildings be especially attentive not to oversize equipment. Strategically placed single- provide adequate comfort for an entire floor, or use mini-duct systems to ensure distribution to smaller rooms. A central thermostat control is strongly recommended.

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

Targeted Cooling Solution

Application Description	Customer primarily or exclusively desires cooling for a particular area or areas of the home. Heating capabilities are seen mostly as an added "luxury".
Suggested ASHP System Configuration (Single/Multi-Zone Ductless, Mini-Duct, Centrally Ducted)	For this application, typical configurations include 1 zone ductless, or 1-3 room mini-duct system. May include more zones as desired by customer.
Suggested Treatment of Existing HVAC System	Left in place, provides primary heat for home.
Sizing Strategy Overview	Size system to meet estimated cooling load of space served. Ensure system total and latent capacity are adequate for the estimated total and latent cooling loads calculated for the space served by the unit(s).
Load Calculation	See "Getting Load Calculations Right" to ensure accurate load calculations.
Equipment Selection Considerations	Match cooling load with equipment's cooling capacity using detailed manufacturer's performance data. Alternately, use AHRF rated capacity (95°F) * 1.06 as substitute in a cold climate.
Oversizing Concerns / Tradeoffs	Unless the zone is highly isolated, excess cooling capacity may contribute to cooling outside the zone. Because cooling is the primary goal and the home already has adequate heating, heating size is of minimal concern. Be aware of low-load cycling issues in cooling mode that may impact mid-weather performance.

Further Guidance

- Heating with the heat pump should be cost-effective in milder winter weather regardless of primary central heating fuel. Outdoor temperature can be estimated if desired, using relative fuel costs and efficiencies.

References

- NEEP's 2013 Market Strategies Report, Aldrich, R. & Lis, D., (2014), Northeast/Mid-Atlantic Air-Source Heat Pump Market Strategies Report
- Rutkowski, Hank, Manual J Residential Load Calculation (8th Edition), January 1, 2016, Air Conditioning Contractors of America. www.acca.org
- Air Conditioning Contractors of America, Manual S - Residential Equipment Selection (2nd Edition), 2015, Air Conditioning Contractors of America. www.acca.org

Heating (or Heating & Cooling) Displacement

Application Description

Customer primarily desires to reduce heating (and/or cooling) cost for central area of home. Heating is supplemental when the existing heating equipment is not at or near the end of its service life. The main tradeoff is between initial cost vs. savings and comfort in remote zones.

Suggested ASHP System Configuration (Single/Multi-Zone Ductless, Mini-Duct, Centrally Ducted)

For this application, typical configurations include 1-zone ductless, or 1-3 room mini-duct located to serve central living space (for reduced installed cost). Alternatively, larger 2-5 zone system, ductless and/or mini duct, can be configured to serve home widely for better comfort and savings (higher installed cost). In some cases, a new single-zone central heat pump may make sense but that is more likely a whole-house replacement.

Suggested Treatment of Existing HVAC System

Left in place, provides heat only as needed. A centrally ducted system may also provide mixing of house air for improved comfort.

Sizing Strategy Overview

Place first zone where heat will cover most central living area. Establish any additional zones (as appropriate) to strategically cover key living areas per customer needs. Size each zone to heating load of area(s) to be served (block load): total will be undersized for whole-house design heating load. If cooling comfort is desired by customer, size to larger of heating or cooling load for each zone.

Load Calculation

See "Getting Load Calculations Right" to ensure accurate load calculations.

Equipment Selection Considerations

Heating capacity of system at or near outdoor design temperature is a secondary concern. Undersizing somewhat for heating should improve efficiency and reduce overall heating costs, even though central system may be used slightly more. High efficiency at predominant winter outdoor temperatures will reduce operating cost.

Oversizing Concerns / Tradeoffs

Cooling oversize is mitigated by variable-speed equipment; if minimum speed cooling capacity is over 130% of design cooling load, look for equipment with a higher ratio of heating to cooling capacity, or a larger turn-down ratio (a lower minimum capacity), or both.

NEEP Cold-Climate Specification/ Product List



DISCLAIMER- Some of the performance values reported as part of the Cold-Climate ASHP Specification are NOT derived from industry standard test procedures or third-party tested/verified (i.e. performance values at 5°F).													
Products added to list since previous update highlighted in pink													
General Information												Capacity (btu/hr)	
Updated: March 9, 2017													
Manufacturer	Brand (if applicable)	AHRI Certificate No.	Outdoor Unit Model	Indoor Unit Model(s)	HSPF (Region IV)	SEER	EER (@ 95°F)	ENERGY STAR Certified	Ductless or Ducted	If Ductless, Multi-zone or Single-zone	Minimum Capacity 47°F	Rated Capacity 47°F	Maximum Capacity 47°F
Daikin		3208521	RXG09HVJU	FTXG09HVJU	11	26.1	15.8	Yes	Ductless	Single-zone	4,668	12,000	18,670
Daikin		3208522	RXG12HVJU	FTXG12HVJU	10.55	24.2	14	Yes	Ductless	Single-zone	4,668	16,000	19,130
Daikin		3208523	RXG15HVJU	FTXG15HVJU	10	21	12.9	Yes	Ductless	Single-zone	4,668	18,000	21,280
Mitsubishi		4217888	MUZ-FE18NA	MSZ-FE18NA	10.3	20.2	14.2	Yes	Ductless	Single-zone	7,500	21,600	29,700
Mitsubishi		4908219	MUZ-FE09NA	MSZ-FE09NA	10	26	15.5	Yes	Ductless	Single-zone	3,000	10,900	18,000
Mitsubishi		4934170	MUZ-FE12NA	MSZ-FE12NA	10.5	23	12.9	Yes	Ductless	Single-zone	3,000	13,600	21,000
Fujitsu		5063325	AOU9RLS2	ASU9RLS2	12.5	27.2	16.1	Yes	Ductless	Single-zone	3,100	12,000	22,000
Fujitsu		5063326	AOU12RLS2	ASU12RLS2	12	25	13.8	Yes	Ductless	Single-zone	3,100	16,000	22,110
Daikin		5265753	RXS09LVJU	FTXS09LVJU	12.5	24.5	15.3	Yes	Ductless	Single-zone	4,400	12,000	15,600
Daikin		5265755	RXS12LVJU	FTXS12LVJU	12.5	23	12.8	Yes	Ductless	Single-zone	4,800	14,400	18,000
Daikin		5265756	RXS15LVJU	FTXS15LVJU	11.6	20.6	14.4	Yes	Ductless	Single-zone	5,800	18,000	22,300
Daikin		5265757	RXS18LVJU	FTXS18LVJU	11	20.3	12.7	Yes	Ductless	Single-zone	5,800	21,600	26,700
Daikin		5265758	RXS24LVJU	FTXS24LVJU	10.6	20	12.5	Yes	Ductless	Single-zone	7,800	25,400	31,400
Nortek Global	Maytag	5597453	PSH4BG024K	B6VMAX024K-B	10	19	13.9	Yes	Ducted	N/A	10,200	22,400	24,700
Nortek Global	Maytag	5597457	PSH4BG036K	B6VMAX036K-B	10	19	12.9	Yes	Ducted	N/A	16,500	34,400	36,800
Fujitsu		5751311	AOU9RLFC	AUU9RLF	13	24	14.5	Yes	Ductless	Single-zone	3,100	12,000	18,000
Fujitsu		5751312	AOU9RLFC	ARU9RLF	12.2	21.5	14.5	Yes	Ductless	Single-zone	3,100	12,000	18,000
Fujitsu		5751313	AOU12RLFC	AUU12RLF	12.2	21.9	12.8	Yes	Ductless	Single-zone	3,100	16,000	19,400
Fujitsu		5751314	AOU12RLFC	ARU12RLF	11.5	20	12.8	Yes	Ductless	Single-zone	3,100	16,000	19,400
LG		5859619	LUU187HV	LCN187HV	10.1	20	15	Yes	Ductless	Single-zone	9,300	20,000	22,000
LG		6236101	LSU240HSV3	LSN240HSV3	10.2	20	12.5	Yes	Ductless	Single-zone	3,070	27,600	38,900
American Standard		6749789	4A6V0024A1	*AM8C0B30V21	10	19.25	13.75	Yes	Ducted	N/A	7,800	20,200	21,900
American Standard		6749791	4A6V0048A1	*AM8C0C48V41	10	19.25	12.5	Yes	Ducted	N/A	11,800	42,500	42,600
Trane		6749942	4TWV0024A1	*AM8C0B30V21	10	19.25	13.75	Yes	Ducted	N/A	7,800	20,200	21,900
Trane		6749944	4TWV0048A1	*AM8C0C48V41	10	19.25	12.5	Yes	Ducted	N/A	11,800	42,500	42,600
American Standard		6750232	4A6V8036A1	*AM8C0C36V31	10	18	13	Yes	Ducted	N/A	8,200	32,200	32,200
American Standard		6750233	4A6V8048A1	*AM8C0C48V41	10	18	12.5	Yes	Ducted	N/A	11,800	41,000	43,000

Current Product List (3.9.17)

Delisted (on 1.1.17)



1

New resources

- 2018- Updated Installer Guides
- 2018- New Installer VIDEOS!!
- 2018- New Consumer Operations & Maintenance Guide
- 2019- Consumer Buying Guidance
- 2019- Case Studies of ASHP Installations



With your help.....



To access resources...

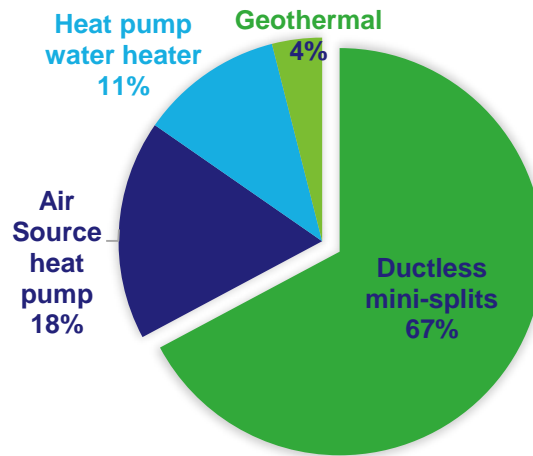
- **Link to NEEP's ASHP Website/Resources**
<http://www.neep.org/initiatives/high-efficiency-products/emerging-technologies/ashp>
- **Dave Lis, NEEP**
 - djlis@neep.org
 - 781-860-9177 (x127)



Financing & Customer Engagement

Smart-E Loan Heat Pump Results in Connecticut

SMART-E LOANS with HEAT PUMPS	
2013-2016	174
2017	400
2018	116



smart-e loan



Solar, heat pump helps couple save money and stay comfortable

- **Ductless mini-splits most common**
 - Then air source heat pumps, heat pump water heaters, and geothermal
- **Heat pumps can sell even when oil prices are low**
 - **Cooling** and comfort are the big customer drivers
- **One third of heat pump projects were part of multi-measure jobs**
 - Heat pumps + solar, insulation or other HVAC

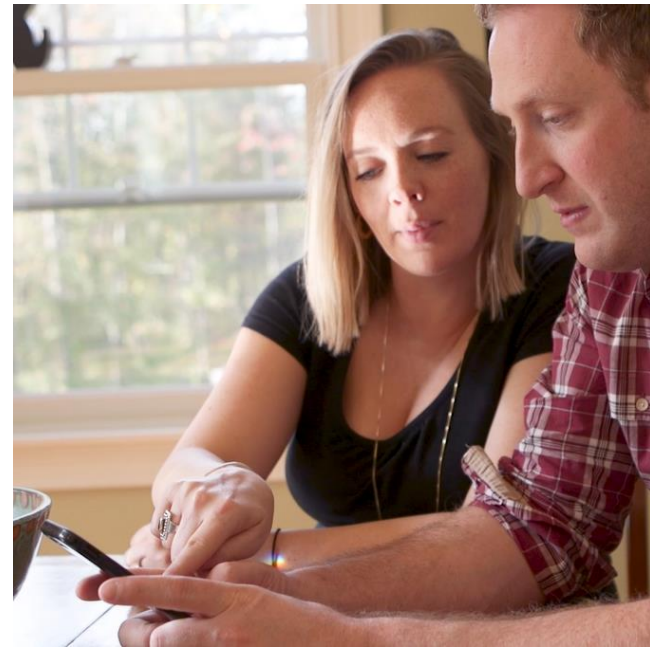
Case Study: Using Special Promotions with CT Market Transformation in Mind



During 2017 Campaign	After Campaign – 2018
<ul style="list-style-type: none">▪ 6x increase in volume – 10x increase in heat pump volume▪ 54 new contractors<ul style="list-style-type: none">▪ Majority of new entrants are HVAC▪ Brought total to 300▪ 85% of contractors used product during campaign<ul style="list-style-type: none">▪ vs. 60% in the year before	<ul style="list-style-type: none">▪ Volume didn't collapse!<ul style="list-style-type: none">▪ 2018 run rate is 3-4x higher than the volume before campaign, including heat pumps▪ Continue training contractors<ul style="list-style-type: none">▪ Over 400 now▪ Majority of new entrants still HVAC▪ Some contractors now funding their own buydowns with lenders

Engaging Customers

- Stay engaged with EnergizeCT
 - Rebates, Smart-E Loan, CT Heat Loan
- Building out your company website with informational resources on the technology and available financing
 - What am I buying and how can I pay for it?
- Connect with a Smart-E Lender to promote your business
 - On-site events
 - In-branch displays
- Work with CT Green Bank to co-brand marketing materials





Heat Pump Market: Discussion