



CT Heat Pump Metering Study Kickoff Call

CT R2246 – Residential Heat Pump Study

December 14, 2022

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Study Objectives



Assess **heating and cooling performance and usage** of residential heat pumps



Estimate **baseline HVAC consumption** across all fuel categories



Quantify **gross baselines** for residential heat pumps to derive **gross measure impacts**



Coordinate with **other CT heat pump activities** throughout the study

Scope and Research Topics

Key research topics align with the Massachusetts HP Metering study

Scope: Massachusetts & Connecticut residential customers. Partial and full-displacement of existing oil, propane, gas, and electric resistance baseboard heating systems with central and mini-split heat pumps.*

Research Topics:**

1. **Performance:** Cold outdoor air temperature performance, operational (in-situ) coefficient of performance (COP) – all seasons
2. **Usage:** HP usage, overall measure impacts (electric consumption increase, fuel savings)
3. **Partial displacement-specific patterns:** Switchover temperatures, HVAC operational patterns, fraction of total loads met by HPs and what affects this (e.g., control sequences, associated settings)
4. **Full displacement-specific patterns:** Necessary system sizes, configurations, and building envelope characteristics
5. **Gross baselines:** Distribution of gross baseline system types

* Guidehouse will also monitor heat pump water heaters' usage when found onsite
** Full list of research questions can be found in the appendix



Usage versus Performance Sites

	Usage Data	Performance Data
Data collected	<ul style="list-style-type: none"> • Usage of heat pump and non-heat pump HVAC equipment: • power draw of heat pumps • usage of gas, propane, fuel oil, and wood • plug load monitoring of window AC units and space heaters 	<ul style="list-style-type: none"> • Captures everything at a usage site. In addition: • fan airflow • indoor temperature and relative humidity at the supply and return • outdoor temperature
Purpose for collection	Provides only electric consumption. Estimate post-retrofit and baseline HVAC consumption across all measure and fuel types.	Provides heating/cooling output for the home. Rated vs. operational (in situ) performance, performance at low outdoor air temperatures, and COP.



Data Sources and Sampling Breakdown

Guidehouse will collect data from three sources

Data Sources:

- 1. **Customer data from PAs** – includes measure details, customer contact info
- 2. **Guidehouse survey of HP program participants** – confirms customer data & gathers data on installation decisions, customer experiences, control types, and gross baseline determination information
- 3. **Onsite data collected from field visits and ongoing monitoring** – includes indoor/ outdoor temperature, humidity, fan airflow, and power draw from all heating sources

Description	Total Sites
Mini-Split HPs	45%
Central HPs	39%
MF Mini-Split HPs	13%
Ground Source HPs	3%
Totals	100%

	Partial	Full	Total
Usage Only	33%	13%	46%
Usage & Performance	13%	41%	54%
Total	46%	54%	--

* Tables represent joint sampling between Massachusetts & Connecticut



Analysis

Data analysts will integrate data sources to generate insights

- **Survey and Metered Data Analysis:**
 - Determine usage, efficiency, and heating/cooling loads for heat pump installations.
 - Determine usage of both heat pumps and backup HVAC systems for use in impact analysis.
 - Summarize customer survey findings (customer installation decisions/baselines, control types, HVAC operation practices, experience with their heat pump, and comfort levels).
- **Bill Disaggregation and Analysis:** Disaggregate electric and fuel utility bills to determine typical pre- and post-retrofit electric and natural gas monthly and annual consumption.
- **Determine Measure Impacts:** Use calibrated building models to estimate baseline consumption with various HVAC systems, fuel types, and efficiencies. Calculate measure impacts (electric increase and fuel savings for each measure, normalized by ton).



Combined MA and CT Schedule

- **October 2022, April 2023:** Meters installed
- **October 2022, April 2023:** Surveys Conducted
- **April 2023:** Results from First Heating Season
- **April 2024:** Results from First and Second Heating Seasons, drafting findings/ recommendations for comments
- **May 2024:** All meters uninstalled
- **August 2024:** Final Report

Estimated CT Budget

Tasks	Budget
Planning, Data Requests & Surveying	\$149K
Sampling & Metering incl. Expenses	\$521K
Analysis & Reporting	\$366K
Total	\$1.04M*

*Does not include contingency

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