

Residential Ductless Heat Pumps

January 7, 2021

Paul Hawkins

Program Manager,
Residential HVAC Lead, BPA

Suzi Asmus

Program Manager,
NW Ductless Heat
Pump Project, NEEA

Robert Weber

Sr. Engineering
Technical Lead, BPA



Agenda

- BPA's draft 2021 residential ductless heat pump, or DHP, specification.
- NEEA's Going Ductless resources.
- A look ahead to the 2023 landscape for DHPs.
- Q&A.

BPA plans to offer residential DHPs in the next rate period!



Residential DHP Specification

Minimum 9.0 HSPF

Likely changes based on Regional Technical Forum updates:

- Incentives likely to decrease.
- Energy savings likely to decrease.

Planning to reduce documentation requirements under new reporting system.



Timeline



- DHP best practices and install techniques
- Simplify DHP measure requirements
- Engineering research



DHP Best Practices

BPA will work to improve energy savings from DHPs by leveraging resources from the NW Ductless Heat Pump Project to support contractors and utilities on best installation practices, such as:

- Equipment placement.
- Design to maximize displacement of electric resistance heat.
- Controls settings.



NEEA DHP Review/Preview

Suzi Asmus

Program Manager, NEEA

January 7 2021

CLASSIFICATION LEVEL: PUBLIC





NEEA's DHP Program Updates

AGENDA:

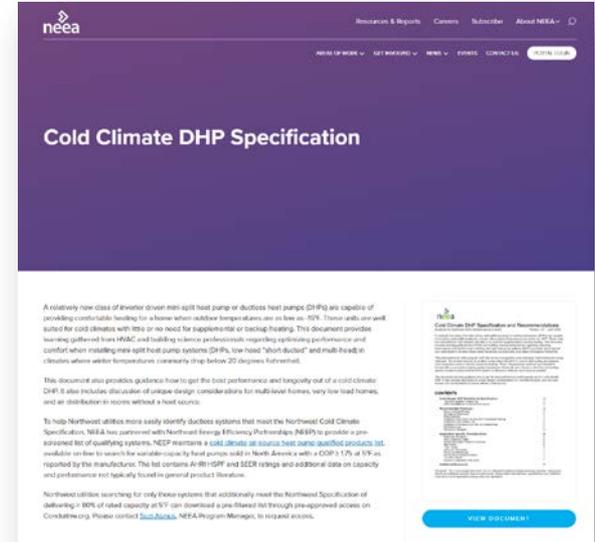
- Cold Climate Resources
- Maximizing Mini-Split Savings
- 2021 What to Expect



Cold Climate: Northwest Specification & Recommendations

- Definition & Specification
- Recommended Practices
- Application Specific Considerations

www.neea.org



Developed by DHP working group in 2018, published in 2019 and revised in 2020



Cold Climate: NW Specification

1. Rated HSPF ≥ 10.0
2. COP @ 5 °F ≥ 1.75 at maximum capacity
3. Maintains minimum 80% of rated capacity at 5 °F
4. Drain pan heaters, if present, operate only during defrost cycle.





Cold Climate: NEEP QPL

- NEEP QPL

<https://ashp.neep.org/>



- NW ccDHP Filtered List
email sasmus@neea.org



NEEP'S COLD CLIMATE AIR SOURCE Heat Pump List



Singlezone Ducted, Centrally Ducted

AHRI Cert #: 205272415

Outdoor Unit #: 25VNA424A*030*

Indoor Unit #: CAP**4221AL*+UI

Maximum Heating Capacity (Btu/hr) @5°F: 17,940

Rated Heating Capacity (Btu/hr) @47°F: 24,000

Rated Cooling Capacity (Btu/hr) @95°F: 23,400

Information Tables

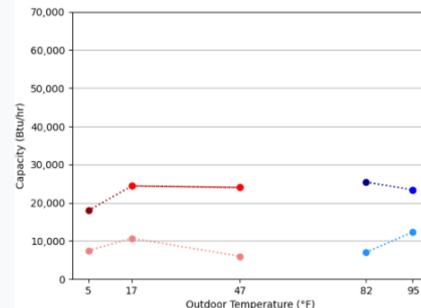
Brand	CARRIER
Series	
Ducting Configuration	Singlezone Ducted, Centrally Ducted
AHRI Certificate No.	205272415
Outdoor Unit #	25VNA424A*030*
Indoor Unit Type	
Indoor Unit #	CAP**4221AL*+UI
Furnace Unit #	58TN**A045C17**12
SEER	21
EER	14
HSPF Region IV	11
Energy Star	✓
Variable Capacity	✓
Turndown Ratio (Max 5°F/Min 47°F)	2.99
Capacity Maintenance (Max 5°F/Max 47°F)	74%
Capacity Maintenance (Rated 17°F/Rated 47°F)	101%
Capacity Maintenance (Max 5°F/Rated 47°F)	74%
Integration	
Operational Diagnostics	
Refrigerant(s)	R410A

Performance Specs

Heating / Cooling	Outdoor Dry Bulb	Indoor Dry Bulb	Unit	Min	Rated	Max
Heating	5°F	70°F	Btu/h	7,460	-	17,940
			kW	0.95	-	2.42
			COP	2.3	-	2.17
Heating	17°F	70°F	Btu/h	10,700	24,400	24,400
			kW	1.11	2.77	2.77
			COP	2.83	2.58	2.58
Heating	47°F	70°F	Btu/h	6,000	24,000	24,000
			kW	0.4	2.28	2.28
			COP	4.4	3.08	3.08
Cooling	82°F	80°F	Btu/h	7,000	-	25,400
			kW	0.29	-	1.39
			COP	7.07	-	5.36
Cooling	95°F	80°F	Btu/h	12,340	23,400	23,400
			kW	0.77	1.69	1.69
			COP	4.7	4.06	4.06

Example listing

Heating/Cooling Capacity Graph





Cold Climate: Installer Guide

- Guide for Contractors and Utility Program Mangers
- FAQs
- Blog Content

INSTALLER GUIDE
DUCTLESS HEAT PUMPS FOR COLD CLIMATES

DUCTLESS HEATING & COOLING SYSTEMS

Do you know some ductless heat pumps are designed to operate in cold climates? When properly applied and installed, research has shown these ductless heat pumps work well for heating homes and for saving energy. Due to the more demanding conditions in which they operate, installation mistakes, shortcuts and oversights can dramatically impact how well these machines perform. This document builds on the Best Practices for Installing Ductless Heating and Cooling Systems to include practices essential to successful installation and performance of these ductless heat pumps in cold climates.

WHAT IS A COLD CLIMATE?
Areas where winter nighttime temperatures commonly drop below 20°F, and where historical data shows winter temperatures regularly fall to 5°F or lower, are considered cold climates. In the Northwest, this usually includes high elevations, areas on the east side of the Cascade Mountains, and much of Montana and Idaho.

Northwest Cold Climate Ductless Heat Pump Specifications*:

1. Compressor must be variable capacity (inverter type)
2. Indoor and outdoor units must be part of an AHRI matched system
3. The AHRI matched system must be rated at or above 10.0 HSPF
4. The AHRI matched system must have a Coefficient of Performance (COP) at or above 1.75 at 5°F
5. Must deliver at least 80% of rated heating capacity at 5°F
6. If a drain pan heater is present, it may only run as part of the defrost cycle

* Northwest Energy Efficiency Partnerships maintains a list of cold climate rated air source heat pumps at <https://nheep.org/#/>. To determine if a system meets the Northwest specification, review a listed unit's HSPF and ensure it meets 80% rated capacity at 5°F.

LOCATION OF THE OUTDOOR UNIT IMPACTS PERFORMANCE

- 1. Avoid installing outdoor units on walkways and patios**
Defrost cycle melt water can re-freeze on ground surfaces and create a dangerous slip hazard.
- 2. Do not install outdoor units under a roof's driplines**
Rain, ice fall and snow melt from roof overhangs and driplines can re-freeze on the compressor's coil surface and overwhelm the unit's defrost cycle. When needed, outdoor units should be installed with drip caps or shields.
- 3. Don't install outdoor units facing into the wind**
If the outdoor unit is facing into dominant wind direction, this could cause counter-rotation of the outdoor fan and lead to failure of the fan motor, fan circuit board, or both.

Tip: If you cannot avoid the dominant wind direction, install an optional wind baffle offered by the manufacturer.

request and run at higher on or single pane windows,

brackets or an equipment.

Equipment Stand

TIP 3
If ground clearance allows, use brackets designed to attach to the foundation wall.

Foundation Mounted Wall Bracket

tion absorbers using the unit brackets. Use ridged vibration absorbers to reduce in transmitting through the wall.

May not perforate link

Partially Rinked

Rinked

7. Ensure outdoor units stay level
The outdoor unit must be level (front-to-back and side-to-side) and remain so for its useful life. This is important to ensure the defrost cycle works properly and to prevent ice buildup in the outdoor unit.

strong, long lasting foundation by removing grass, topsoil and mulch and getting down to base soil, before adding a ground pad to prevent saturated soils from shifting.

is
circuit length. This ensures liquid or saturation coverage also retains

serious performance issues.



Cold Climate: Training Webinars

- **INSTALLATION BEST PRACTICES FOR COLD CLIMATES**
- **SIZING AND SELECTING FOR COLD CLIMATES**

[GoingDuctless on YouTube.com](https://www.youtube.com/GoingDuctless)





Maximizing Mini-Split Research

Phase	Work Description	Timing
1	Meta Study – review all reports, projects and unpublished work regarding DHP performance	2019
2	Market Research – identify products, costs, installer challenges and program challenges.	2020
3	Measure Development – identify 3-10 viable enhancement measures	2020
4	Generate report	2020





Maximizing Mini-Split Savings

Recommendations

- Targeting
- Design for Displacement
- Integrated Control for Backup
- Customer Education
- Quality Assurance





2021 What to Expect - Resources

- DHP Installer Finder *Through Oct. 1, 2021*
- GoingDuctless.com *Through Oct. 1, 2021*
- Installer Webinars *On demand 2021*

All other resources

- SURVEY *January/February 2021*

DUCTLESS
HEATING & COOLING SYSTEMS

GOING DUCTLESS THIS WINTER

Reliable heating and lower electrical costs, all with one energy-efficient system. Ductless heating and cooling systems boost your home's comfort while using up to 50 percent less energy.

IS A DUCTLESS SYSTEM RIGHT FOR YOUR HOME?

WHY GO DUCTLESS?

- Monthly savings on your energy bill
- Increased comfort year-round
- Heating and cooling in one system

The advertisement features a central illustration of a house with a cutaway showing a person sitting on a sofa inside. Red arrows indicate the flow of air from a central unit in the ceiling. The background shows a winter scene with snow, trees, and a large evergreen. The text is clean and modern, with a mix of blue, green, and orange colors.

» Suzi Asmus

Program Manager, NEEA

503-688-5407 sasmus@neea.org



2023 Landscape

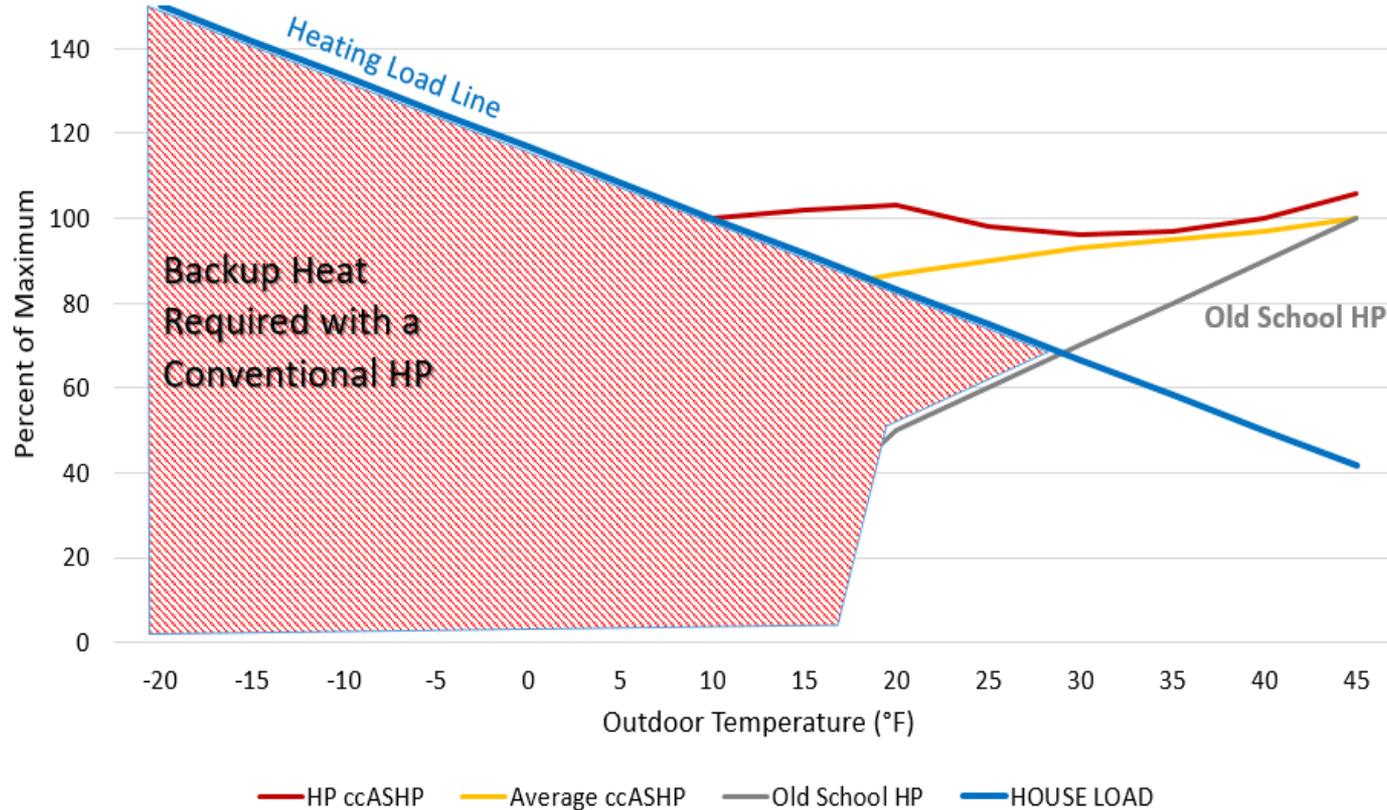
Robert Weber



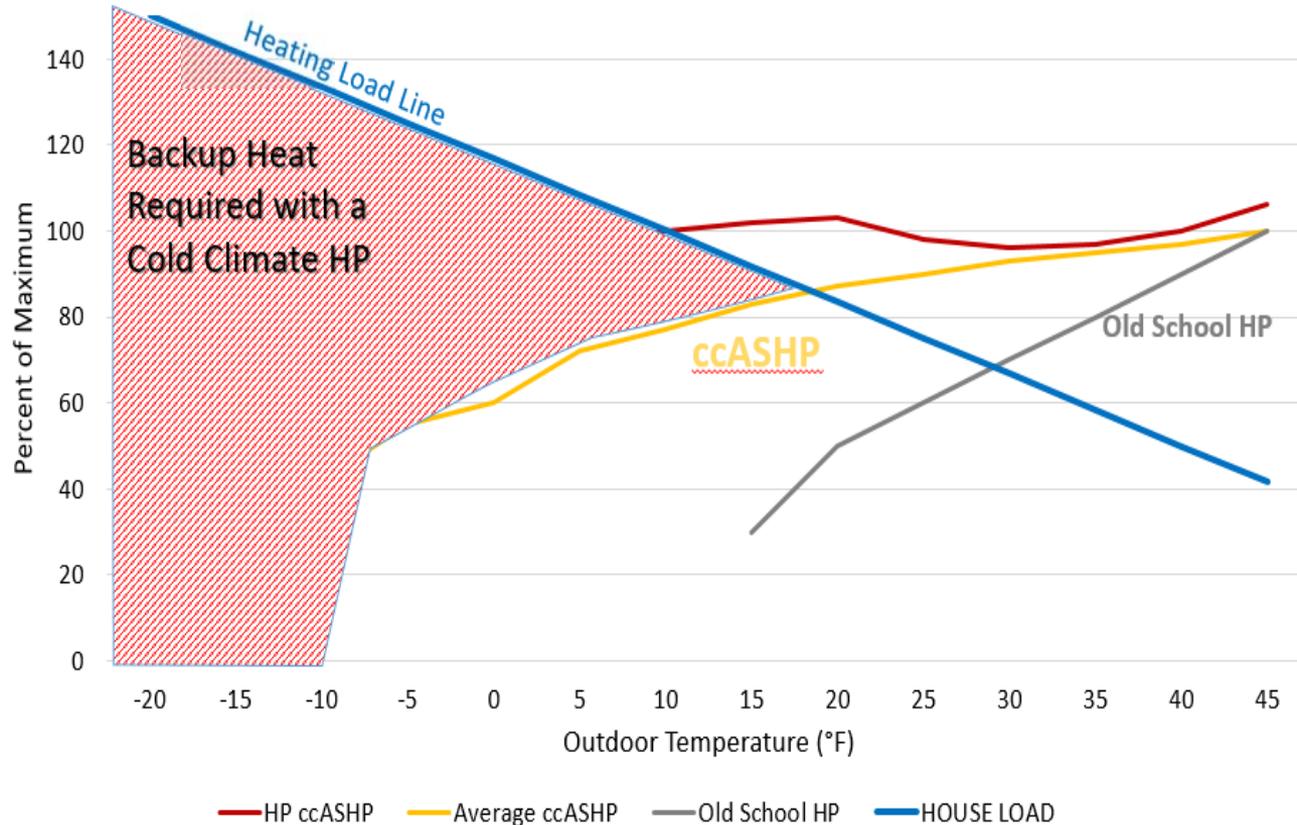
Setting the Stage VSHP

- Focus is on Variable Speed (VS) ASHPs
- VS ASHP equipment performance is improving. Creates new utility incentive opportunities
- Want to realize the energy and capacity savings value from this equipment
- Variety of nomenclature used today – Variable Speed, Extended Capacity, Cold Climate, High Performance...
- HSPF and SEER are not sufficient proxies for performance
- Need additional performance metrics and/or methods to identify VSHP equipment

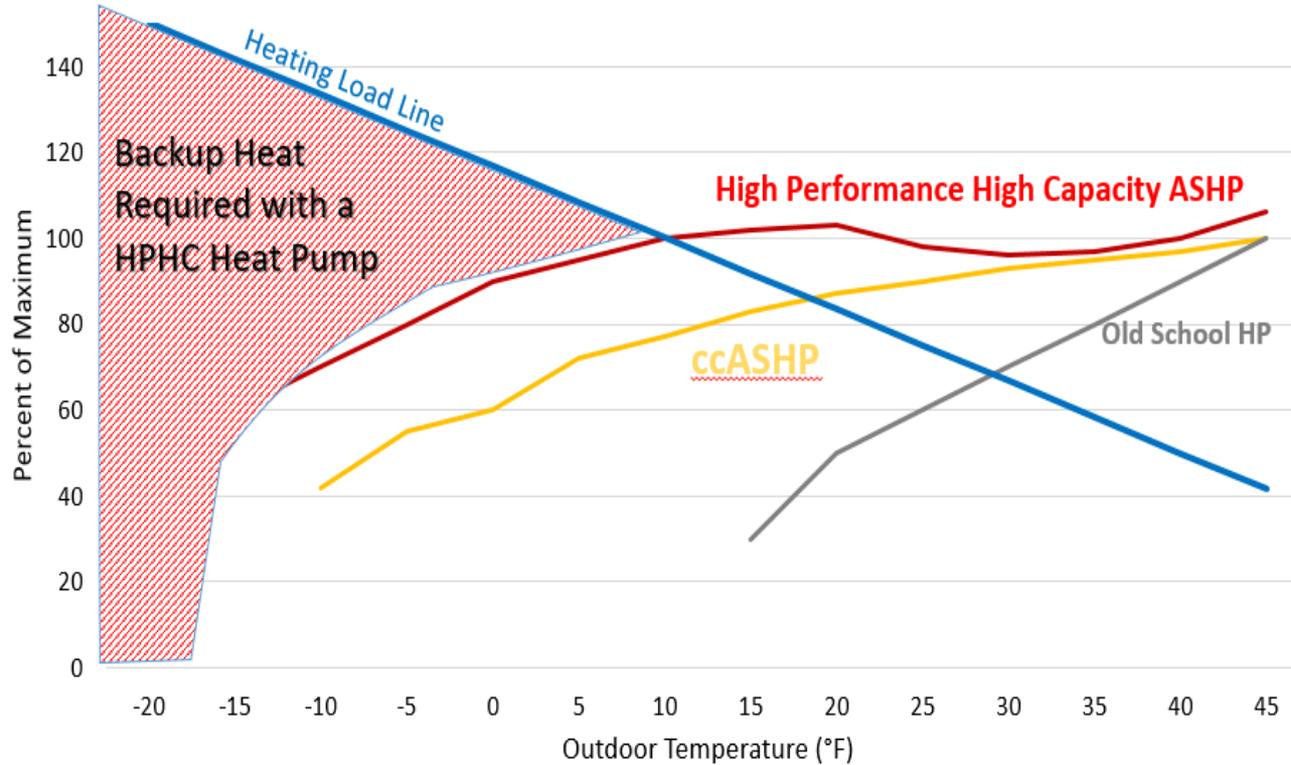
Heat Pump Capacity and House Heating



ccHeat Pump Capacity and House Heating

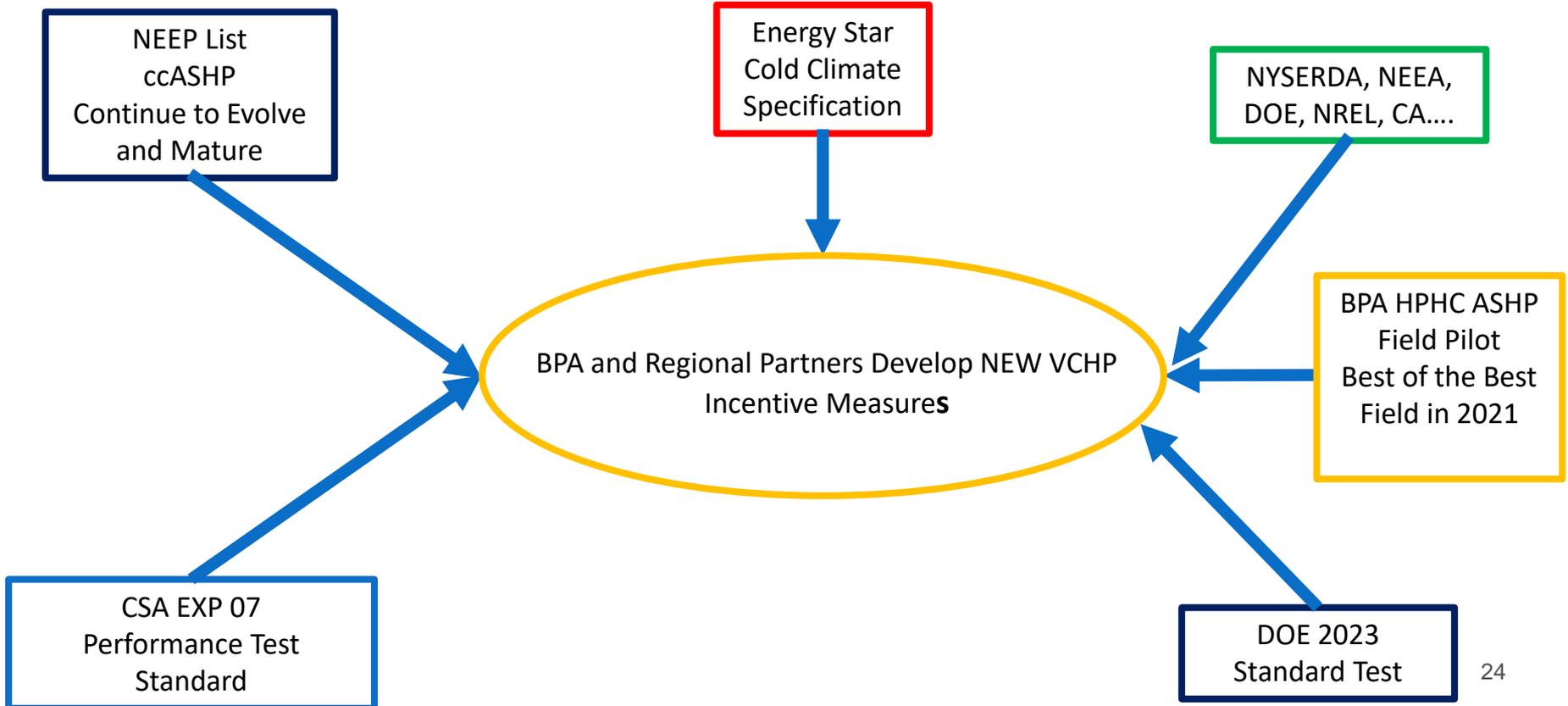


Best of the Best VC ASHP



— HP ccASHP — Average ccASHP — Old School HP — HOUSE LOAD

VS ASHP Incentive Development - 2023



New Opportunities

- Continue to scan and evaluate new opportunities
- One Example. New Form Factor- PTAC Alternative-Mono Block
- TIM Process:
 1. Step One: Complete - Feasibility Study - BPA E3T website
 2. Step Two: Planned - Bench/Applications test - “Kick the Tires”.



Additional Resources





Cold Climate Resources

1. Research:
 - a. [EXP07:19 Load-Based and Climate-Specific Testing and Rating Procedures for Heat Pumps and Air Conditioners - 2020](#)
 - b. [DHPs in Cold Climates Installer Research – 2020](#) (Addendum to DHP MPER #8)
 - c. [DHP Cold Climate Performance Evaluations - 2013](#) (Addendum No. 1 to the Ductless Heat Pump Impact and Process Evaluation: Field Metering Report)
2. [NW Cold Climate DHP Specification & Recommendations](#)
 - a. [NEEP QPL](#)
 - b. QPL filtered to NWSpec (contact sasmus@neea.org for access)
3. www.GoingDuctless.com
 - a. [Installer Guide: Ductless Heat Pumps for Cold Climates](#)
 - b. Blog Post: [DHP's for Cold Climates](#) – for Consumer audience
 - c. Blog Post: [9 Recommended Practices for Cold Climate DHP Installations](#) – for Installer audience
 - d. Blog Post: [Key Considerations for Cold Climate DHPs](#) – for Installer audience
 - e. Blog Post: [All About Cold Climate DHPs](#) – for Installer audience
4. [HVAC Sizing Tool](#) (available on BetterBuiltNW.com)
5. [2020 Installer Cold Climate Webinar Recordings](#) – Coming January 2021
6. Past Utility Webinars: ConduitNW.org – [NWDHPP/Resources](#)

Maximizing Mini-Split Savings Resources

1. [Maximizing Minisplit Meta Study Findings Nov. 3, 2020 – Webinar](#)
2. [www.GoingDuctless.com](#)
 - a. Blog Post: [Announcing Heat Pump Research Designed to Help Contractors and Utilities Maximize Energy Savings](#)
 - b. Blog Post: [Maximizing Energy Savings for Ductless Heat Pumps](#)
 - c. Blog Post: [Avoid Deep Thermostat Setbacks with Variable Capacity Heat Pumps](#)
 - d. Blog Post: [New Research Identifies Five Ways to Help Preserve Ductless Rebates](#)
3. Past Utility Webinars: ConduitNW.org – [NWDHPP/Resources](#)
4. Installer Training Webinars - [NWDHPP YouTube Channel](#)

Question & Answer

? ? ?



Thank you!

Paul Hawkins, BPA
pahawkins@bpa.gov

Suzi Asmus, NEEA
sasmus@neea.org

Robert Weber, BPA
rmweber@bpa.gov

