



Memorandum

To: Brett Feldman, Ann Clarke, Rhode Island Energy

From: Jeremy Newberger, Annemarie Eastwood, Guidehouse

Date: October 14, 2025

Re: Massachusetts and Connecticut 2024 Heat Pump Study Review and Application to Rhode Island

Introduction

In the 2025 Annual Energy Efficiency Plan, Attachment 3 (Evaluation, Measurement and Verification Plan), Rhode Island Energy (RIE) proposed to review the recently completed “Massachusetts and Connecticut 2024 Heat Pump Study” (the Study) and obtain Rhode Island-specific useful information from it.

The MA/CT Study covered different types of baseline configurations and installations and presented various savings and impact parameters. It is therefore necessary for the Company to review the Study to determine if all the information it needs relative to measures it offers is provided by the Study. If the determination is “yes,” then no further analysis would be required, and the Company can proceed with adopting the results of the Study. If the determination is “no,” then the Company would need to work with the Study’s authors¹ to leverage and analyze the Study’s dataset to isolate results for application to Rhode Island Energy’s program offerings.

This memo contains the results of our review of the Study and our recommendations about whether additional analysis is needed.

Needs

It is our assessment that Rhode Island Energy is interested in the following three items and if the Study can address these needs, no further analysis of the Study’s data would be needed:

- a. Specific results to update the impact results for RIE’s program offerings. At this point, this is restricted to electric resistance-to-electric heating system upgrades; fuel conversion is not of significant interest to RIE, though it is of interest to the state and its programs.
- b. Specific results to inform discussions with state heat pump program administrators about savings from coordinated heat pump and weatherization (HP+WX) installation.
- c. Qualitative findings regarding best practices to ensure quality installations and optimal performance of heat pumps installed by RIE’s programs in Rhode Island.

In addition to these needs, Rhode Island Energy also expressed interest in applying the results of the study for cooling-only savings for heat pump measures and Small Business applications.

¹ The study was conducted by Guidehouse for MA and CT program administrators. We acknowledge that our review and findings present a potential conflict of interest and therefore provide full documentation of our review for RIE’s consideration and decision making.



Measures Included in the Study with Reported Results

The Study provides energy impacts, per ton, for central heat pumps (full displacement), central heat pumps (partial displacement), mini-split heat pumps (full displacement), mini-split heat pumps (partial displacement), and ground source heat pumps (full displacement). For each of these, the impacts are presented for a variety of pre-existing fuels: electric, natural gas, oil, and propane.

Further, the Study isolates savings associated with an electric resistance baseline and full disconnection or removal of the baseline system. Therefore, for the seven measures offered by RIE, the Study's results appear to be sufficient. The Study also provides performance information – COP, output, seasonal performance – for various equipment configurations.

Rhode Island Baseline Adjustments

Baseline adjustments were applied to the various heat pump measures to align with the appropriate baseline used in Rhode Island. The tables in section 2.5.5 of the Study were leveraged to normalize the baseline savings.

The following adjustments were made to the baselines:

- For all heat pump measures, the heating baseline was normalized to include existing conditions only rather than including the alternative action of what the customer would have installed if they did not install a heat pump.
- For the electric resistance to MSHP measures, the heating baseline was adjusted to consider electric resistance heat only, whereas the Heat Pump Study found that homes with electric resistance heat may also heat with delivered fuels and natural gas.
- For the mini-split heat pump measure, the heating and cooling baselines were normalized to reflect a baseline standard efficiency mini-split heat pump.

Additionally, the savings were assumed to be an average of partial displacement and full displacement. Rhode Island Energy does not have any requirements for full displacement but with electric resistance displacement it is likely that full displacement is occurring.



Impact Results

Measures RIE Offers

As seen in Table 1, there are seven residential heat pump measures in the Rhode Island TRM. The Study provided savings for single family homes thus five of the seven measures require updating. The measures in the multifamily programs are calculated and therefore do not require updating.

Table 1. Residential Heat Pump Measures Comparison

Program	Measure Name	Base case	High Efficiency Case	2025 Plan Savings (kWh/cooling ton) ^a	2025 Plan Heat Pump Capacity (Cooling Tons)	Proposed Savings (kWh/cooling ton) ^b	Nominal Heat Pump Capacity (Cooling Tons) ^c	Demand Savings (kW/cooling ton) ^d	Benefit-Cost Ratio ^e
EnergyWise Single Family	Electric Resistance to MSHP	The baseline efficiency case for heating is a residential electric resistance heating system.	The purchase and installation of high efficiency mini-split heat pump system to replace an electric resistance heating system. (ENERGY STAR Cold Climate Heat Pump v6.1)	2,695	2.43	2,529	2.9	0.49	3.20
Income Eligible Single Family	Electric Resistance to MSHP	The baseline efficiency case for heating is a residential electric	The purchase and installation of high efficiency mini-split	2,695	2.43	2,529	2.0	0.49	1.51



Program	Measure Name	Base case	High Efficiency Case	2025 Plan Savings (kWh/cooling ton) ^a	2025 Plan Heat Pump Capacity (Cooling Tons)	Proposed Savings (kWh/cooling ton) ^b	Nominal Heat Pump Capacity (Cooling Tons) ^c	Demand Savings (kW/cooling ton) ^d	Benefit-Cost Ratio ^e
		resistance heating system.	heat pump system to replace an electric resistance heating system.						
Residential HVAC	Central Heat Pump	Baseline is electric resistance heating or a standard efficiency central heat pump	Efficient case is high-efficiency heat pump.	506	3.03	1,443	3.03	-0.69	7.16
Residential HVAC	Electric Resistance to MSHP	The baseline efficiency case for heating is a residential electric resistance heating system.	The purchase and installation of high efficiency mini-split heat pump system to replace an electric resistance heating system. (EnergyStar v6.1)	2,695	2.43	2,529	2.9	0.49	3.20



Program	Measure Name	Base case	High Efficiency Case	2025 Plan Savings (kWh/cooling ton) ^a	2025 Plan Heat Pump Capacity (Cooling Tons)	Proposed Savings (kWh/cooling ton) ^b	Nominal Heat Pump Capacity (Cooling Tons) ^c	Demand Savings (kW/cooling ton) ^d	Benefit-Cost Ratio ^e
Residential HVAC	Mini Split HP	The baseline efficiency case is a non-energy efficient rated ductless mini split heat pump with SEER 15, HSPF 8.2.	The minimum program qualifications for the high efficiency case is an ENERGY STAR Cold Climate Heat Pump v6.1: 15.2 SEER2 8.5 HPSF2 system.	251	2.33	911	2.33	0.17	4.40
EnergyWise Multifamily	Heat Pumps	Existing site conditions (electric resistance heating or heat pump)	Heat pump displacing electric resistance heating or an inefficient heat pump.	Calculated	Site Specific	Calculated	Site Specific	Calculated	NA
Income Eligible Multifamily	Heat Pumps	Existing site conditions (electric resistance heating or heat pump)	Heat pump displacing electric resistance heating or an inefficient heat pump.	Calculated	Site Specific	Calculated	Site Specific	Calculated	NA

a. Previously, RIE used kWh savings for heat pump measures, but we recommend using kWh/ton savings moving forward; the numbers in the table reflect this conversion. We anticipate the tonnage would be an input into the calculation of the savings.



- b. Values are derived from MA/CT Heat Pump Study; we assumed the average savings per ton between full displacement and partial displacement as the values did not vary significantly as seen in Table 6-4 of the Study and RIE does not have a requirement of full displacement. [MA-HPMS-CT-R2246-Heat-Pump-Metering-Study-Final-Report_August_2024.pdf](#)
- c. Values are derived from the results of the EWSF Impact Evaluation for the EWSF program, based on historic data from EFI production data for the Residential HVAC program, and recent heat pump data for IESF Program.
- d. Demand savings come from the Heat Pump Study and are referenced in the MA 2025-2027 TRM.
- e. All measures were screened in the September 16, version of the 2026 Benefit Cost Model. The proposed savings and demand savings were used for benefit-cost screening. Please refer to [Attachment 3](#), Section 5.2 of the 2026 Annual Plan for more details on the cost assumptions used during screening.



Cooling Only Heat Pump Measures

Regarding cooling-only savings for heat pump measures, Guidehouse researched how MA is currently applying the savings and found the following savings, as seen in Table 2, noted in the MA 2025-2027 Plan. The MA TRM notes the source of the values is the Study, but it is not apparent how these values were calculated after reviewing Study results. Guidehouse screened the measures through the benefit cost model using the savings and cost assumptions noted in MA and found these measures to not be cost effective as seen in Table 2.

Table 2. Cooling Only Heat Pump Measures

Measure	Base Case	High Efficiency Case	kWh/ton Savings	kW/ton savings	Benefit Cost Ratio
Central Heat Pump (Cooling Only)	The baseline is an existing central air conditioning system.	The high efficiency case is a SEER 17.6, HSPF 9.8 heat pump unit.	69	0.0656	0.14
MiniSplit Heat Pump (Cooling Only)	The baseline is a room air conditioner.	The minimum program qualifications for the high efficiency case is a 16 SEER 9.5 DMSHP system. For savings the high efficiency is based on the average capacity and efficiency levels of systems rebated in the previous calendar year which is 19.7 SEER and 11.2 HSPF.	156	0.1482	0.16

Applicability to Small Business Heat Pump Measures

Regarding the applicability of the Study results to HP installations in small business premises, the Study does not provide results for Small Business installations. The average ASHP size reported in the Study was up to 4.4 tons for Central HP, partial displacement. If the Company’s Small Business HP offering were to be restricted to the installation of multiple units 5 tons or less, the results of the Study may be applicable, subject to additional confirmation of applicable usage patterns. If the Small Business offering were to include larger units, the impact results from the Study would not be applicable.



Heat Pump and Weatherization Installations

Both MA and CT offer incentive bonuses on heat pump installation to customers when they move forward with weatherization recommendations made during a home energy assessment prior to installing the heat pump. Weatherization status was surveyed in the Study. Over 75% of customers doing a full displacement installation indicate completing home weatherization upgrades in response to a MA or CT home energy assessment and a majority (over 55%) of partial displacement installations reported the same.

Recruiting for the MA/CT Study occurred in 2021 and 2022. It is not clearly documented in the Study when the reported weatherization occurred relative to recruitment. However, given the preponderance of responses indicating that weatherization had occurred, it is reasonable to assume that the results provided in the Study are HP savings assuming weatherization had already occurred, and the reported savings are from heat pump installations alone.

The Study observes that measure impacts are lower than what was previously being used by MA and CT. Among the factors contributing to this are lower hours of HP use due to the use of other forms of heat, higher existing unit efficiencies, use of integrated controls and varying switchover temperatures.

In Rhode Island, there is insufficient information available to determine whether homes are weatherized before heat pump conversions. The Office of Energy Resources (OER) previously offered the Clean Heat RI program to both market rate and income eligible customers but only required weatherization prior to heat pump installation for income eligible customers. With the relaunch of the Clean Heat RI program in 2025, the Office of Energy Resources (OER) will focus exclusively on income eligible and moderate income customers, requiring weatherization for all participants.

For homes that are not weatherized, the 2025 Income Eligible Single Family Impact Evaluation in Rhode Island developed results for weatherization savings after a heat pump conversion, as seen in Table 3. The modeling that was developed for the Income Eligible Single Family program was leveraged with the results from the Energy Wise Single Family Evaluation to develop the weatherization savings as seen in Table 3 for Energy Wise Single Family. The weatherization savings after heat pump installation are additive to the savings from the heat pump conversion. RIE will need to discuss how they want to apply these savings.

Table 3. Weatherization Savings After Heat Pump Installation²

Program	Weatherization Savings After Heat Pump Installation (Annual kWh savings)	Weatherization Savings After Heat Pump Installation (Annual kWh/ton savings)	Average Heat Pump Capacity (tons)
Income Eligible Single Family	145	101	1.4
Energy Wise Single Family	291	101	2.9

² For more details on weatherization savings prior to heat pump installation, please refer to Appendix A.

Quantitative Findings to Increase Likelihood of Optimal Performance Consistent with the Results

The following characteristics or program requirements from Massachusetts and/or Connecticut are noted in the Study. They are presented here to identify potential program “best practices” rather than program rules on which the savings are contingent.

- Project must include either the removal or disconnection of the pre-existing heating system, or the homeowner must agree to not use the pre-existing system unless there is an emergency. The pre-existing system can remain in place and operate only if it is used for domestic hot water heating.
- Homes must also be occupied full time during the winter heating season.
- Homes must be sufficiently weatherized prior to heat pump installation.
- There should be a switchover temperature of 30°F or lower.
- Create or enhance quality control checklists for any verification visits.
- Check for potential maintenance items such as condensate or refrigerant charge issues.

The following are specific considerations recommended by the Study for future program design:

- Enhance program requirements to more clearly identify criteria for Full Displacement and Partial Displacement installations.
- Give additional guidance to installers on switchover temperatures and heat pump sizing.
- Consider adjustments to program requirements for integrated controls, especially for MSHPs.
- Provide customers with additional education on how installing a heat pump will impact their electricity bill.
- Conduct a heat pump technical assessment periodically to inform program requirements.

Conclusions and Next Steps

Based on our review, we conclude the following:

- The MA/CT Study provides sufficient information to RIE for application to RIE’s current heat pump measure offerings; no further analysis of MA/CT data is warranted.
- Therefore, the MA/CT Study should be adopted by RIE with regard to the measures RIE offers; no conclusion is made about measures RIE does not currently offer.³
- The 2026 RI TRM and planning tools should be updated to incorporate the quantitative results for electric resistance to HP measures (assuming full disconnect of baseline).⁴
- Guidehouse reviewed a cooling only replace on failure for central and/or mini-split heat pumps measures and found that the measures are not cost effective.

In addition, we recommend the following

- RIE should conduct further research to identify applicable savings to use in characterizing small business HP measures.
- RIE should review its own heat pump program requirements and compare it with the Study’s recommendations related to future program design.

³ Should RIE begin to offer incentives for fuel conversion, another review of the MA/CT Study would be necessary.

⁴ Guidehouse performed a comparison of the savings estimates for HP installation, assuming pre-installation weatherization, from the recent Cadeo analysis with the HP savings estimates to the Study. Overall, the Study’s results showed lower savings compared to the Cadeo analysis. However, since the Study’s results are based on metered data rather than modeling, we determined that the Study is a more reliable source. Please see Appendix A for this comparison.



Appendix A

Comparison

Table A is a comparison of the results between the Cadeo analysis⁵ (as seen in green) and the Heat Pump Study (as seen in blue). The Cadeo analysis used building modeling for the calculation of savings whereas the Study used metered data. We are currently using the Cadeo Analysis for the cooling ton estimates in Table 1 for EWSF. We are also using the weatherization savings from the Cadeo Analysis for the EWSF and IESF programs.

Table A. Cadeo Results Compared to Heat Pump Study

Program	Existing Heating System	New Heating System	Heat Pump Capacity (tons)	RI										MA w/ Baseline Adjustments for Electric Resistance Heat							
				Weatherization Savings Before Heat Pump Installation		Weatherization Savings After Heat Pump Installation		Heating System Conversion Savings				Weatherization Savings + Heating System Conversion Savings		Full Displacement MSHP		Partial Displacement MSHP		Full Displacement CHP		Partial Displacement CHP	
				Electric Savings (kWh)	Gas Savings (MMBtu)	Electric Savings (kWh)	Electric Savings/Heat at Pump Capacity (kWh/ton)	Electric Savings (kWh)	Electric Savings/Heat at Pump Capacity (kWh/ton)	Delivered Fuel Savings (MMBtu)	Del Fuel Savings/Heat Pump Capacity (MMBtu/ton)	Electric Savings/Heat Pump Capacity (kWh/ton)	Del Fuel Savings/Heat Pump Capacity (MMBtu/ton)	Electric Savings/Heat Pump Capacity (kWh/ton)	Del Fuel Savings/Heat Pump Capacity (MMBtu/ton)	Electric Savings/Heat Pump Capacity (kWh/ton)	Del Fuel Savings/Heat Pump Capacity (MMBtu/ton)	Electric Savings/Heat Pump Capacity (kWh/ton)	Del Fuel Savings/Heat Pump Capacity (MMBtu/ton)	Electric Savings/Heat Pump Capacity (kWh/ton)	Del Fuel Savings/Heat Pump Capacity (MMBtu/ton)
IESF	Electric Resistance	Heat Pump	1.4	596	NA	145	101	2,865	2,003	NA	NA	2,105	NA	1,103	NA	1,140	NA	1,808	NA	1,079	NA
IESF	Electric Furnace	Heat Pump	1.4	710	NA	145	101	4,320	3,021	NA	NA	3,122	NA	1,103	NA	1,140	NA	1,808	NA	1,079	NA
IESF	Heat Pump	NA	1.4	145	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
IESF	Gas Boiler/Furnace	Heat Pump	2.3	84	9.3	405	NA	-2,793	-1,209	NA	79.9	-1,034	34.6	NA	NA	NA	NA	NA	NA	NA	NA
IESF	Oil Boiler/Furnace	Heat Pump	2.5	84	8.5	424	170	-2,940	-1,181	78.2	-1,010	31.4	-1,208	15.5	-1,129	15.3	-1,338	16.8	-920	10.6	
IESF	Propane Boiler/Furnace	Heat Pump	1.7	84	5.8	316	185	-2,067	-1,209	54.6	54.6	-1,024	31.9	-1,002	14.9	-927	14.6	-1,328	15.4	-915	9.7
EWSF	Electric Resistance	Heat Pump	2.9	1,148	NA	291	101	5,883	2,050	NA	NA	2,151	NA	1,103	NA	1,140	NA	1,808	NA	1,079	NA
EWSF	Electric Furnace	Heat Pump	2.9	1,408	NA	291	101	8,561	2,983	NA	NA	3,084	NA	1,103	NA	1,140	NA	1,808	NA	1,079	NA
EWSF	Heat Pump	NA	2.9	291	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EWSF	Gas Boiler/Furnace	Heat Pump	3.5	70	13.1	615	NA	-3235	-922	NA	78.4	-747	22.4	NA	NA	NA	NA	NA	NA	NA	NA
EWSF	Del Fuels Boiler/Furnace	Heat Pump	3.4	64	12.2	603	177	-3172	-933	76.2	76.2	-756	22.4	-1,208	15.5	-1,129	15.3	-1,338	16.8	-920	10.6

⁵ The [Income Eligible Single Family Impact Evaluation](#) completed an additional analysis of weatherization savings pre- and post- heat pump conversion. These results are presented in Table A.