

Residential Cold-Climate Heat Pump Technology Challenge

Update for AEG New York Building Decarbonization Summit

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Introduction

- **Residential Cold-Climate Heat Pump Challenge ([Link](#))** aims to develop, test, and commercialize products by 2024 that are designed for 5°F and -15°F operation with performance beyond current best-in-class products.
 - DOE, NRCAN, and EPA
 - HVAC Manufacturers (8 commitments to date)
 - Utilities, State agencies, and other EE organizations (28 commitments to date)



U.S. DEPARTMENT OF
ENERGY



**Natural Resources
Canada**



United States
Environmental Protection
Agency



Scope of the CCHP Challenge

Residential, centrally ducted, electric-only HPs that perform better than today's products:

- Nominal cooling capacity 24,000 – 65,000 Btu/hr. and comply with all applicable federal and state standards
- Perform efficiently in cold climates with goals for 5 °F and optional challenge for -15 °F outdoor temperatures
 - Heating Seasonal Performance Factor 2 (HSPF2) of 8.5 (Region V cold climate temperature bins)
 - COP target of ≥ 2.4 for products under 48,000 Btu/hr and ≥ 2.1 for products over 48,000 Btu/hr.
 - Capacity ratio of 100% for capacity at 5 °F to capacity at 47 °F
 - Minimum turndown ratio at 47 °F (8.3 °C) $\geq 30\%$
 - Multi-stage auxiliary electric heating
- Employ low-GWP refrigerants (< 750 GWP, AR4 100 year)
- Incorporate advanced controls and grid-interactive capabilities (AHRI 1380 Demand Response)

Out-of-Scope*: Air-to-water, Ductless, Multi-split, Hybrid/dual fuel, Commercial rooftop units**

**May be considered for future initiatives*

*** DOE has recently launched a Commercial Building Heat Pump Technology Challenge ([Link](#))*

Updated List of State and Utility Partners ([Link](#))

- 9 State Agencies



- 19 Utilities and Cooperatives



CCHP Technology Challenge Timeline

Specification Development (2021-2022)

Kickoff Workshop
(June 2021)

Workshops /
Discussions with
Manufacturers
(Summer 2021)

Commitments &
Public
Announcement
(Nov. 2021 – Jan. 2022)

Product Development & Deployment (2022-2024)

Product
Prototype
(2021-2022)

Lab Testing
(2022-2023)

Field Testing
(Winter
'22-'23 &
'23-'24)

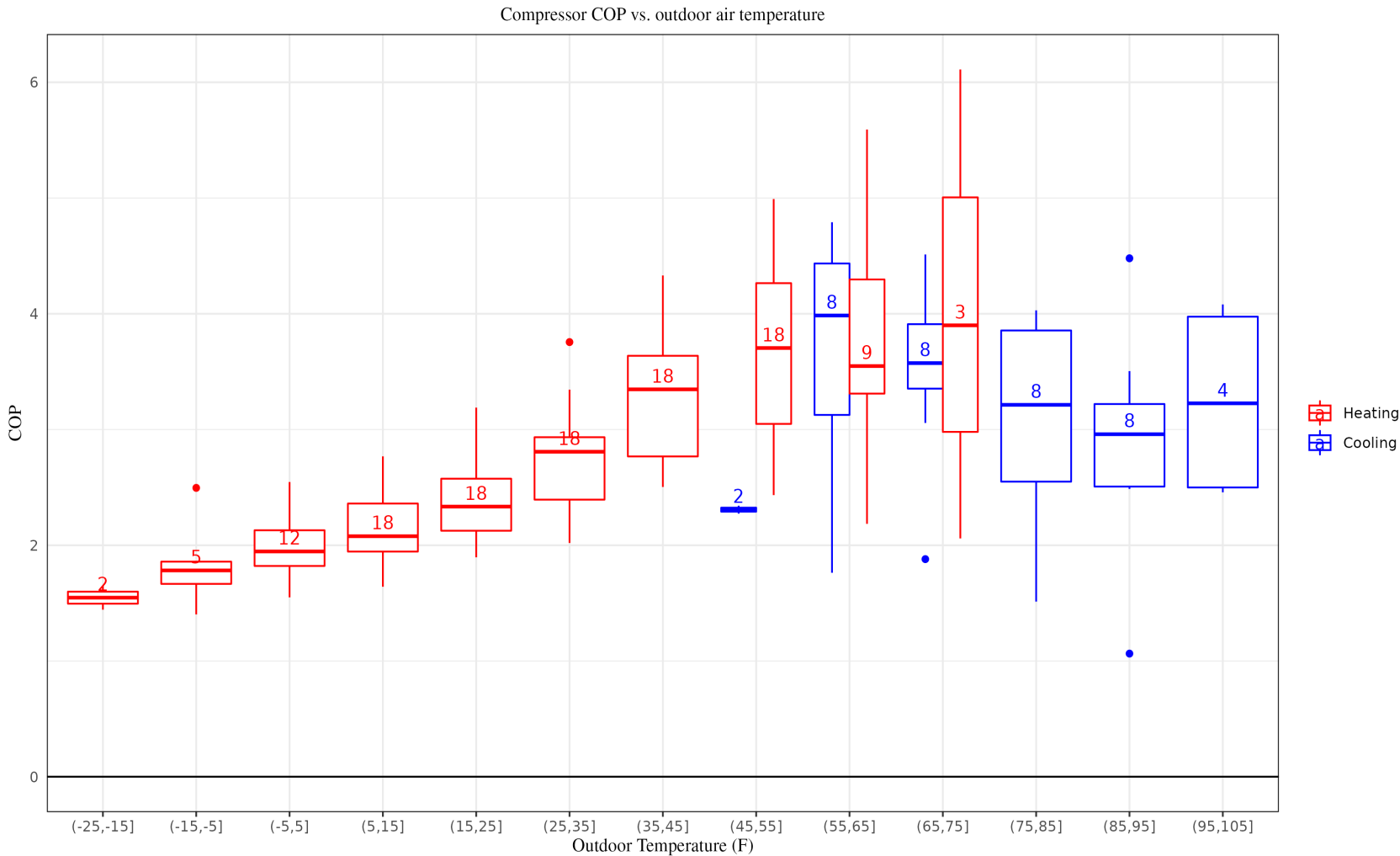
Deployment
Programs/
Commercial-
ization
(2024)

Nov. 1st, 2021: Launch with VP Harris
and Sec. Granholm in NY



- 8 manufacturers completed prototype performance testing at Oak Ridge National Laboratory or other testing facilities in 2022 or 2023
- When manufacturers successfully completed lab testing, their prototypes moved forward with field testing across US and Canadian homes:
 - 12 sites installed for winter '22-'23 with an additional 10 sites for winter '23-'24 (22 total sites)
 - **Northeast has 7 sites total with 5 in NYS,** 10 in Midwest, 2 Mountain West, and 3 Canada,

Field testing - Overall Trends and Observations



- Centrally ducted CCHPs can be installed in attics, garages, basements, crawlspaces, closets, and other locations
- Most CCHPs provided majority of the heating load, with little assistance from aux electric heating
- The variable-speed HPs responded to DR events by modulating their speeds to limit power consumption to pre-determined 30% or 60% reduction
- Prototype CCHPs were generally reliable; when issues occurred, the systems switched to aux electric heating to maintain comfort while technicians investigated the issue.

Each site represents one data point, the overall COP for each temperature bin. The number on each box plot indicates the number of sites with significant data (> 3 hours compressor runtime) in that temperature bin.

THANK YOU!

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