Northeast Energy Efficiency Partnerships

How Can Stakeholders Effectively Differentiate Air-Source Heat Pumps That Perform at Low Temperatures?

PRESENTED BY
Richard Faesy (Energy Futures Group)
David Lis (Northeast Energy Efficiency Partnerships

WEDNESDAY FEBRUARY 4, 2015

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PRESENTATION AGENDA

- Introduction
- The basics of heat pump technology
- The arrival of "cold climate" systems
- Economic/environmental case for heat pump adoption
- Why we can't differentiate "cold climate" heat pumps using the current performance metrics alone
- Development of Cold Climate ASHP specifications
- Using new specifications to select heat pumps for cold climate applications
- Standardizing new metrics; AHRI activity
- Q&A

PRESENTERS

- Richard Faesy, Energy Futures Group
  - Hinesburg, VT
  - Energy efficiency policy and program consulting
  - GMP CEED Cold Climate Heat Pump Program (2013)
  - NEEP heat pump committees (2013-2014)
  - NEEP Ductless Heat Pump Meta-Study (2014)
- Dave Lis, NEEP
  - Facilitates Northeast Air-Source Heat Pump Working Group

HEAT PUMP BASICS

- Who has installed one or lives with one?
- Thanks to Jake Marin, Efficiency Vermont for use of his slides

Characteristics of Heat Pumps

- Heating and cooling from the same equipment
- Less expensive operation than most conventional combustive and resistive heating systems
- Efficient cooling with SEERs >25
- Ductless heat pumps are a quick and non-invasive retrofit installation
- New construction - reduced need for heating and cooling infrastructure
- Can be sustainable if powered by renewables

Efficiency Acronyms

(*following expressed as Btus/watt*)

- **HSPF** – Heating Seasonal Performance Factor
  - Seasonal *heating* efficiency of a heat pump
- **SEER** – Seasonal Energy Efficiency Ratio
  - Seasonal *cooling* efficiency of a heat pump
- **EER** – Energy Efficiency Ratio
  - *Peak cooling* efficiency of heat pump at 95˚F

(following is unit neutral, such as watt/watt or btu/btu)

- **COP** – Coefficient of Performance
  - Static ratio of energy out to energy in

Some Equipment Terminology

- **Heat Pump** – Overarching technology
- **Air Source Heat Pump** – Heat pump equipment with air derived heat energy
- **Geothermal (Ground Source) Heat Pump** – Heat pump equipment with ground or water derived heat energy
- **Ductless Heat Pump** – An air-source heat pump which delivers space conditioning without air ducts
- **Mini-Split** – A heat pump in which the system is "split" between indoor and outdoor components
- **Multi-Split** (or **multi-port, zone or head)** – As above but with multiple indoor units connected to a single outdoor unit
- **Ductless Mini-Split** – A ductless delivery split system

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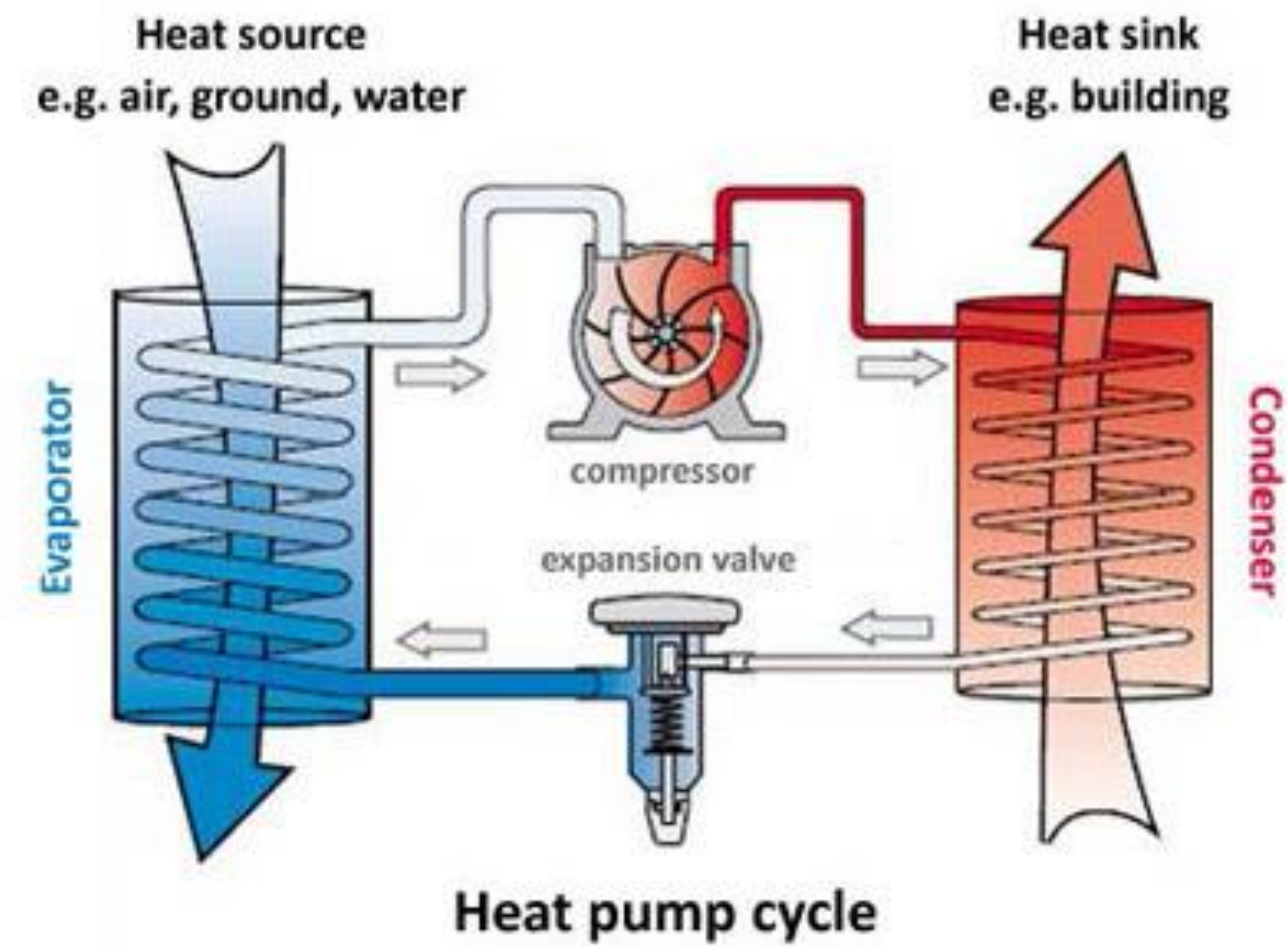
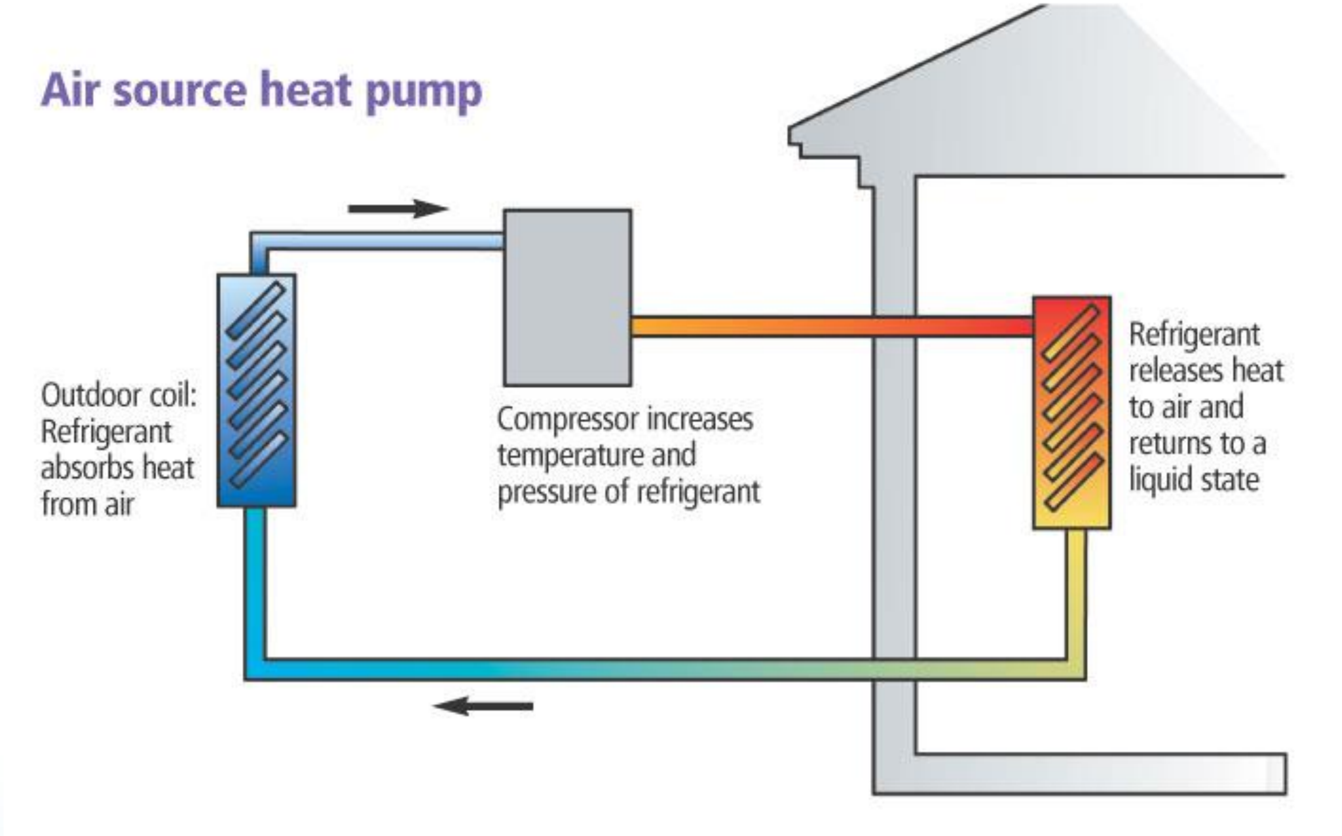
Ductless Heat Pumps (Mini-Splits)


Heat Source → Heat Sink



Heat Source

- Air (Air Source Heat Pump)



Heat Pump Efficiency

- Heat pumps *move* heat, rather than *generate* heat
- Leverage heat existing in the environment rather than burn fuel to release energy
- HSPF ratings up to 13
- SEER ratings up to 30
- Seasonal COPs of 2-4+
  - COP (Coefficient Of Performance) = Energy Out/Energy In
- So… A COP of 2-4 is equivalent to 200-400% efficiency!

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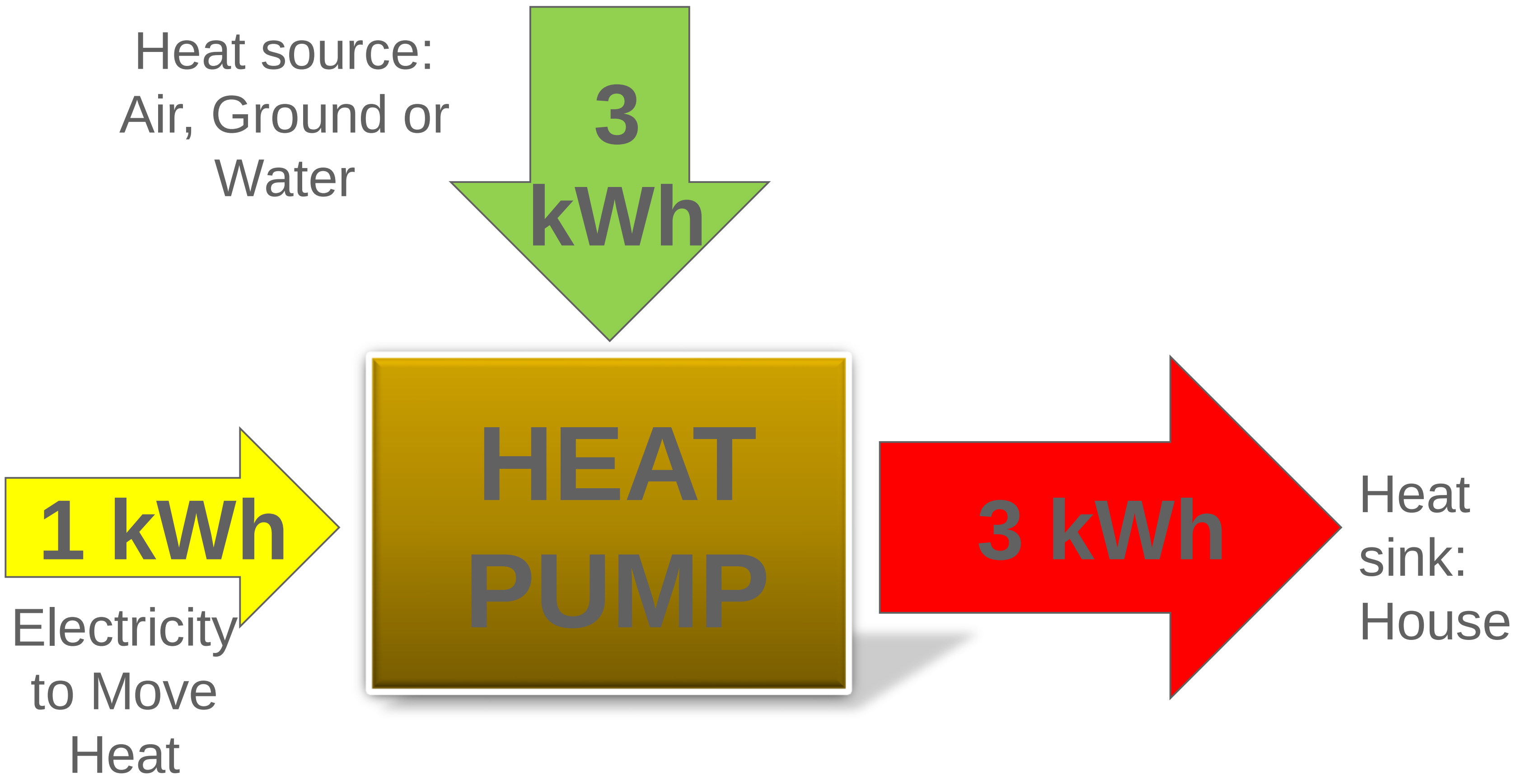
More Out than In?



Theoretical Maximum Efficiency (COP)

	Technology		
	Combustion	Resistive	Heat Pump
Present Peak Efficiency	0.95	1.0	2.0-4.0
Theoretical Maximum	1.0	1.0	17.0*

- Combustion Technology is near maximum
- Heat Pumps present huge potential

**Calculated using the thermodynamic Carnot Cycle*

"Cold Climate" Heat Pumps have Arrived!

- Cold Climate Heat Pump
  - ➢Maintain capacity at very cold temperatures (below 5°F)
  - ➢High COP at these low temperatures

- How is this achieved?
  - ➢New refrigerants
  - ➢Ultra high pressure systems
  - ➢Variable speed compressors
  - ➢Sophisticated controls

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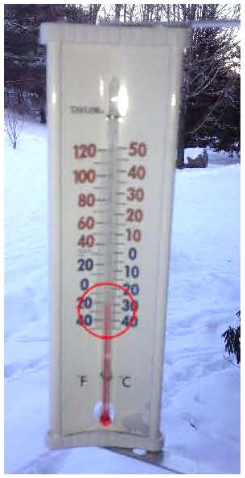
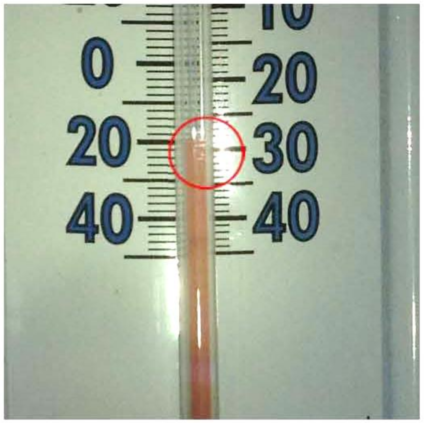
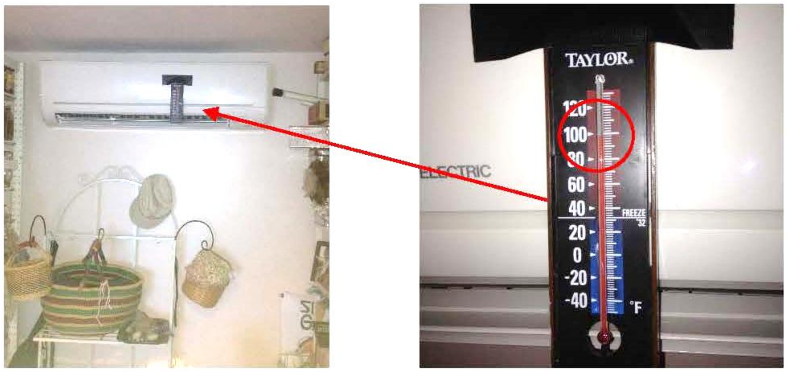
Performance at <-17° F

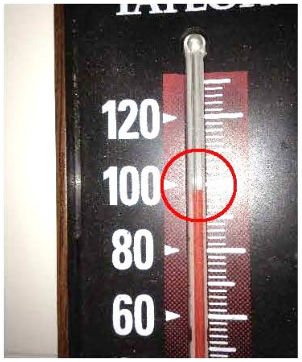
Two thermometers reading between -17 and -20 degrees F outside:





Mitsubishi Mr. Slim (MUZ-FE18NA) puts out 98 degree air inside:

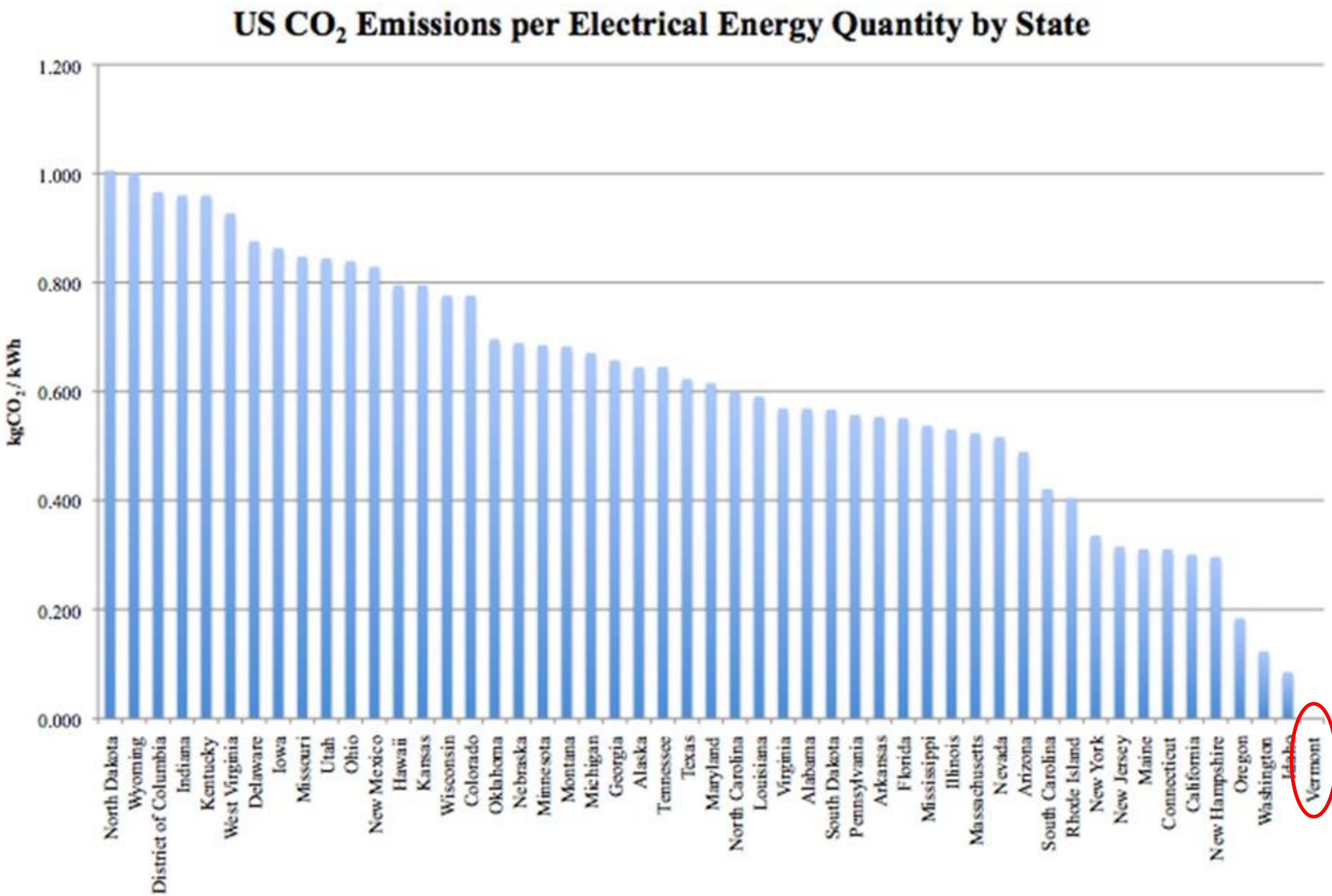




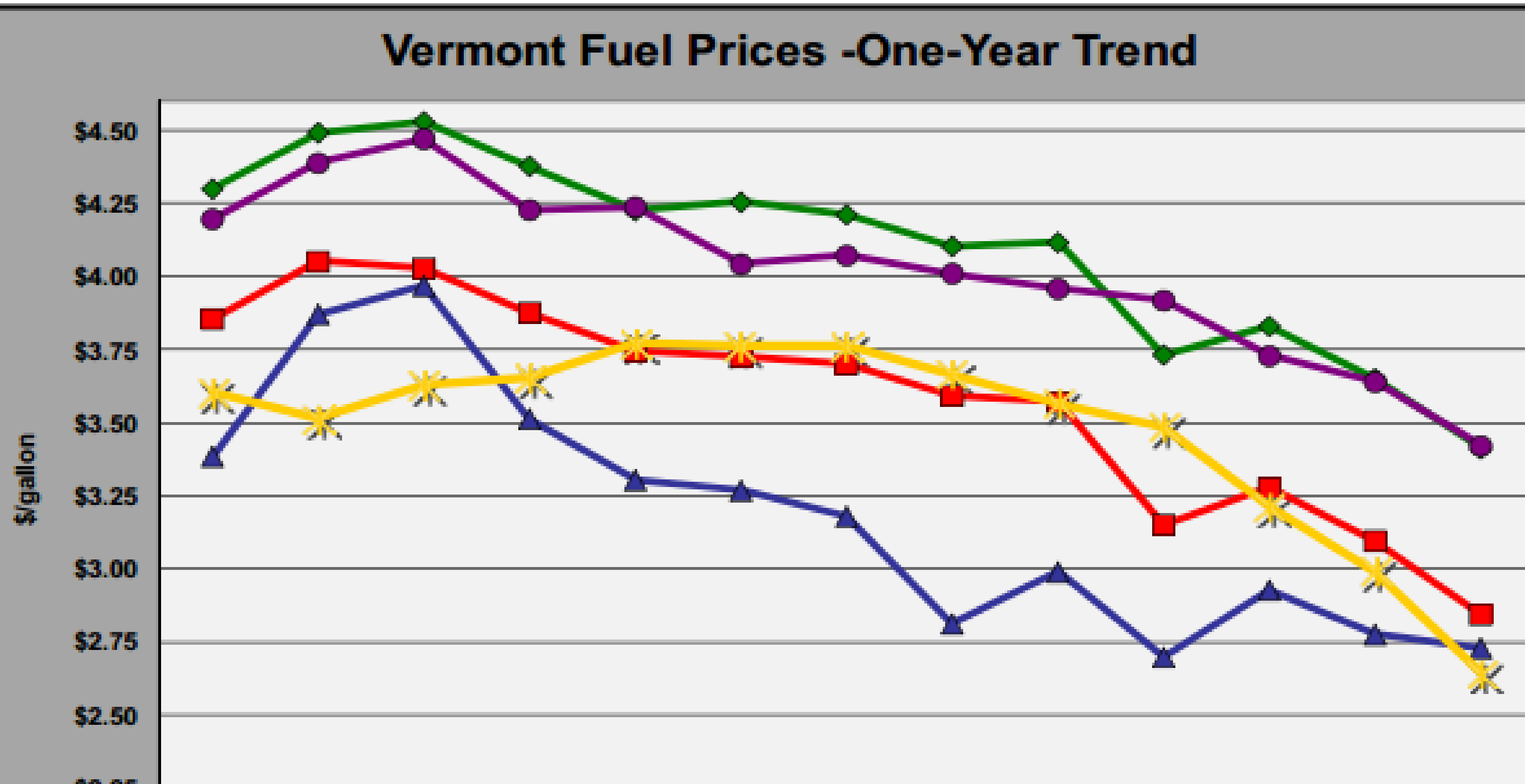
Evidence of low-temperature performance

- NEEP's Ductless Heat Pump Meta-study
  - 40+ DHP evaluation studies reviewed for performance and market findings
  - Heating at outdoor temperature ranges consistent with manufacturer specifications
  - Ability to deliver heat as low as -20˚F for some models
  - Tested models capable of delivering heat at approximately 60% of rated output at lowest rated operating temperature ranges
  - Performance degrades in terms of total thermal output and COP as temperature drops

Outdoor Temperature	COP
≥40°F	≥ 3.5
10°F to 20°F	≈ 2.5 to 3.5
-10°F to -20°F	≈ 1.4
Average Seasonal	2.4 – 3.0


US CO_2 Emissions per Electrical Energy Quantity by State
kgCO2 / kWh
1.200
1.000
0.800
0.600
0.400
0.200
0.000
North Dakota
Wyoming
District of Columbia
Indiana
Kentucky
West Virginia
Delaware
Iowa
Missouri
Utah
Ohio
New Mexico
Hawaii
Kansas
Wisconsin
Colorado
Oklahoma
Nebraska
Minnesota
Montana
Michigan
Georgia
Alaska
Tennessee
Texas
Maryland
North Carolina
Louisiana
Virginia
Alabama
South Dakota
Pennsylvania
Arkansas
Florida
Mississippi
Illinois
Massachusetts
Nevada
Arizona
South Carolina
Rhode Island
New York
New Jersey
Maine
Connecticut
California
New Hampshire
Oregon
Washington
Idaho
Vermont

Vermont Fuel Prices



	Jan '14	Feb'14	Mar'14	Apr'14	May'14	June '14	July '14	Aug '14	Sept '14	Oct '14	Nov '14	Dec '14	Jan '15
Fuel Oil #2	$3.86	$4.05	$4.03	$3.877	$3.746	$3.726	$3.701	$3.593	$3.570	$3.152	$3.277	$3.097	$2.845
Kerosene	$4.30	$4.49	$4.53	$4.379	$4.226	$4.255	$4.213	$4.104	$4.117	$3.733	$3.831	$3.651	$3.413
Propane	$3.39	$3.87	$3.97	$3.514	$3.305	$3.269	$3.180	$2.813	$2.990	$2.699	$2.928	$2.776	$2.730
Gasoline	$3.60	$3.52	$3.63	$3.653	$3.773	$3.762	$3.763	$3.664	$3.563	$3.484	$3.213	$2.991	$2.646
Diesel	$4.20	$4.39	$4.47	$4.229	$4.238	$4.043	$4.073	$4.011	$3.959	$3.919	$3.729	$3.640	$3.421

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A Comparison of Heating Fuels

Fuel Type	Unit	Btu/Unit	Efficiency	$/Unit	$/MMBtu
Wood	Cord	22,000,000	60%	$227	**$17.21**
Natural Gas	Therm	100,000	90%	$1.48	**$16.44**
Pellets	Ton	16,400,000	80%	$294	**$22.41**
Fuel Oil	Gallon	138,200	85%	$2.85	**$24.22**
Kerosene	Gallon	136,600	85%	$3.41	**$29.39**
Propane	Gallon	91,600	90%	$2.73	**$33.11**
Electricity (Resistance)	kWh	3,412	100%	$0.15	**$43.96**
Electricity (Heat Pump)	kWh	3,412	**240%**	$0.15	**$18.32**
Electricity (Heat Pump)	kWh	3,412	**270%**	$0.15	**$16.28**
Electricity (Heat Pump)	kWh	3,412	**300%**	$0.15	**$14.65**

Source: VT Dept. of Public Service Fuel Price Report, Jan. 2015

Typical Residential Heating Fuel Costs (75 MMBtu/Yr)

Fuel Type	Unit	Volume	Annual Cost
Wood	Cord	5.7	$1,291
Natural Gas	Therm	833	$1,233
Pellets	Ton	5.7	$1,681
Fuel Oil	Gallon	638	$1,816
Kerosene	Gallon	646	$2,205
Propane	Gallon	910	$2,484
Electricity (Resistance)	kWh	21,981	$3,297

- Typical heating costs run $1,200-$3000+ per year

Heating Fuel Cost Savings with a Heat Pump (COP 2.7)

Fuel Type	50 MMBtu / Year	75 MMBtu / Year	100 MMBtu / Year
Wood	$37	$56	$74
Natural Gas	$6	$10	$13
Pellets	$245	$368	$490
Fuel Oil	$317	$476	$635
Kerosene	$524	$787	$1,049
Propane	$673	$1,010	$1,347
Electricity (Resistance)	$1,107	$1,661	$2,214

- Savings ~$300-$2000/yr+
- Assuming 80% heating fuel offset and no cooling effects

Payback for a Heat Pump

Fuel Type	50 MMBtu / Year	75 MMBtu /Year	100 MMBtu /Year
Wood	108	72	54
Natural Gas	617	411	309
Pellets	16	11	8
Fuel Oil	13	8	6
Kerosene	8	5	4
Propane	6	4	3
Electricity (Resistance)	4	2	2

- Assuming $4,000 installed cost
- Assuming 80% heating fuel offset and no cooling effects

KEY ISSUE OF THE DAY

- Is there a mechanism for the market to differentiate these products that "perform" in cold-climate applications from the product's that cannot?

NORTHEAST ENERGY EFFICIENCY PARTNERSHIPS

"Accelerating Energy Efficiency"

MISSION

Accelerate the efficient use of energy in the Northeast and Mid-Atlantic Regions

MARKET STRATEGIES TEAM

Developing and implementing Market Strategies to facilitate the transformation of priority product categories;

- Residential Lighting
- Home Energy Management
- Heat Pump Water Heaters
- Air-Source Heat Pumps

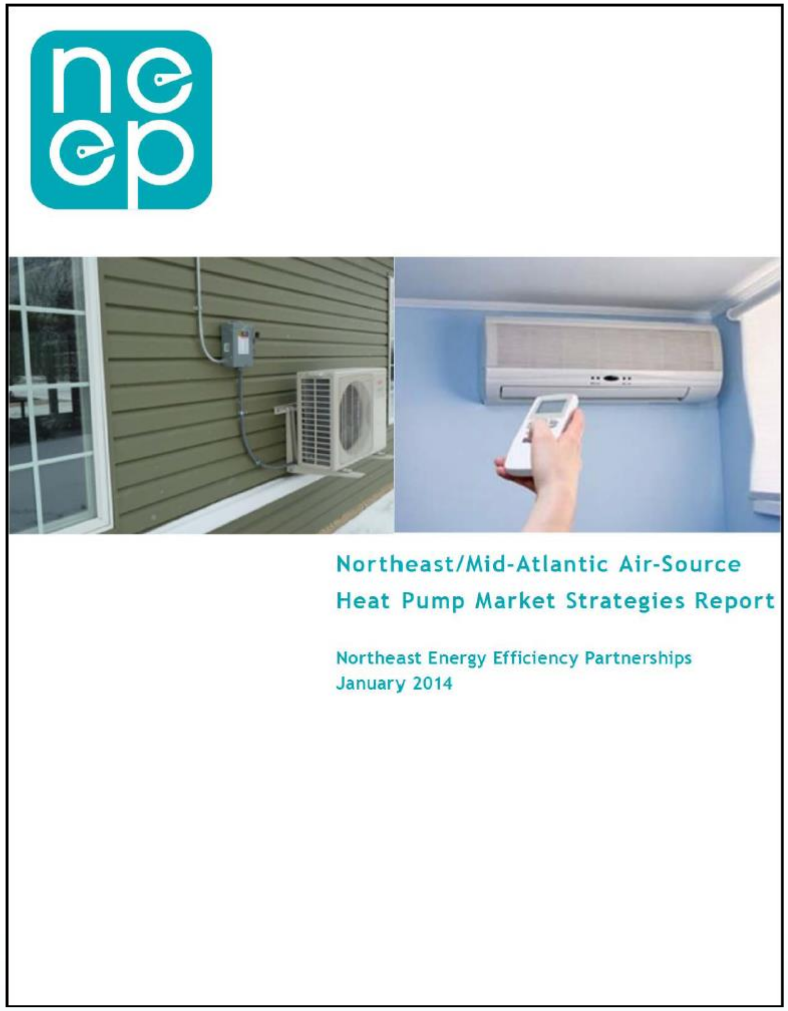
NEEP's Perspective

- NEEP views the expanded use of this particular technology in the region as a potential pathway to multiple outcomes:
  - Reduction in energy use, greenhouse gas emissions and costs associated with space heating
  - Effective solution for comprehensively meeting heating/cooling loads in low load homes (i.e. zero-net energy homes)

What's at stake?

- Long-term health of the market
- Not wanting to repeat the same mistakes of other emerging technologies …Need for coordinated market growth strategies
- HURRY UP SLOWLY!

Northeast/Mid-Atlantic ASHP Market Strategies Report



www.neep.org/efficient-products/emerging-technologies/Air-Source-Heat-Pumps/index

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RECOMMENDED STRATEGIES

1. Develop more accurate ***tools*** to predict energy and cost savings associated with ASHP installations, through collection of real world performance data
2. Develop standardized ***metrics*** for Cold Climate ASHP Performance
3. Increase ***consumer awareness and education***
4. Expand HVAC ***contractor awareness and education***
5. Improve ***integration*** of ASHPs with other heating systems
6. Provide ASHPs at ***affordable costs*** to consumers
7. Characterize ***policy implications*** of large scale deployment of ASHPs

June 2014 ASHP Workshop

- Many efficiency programs considering 2015 program structures/performance requirements
- Efficiency Vermont reexamining program
- Issue becomes clear priority

Cold-climate Metrics Sub-committee

- Volunteers from standing Regional ASHP Working Group

- Charge- Develop recommendations for improved cold-climate metrics

Sub-Committee Approach

- Closer examination of existing metrics
- What are the parameters that truly define cold climate capabilities?
- What additional data is available?
- Gathering of existing data
- Determining scope of applicable metrics
- Determine new performance metrics
- Determine exact performance levels/reporting requirements

Heat Pump Performance Metrics

- Heating Season Performance Factor (HSPF)
  - Based on AHRI's Test Procedure 210/240
  - Purpose: measuring efficiency (Btu/Watt) of equipment over the course of a year
  - How is it calculated?
    - Weighted average of four lab test results (region 4)
      - 56°F OWB, min. capacity
      - 43°F OWB, max. capacity
      - 33°F OWB, intermediate capacity
      - 17°F OWB, max. capacity

Key Deficiencies of HSPF

- Developed for heat pump operation in more moderate climates
- HSPF includes assumptions about use of electric resistance below ~30°F.
- Static capacity testing (No allowance for modulation)
- And…

What about performance below 17F?

Can we Differentiate "Cold Climate" Heat Pumps using this Metric?

CONCLUSION

- No, HSPF alone does not provide enough information
- No direct correlation between a high HSPF rating and performance at low temperatures
- We need additional metrics to help us quantify/differentiate low temperature performance!

What are the Parameters to include?

- Heat pumps that provides heat (Capacity measured in Btus) efficiently (efficiency measured by COP) at low temperature (~5°F)

Early Efforts

- Efficiency Vermont took a shot in 2013

ELIGIBLE COLD-CLIMATE HEAT PUMP PRODUCTS

	DUCTLESS	CENTRAL
Definition	A split-system heat pump unit that heats (or cools) directly into the room without ducts	A split-system heat pump unit connected to whole house distribution systems
Capacity	100% of Nominal Capacity at 5°F	Maximum heating capacity at 5°F >50% rated capacity
Heating Efficiency	COP >1.75 @5°F maximum capacity rating; HSPF > 9	COP >1.75 @5°F maximum capacity rating
Cooling Efficiency	>20 SEER	>SEER 13

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Early Efforts

- Why these standards?
  - Available data:
    - Fujitsu and Mitsubishi had ratings at 5°available
    - 17° is cool, but not cold
    - There was no 0° or -10° data available
  - There were two manufacturers that could meet the standards
  - All of the models within the series (9, 12 and 18kBtu/hour) could meet the standards

Gathering Available Data

- Building low-temperature performance data set
- What is the low-temp performance of products marketing themselves as "cold-climate" heat pumps?
- Pulled data from Technical/Engineering manuals
  - Mitsubishi, Fujitsu, Daikin, Carrier

Low-temperature Performance

DESIGN & TECHNICAL MANUAL

for Extra Cold Climate Area

6-2. HEATING CAPACITY

■ MODEL: ASU9RLS2

AFR	500

			Indoor temperature							
		°FDB	60		65		70		75	
	°FDB	°FWB	TC	IP	TC	IP	TC	IP	TC	IP
Outdoor temperature	-15	-17	11.6	2.10	11.4	2.14	11.1	2.18	10.5	2.26
	-5	-7	14.7	2.12	14.3	2.16	14.0	2.20	13.3	2.28
	5	3	16.1	2.13	15.7	2.17	15.4	2.21	14.6	2.30
	14	12	16.8	2.06	16.4	2.10	16.0	2.14	15.2	2.22
	23	19	18.3	1.99	17.9	2.03	17.5	2.07	16.6	2.15
	32	28	18.8	1.93	18.4	1.97	17.9	2.00	17.0	2.08
	41	37	21.3	1.85	20.8	1.89	20.3	1.93	19.3	2.00
	47	43	23.1	1.91	22.6	1.95	22.0	1.99	20.9	2.07
	50	47	25.5	1.94	24.9	1.98	24.3	2.02	23.1	2.10
	59	50	26.5	1.95	25.8	1.99	25.2	2.03	23.9	2.11

AFR : Air Flow Rate (CFM)
TC : Total Capacity (kBtu/h)
IP : Input Power (kW)

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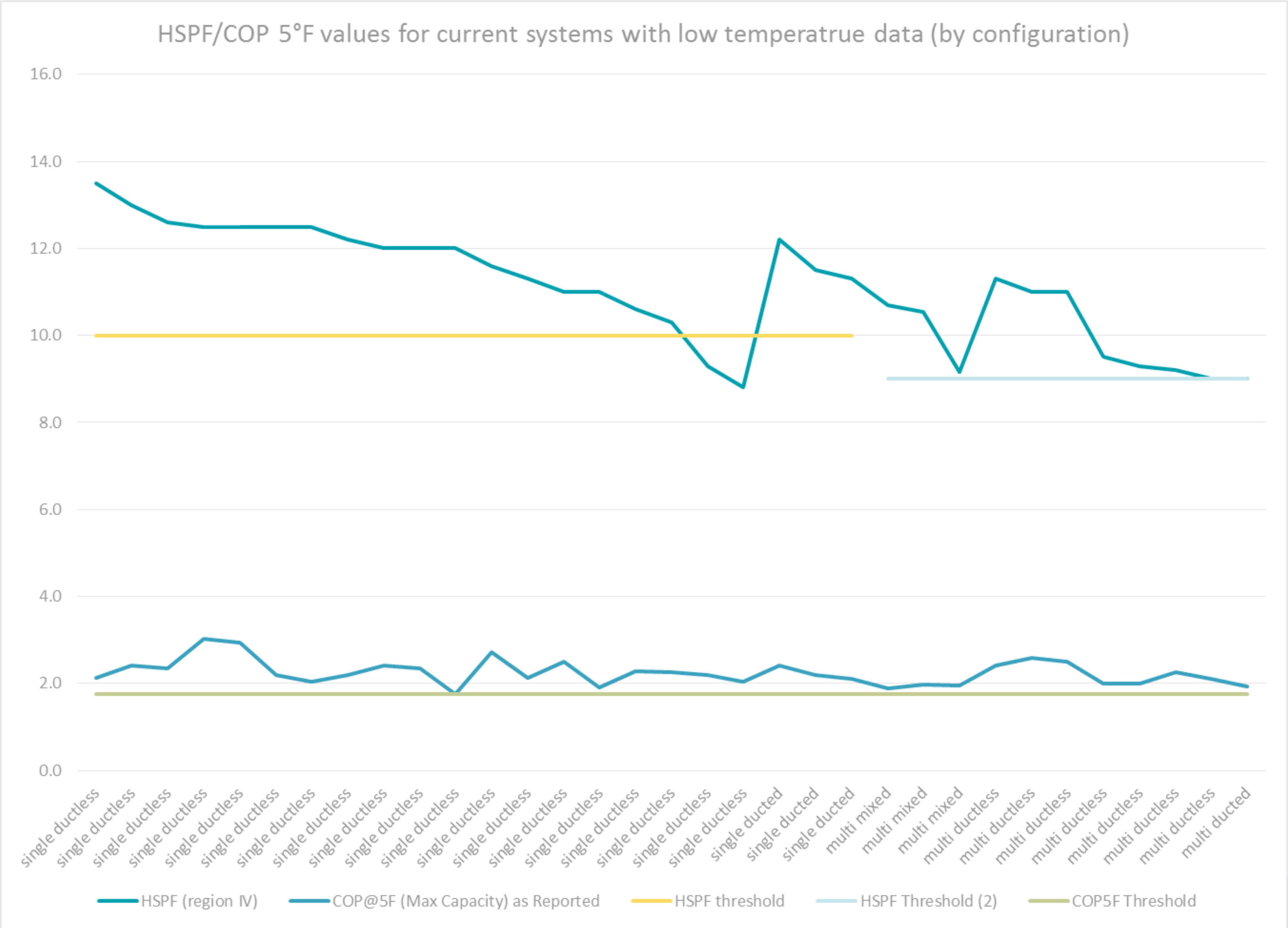
Charting Existing Data



Scope of Specification

- Air-to-air, split system heat pumps
- Both single-zone and multi-zone systems
- <65k Btu/hour at 47˚F (dry bulb)
- Ducted and ductless systems
- Does NOT include ground-source or air-to-water heat pump systems

Performance Requirements

- Compressor must be variable capacity
- Indoor and outdoor units must be part of an AHRI matched system
- **COP @5˚F ≥1.75 (at maximum capacity operation)**
- **HSPF ≥10 for Single-zone systems or HSPF ≥9 for Multi-zone systems**
- ENERGY STAR Certified
- Engineering data for each system must be reported through the attached "*Cold Climate Air-Source Heat Pump Performance Information Tables*".

Reporting Requirements

ccASHP Application Directions: Please complete the following fields. Note that Sections One, Two, and Three are required, but Sections Four is Optional. Include a scanned copy of your signature, title, and date in the field below.

SECTION ONE

Manufacturer	
Brand (if applicable)	
AHRI Certificate No.	
Outdoor Unit Model:	
Indoor Unit Model(s)[1]:	
Variable-Capacity (Yes/No)	
HSPF (Region IV):	
SEER	
EER (@ 95°F)	
ENERGY STAR Certified (Yes/No)	

SECTION TWO

Outdoor Dry Bulb (°F)	Indoor Dry Bulb (°F)		Capacity Level		
			Minimum	Rated	Maximum
47°F	70°F	Btu/h			
		kW			
		COP			
17°F	70°F	Btu/h			
		kW			
		COP			
5°F	70°F	Btu/h			
		kW			
		COP			

SECTION THREE

Pan Heater		
Integrated or Accessory (provide model #)	Input Power (kW)	What determines when heater operates? (Limit 300 characters)

Optional: SECTION FOUR

Outdoor Dry Bulb (°F)	Indoor Dry Bulb (°F)		Capacity Level		
			Minimum	Rated	Maximum
	70°F	Btu/h			
		kW			
		COP			

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Reporting Requirements

SECTION ONE	Manufacturer	
	Brand (if applicable)	
	AHRI Certificate No.	
	Outdoor Unit Model:	
	Indoor Unit Model(s)[1]:	
	Variable-Capacity (Yes/No)	
	HSPF (Region IV):	
	SEER	
	EER (@ 95°F)	
	ENERGY STAR Certified (Yes/No)	

Reporting Requirements

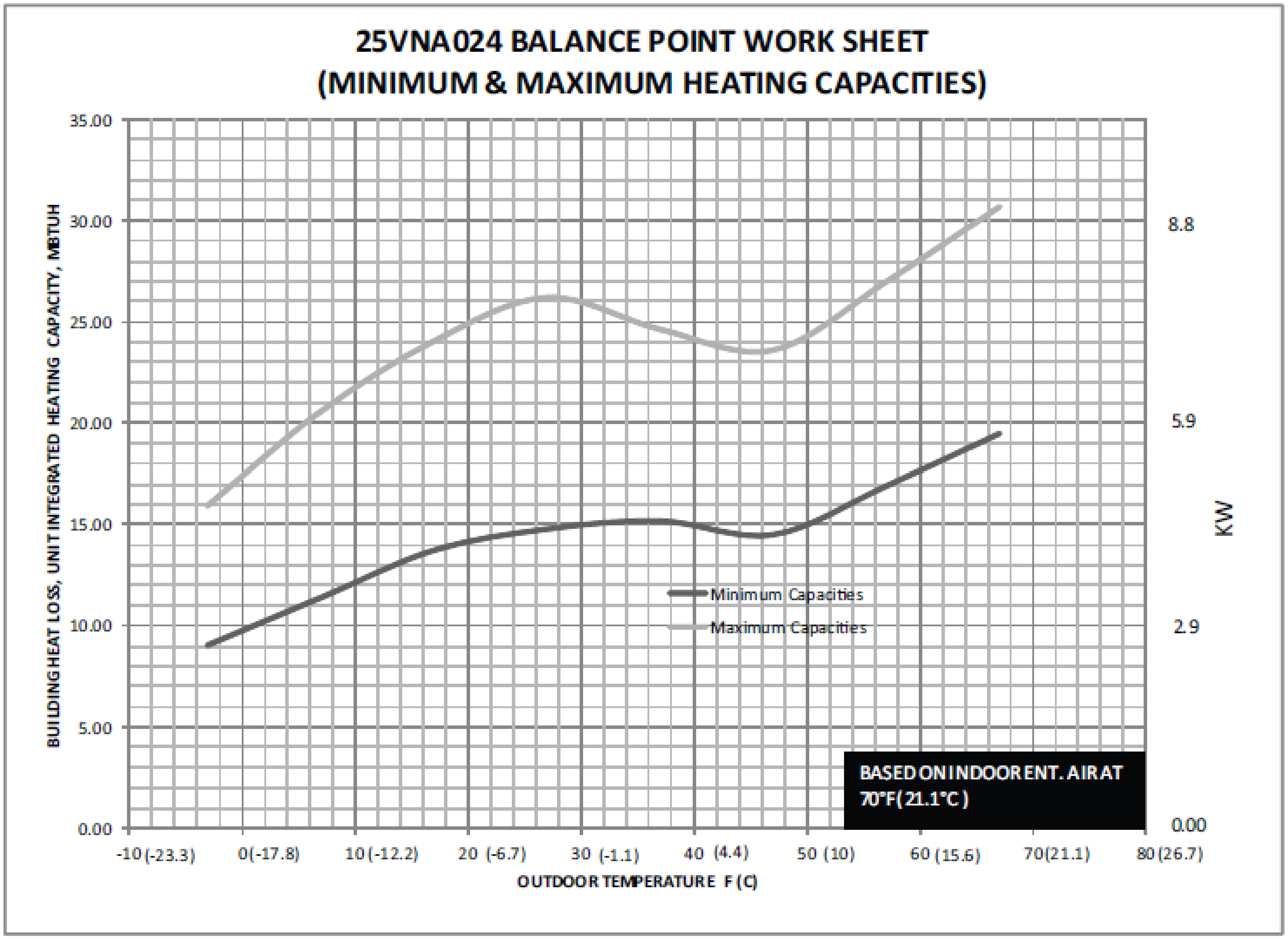
				Capacity Level		
SECTION TWO	Outdoor Dry Bulb (°F)	Indoor Dry Bulb (°F)		Minimum	Rated	Maximum
	47°F	70°F	Btu/h			
			kW			
			COP			
	17°F	70°F	Btu/h			
			kW			
			COP			
	5°F	70°F	Btu/h			
			kW			
			COP			

Reporting Requirements

SECTION THREE	Pan Heater		
	Integrated or Accessory (provide model #)	Input Power (kW)	What determines when heater operates? (Limit 300 characters)

Optional: SECTION FOUR	Outdoor Dry Bulb (°F)	Indoor Dry Bulb (°F)		Capacity Level		
				Minimu m	Rated	Maximum
		70°F	Btu/h			
			kW			
			COP			

Maintenance of Capacity?



Maintenance of Capacity?

"Stakeholders should be aware that simply meeting the performance requirements 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"

Cold-Climate ASHP Specification

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Northeast Energy Efficiency Partnerships

COLD CLIMATE AIR-SOURCE HEAT PUMP SPECIFICATION

On behalf of energy efficiency stakeholders across the Northeast and Mid-Atlantic, Northeast Energy Efficiency Partnerships (NEEP) is pleased to be housing the new Cold Climate Air-Source Heat Pump (ccASHP) Specification and a list of those products that meet the specification's requirements. Those requirements include both specific performance levels as well as a series of reporting requirements.

Energy efficiency Stakeholders from the Northeast lack confidence that the existing heating performance metric (HSPF) for air-source heat pumps provides the necessary information to adequately characterize heating performance at low temperatures. In addition, the supplemental information that is provided by manufacturers to demonstrate cold temperature performance is not standardized or consistent. The current performance metric (HSPF) does not include low temperature testing points below 17°F, assumes the use of electric resistance elements, and tests in steady-state operation (as opposed to allowing modulation). These deficiencies add up to measurements that do not accurately reflect performance of the latest generation of air-source heat pumps, designed and optimized to provide heat during cold conditions.

In order to address these concerns, a group of interested stakeholders, working together as part of the Northeast/Mid-Atlantic Air-Source Heat Pump Working Group (facilitated by Northeast Energy Efficiency Partnerships), has come together to develop a Cold Climate Air-Source Heat Pump (ccASHP) Specification or "ccASHP Spec" to better characterize heat pump performance . Participants include energy efficiency program administrators, heat pump installers, state energy office staff, as well as technology experts.

LISTING PRODUCTS- To appear on the list of Cold Climate Air-Source Heat Pumps, manufacturers are invited to download the following Application. Please send in a complete application to Samantha Bresler via email with the subject line, "Cold Climate Air-Source Heat Pump Specification". Products for which submitted documentation reveals met performance requirements and provides **fully completed** Cold Climate Air-Source Heat Pump Performance Information Tables will appear on the list within three days of submission. The first list of products will be posted in January, 2015 and will be updated on a continuous basis.

Cold Climate Air Source Heat Pump Specification

APPLICATION: Cold Climate Air-Source Heat Pump Application (Excel)

ASHP

Cold Climate Air-Source Heat Pump Specification

PROJECT STAFF

SAMANTHA BRESLER

DAVE LIS

RELATED BLOG POSTS

The ASHP Magic Trick: Creating Warmth from Thin (Freezing) Air

Air Source Heat Pumps a hot topic at NEEP's Pre-Summit Workshop

A Breeze of Innovation, Air Source Heat Pumps Hold Potential

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Efficiency Vermont's Heat Pump Requirements

- Differ slightly from ccASHP Specification
  - Requires slightly higher HSPF (10.3 vs 10) for single zone
  - Cooling requirement- 20 SEER, 12 EER

Efficiency Vermont's QPL

Cold Climate Heat Pumps

Qualifying Products (Sorted by Manufacturer)*

Effective 12/1/2014; Updated 1/5/2015

** Eligible for Efficiency Vermont's $300 Instant Off Invoice Rebate. Rebate offer only available to electric utility customers in Vermont; customer information required at point of purchase.*

This list will be continuously updated with additional distributors and heat pump manufacturers as they join the program. Please check back for updates.

DAIKIN	FUJITSU	MITSUBISHI ELECTRIC COOLING & HEATING
www.daikin.com	www.fujitsu.com	www.mitsubishi.com

Manufacturer	Outside Model Number	Inside Model Number	Model Name	Capacity (Btu/h)	HSPF	EER	SEER	Distributor(s)	Product Incentive
Daikin www.daikin.com	RXS09LVJU	FTXS09LVJU	LV Series	9,000	12.50	15.30	24.50	F.W. Webb United Refrigeration	$300
	RXS12LVJU	FTXS12LVJU		12,000	12.50	12.80	23.00		$300
	RXS15LVJU	FTXS15LVJU		15,000	11.60	14.40	20.60		$300
	RXS18LVJU	FTXS18LVJU		18,000	11.00	12.70	20.30		$300
	RXS24LVJU	FTXS24LVJU		24,000	10.60	12.50	20.00		$300
Fujitsu www.fujitsu.com	AOU9RLS2	ASU9RLS2	Halcyon Invertor	9,000	12.50	16.10	27.20	Blodgett Supply Central Supply Premier Supply Group Sid Harvey's	$300
	AOU12RLS2	ASU12RLS2		12,000	12.00	13.80	25.00		$300
	AOU15RLS2	ASU15RLS2		15,000	12.00	12.00	21.50		$300
	AOU15RLS2H	ASU15RLS2		15,000	10.30	12.00	21.50		$300
	AOU9RLFF	AGU9RLF		9,000	12.60	16.00	26.00		$300
	AOU12RLFF	AGU12RLF		12,000	11.60	13.10	22.70		$300
	AOU15RLFF	AGU15RLF		15,000	11.20	12.50	20.30		$300
	AOU9RLFFH	AGU9RLF		9,000	12.40	16.00	26.00		$300
	AOU12RLFFH	AGU12RLF		12,000	11.30	13.10	22.70		$300
	AOU15RLFFH	AGU15RLF		15,000	11.00	12.50	20.30		$300
	AOU9RLFC	ARU9RLF		9,000	12.20	14.50	21.50		$300
	AOU12RLFC	ARU12RLF		12,000	11.50	12.80	20.00		$300
	AOU9RLFC	AUU9RLF		9,000	13.00	14.50	24.00		$300
	AOU12RLFC	AUU12RLF		12,000	12.20	12.80	21.90		$300
Mitsubishi www.mitsubishi.com	MUZ-FE12NA1	MSZ-FE12NA	Mr. Slim	12,000	10.50	12.9	23.00	Bell Simons The Granite Group Homans Associates	$300
	MUZ-FE18NA	MSZ-FE18NA		18,000	10.30	14.2	20.20		$300
	MUZ-FH09NA(H)	MSZ-FH09NA		9,000	12.50	16.1	30.50		$300
	MUZ-FH12NA(H)	MSZ-FH12NA		12,000	12.00	13.8	26.10		$300
	MUZ-FH15NA(H)	MSZ-FH15NA		15,000	12.00	12.5	22.00		$300

For more information, visit: www.efficiencyvermont.com/cchppartners

Participating Distributors:

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F.W. Webb Company www.fwwebb.com	The Granite Group www.thegranitegroup.com	Homans Associates www.homans.com
PSG Premier Supply Group www.premiersupplygroup.com	Sid Harvey's www.sidharvey.com	UR www.uri.com

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Other flavors of ccASHP specs

- Other flavors of Cold climate specifications
  - Massachusetts Clean Energy Center
    - ccASHP Spec levels
    - Additional Cooling- SEER (20) and EER (12)
  - Efficiency Maine
    - 12/10 HSPF (single-zone/multi-zone)

Specifying Cold Climate Systems

1. Identify Qualifying equipment (Efficiency Vermont's QPL, Regional ccASHP list)
2. Sizing matters greatly;
   - Consumers, contractors, and designers should review building loads, equipment capacities at design temperatures, and other important factors before selecting equipment
   - Relevant performance data to be more easily accessible via ccASHP Specification database

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AHRI Developments

- The Cold-climate ASHP Specification is intended to be an interim step before AHRI or other standards-setting bodies (DOE, etc.) develops/adopts improved cold climate metrics/test procedures.
- Regional Stakeholders hope to influence AHRI to add a lower temp test point
- AHRI's test procedure committee aware of activity, early discussions beginning

QUESTIONS/COMMENTS???

THANK YOU

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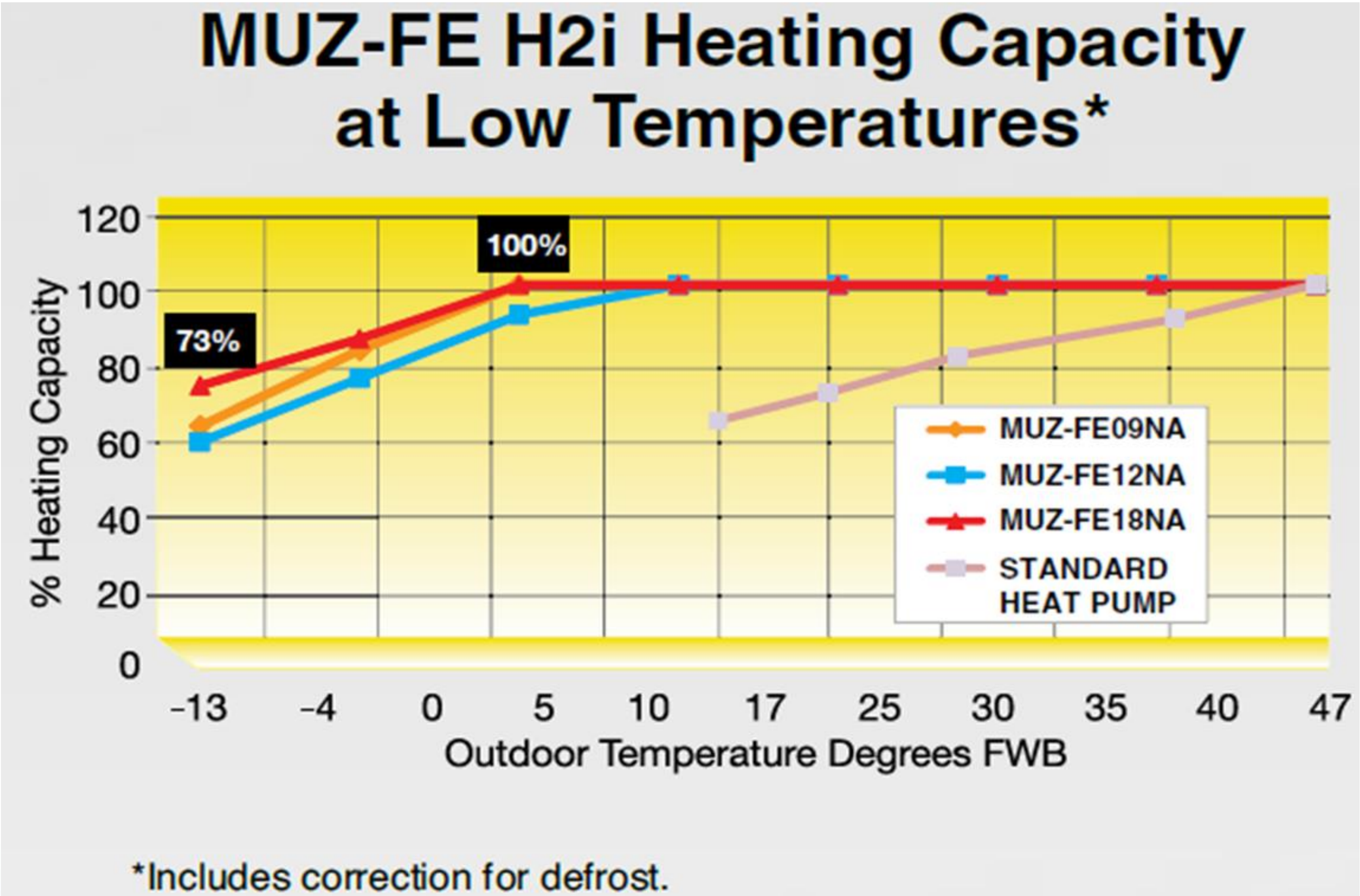
CAN WE DIFFERENTIATE "COLD-CLIMATE" HEAT PUMPS USING THESE METRICS?



#2- Develop standardized metrics for ccASHP performance

a) Encourage AHRI to amend standardized test procedures for heat pumps in order to accurately measure:

- Performance at colder outdoor conditions.
- Part-load performance

#2- Develop standardized metrics for ccASHP performance

b) Examine alternative HSPF-type metrics which assumes a heat pump can provide more of a space's heating load at colder temperatures.
   – This could highlight the advantages of variable-speed heat pumps over conventional, single-speed heat pumps.

c) Voluntary programs (i.e. Energy Efficiency programs) should adopt and implement climate-appropriate performance requirements

d) Influence national groups (i.e. ENERGY STAR) to adopt similar requirements

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What's at Stake?

- Customer satisfaction and confidence in the technology