

Appendix I
Residential Baseline Study

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for Residential Baseline Study**

**By Ian G. Burnes and Laura Martel
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Introduction

1. What is the purpose of this testimony?

This testimony describes the Residential Baseline Study commissioned by Efficiency Maine and conducted by NMR Group.

2. Who is introducing this testimony?

The testimony is provided by Ian Burnes and Laura Martel. At the Trust, Mr. Burnes is the director of strategic initiatives and Ms. Martel is the evaluations manager.

3. Mr. Burnes, please state your name, title and business address.

My name is Ian Burnes, and I am employed by EMT as the Director of Strategic Initiatives. My business address is 168 Capitol Street, Suite 1, Augusta, ME 04330.

4. Please summarize your educational and professional experience.

I have a Bachelor of Arts Degree in Economics from Wesleyan University. I have been working at the Trust since 2009. My responsibilities include the oversight of the strategic initiatives team that implements the Trust's customer tracking database, maintains the Technical Reference Manuals, oversees the program evaluations, manages the Trust's resource in ISO-NE's Forward Capacity Market, and coordinates the Trust's work at the Public Utilities Commission. Before coming to the Trust, I worked at the Governor's Office of Energy Independence and Security.

5. Ms. Martel, please state your name, title and business address.

My name is Laura Martel, and I am employed by EMT as the Senior Research and Evaluation Manager. My business address is 168 Capitol Street, Suite 1, Augusta, ME 04330.

6. Please summarize your educational and professional experience.

I have a Bachelor of Science Degree in Ocean Engineering from Florida Atlantic University and a Master of Engineering in Acoustics from Pennsylvania State University. I have over 20 years of technical leadership, project management, and research and evaluation experience. I was hired by EMT in 2014 to design and implement impact and process evaluations for energy efficiency programs. I am responsible for the Efficiency Maine Technical Reference Manuals. Prior to joining EMT, I was with Lockheed Martin in Manassas, Virginia, where I served in various engineering, management, and technical leadership roles of increasing responsibility.

7. What are the objectives of the Residential Baseline Study?

The Residential Baseline Study was commissioned to assess the existing condition of Maine’s residential housing stock and to identify opportunities for energy saving. The study was intended to update and supplement a 2015 baseline study and assess changes in the existing housing stock over the past 9 years.

8. How does this study differ from the 2015 Residential Baseline Study?

The 2015 Residential Baseline Study was conducted with on-site, in-depth audits of 42 single family homes. The current study expanded the scope to include multifamily buildings and to over sample manufactured homes to gain insight into these building types that were not addressed in the 2015 study.¹ The current study leveraged a much larger sample size with photo-augmented web surveys and virtual audits to assess hundreds of homes providing a more robust sample.

9. What are some of the key findings from this study regarding past program activity?

Efficiency Maine programs are influencing the existing housing stock in Maine. Heat pump and heat pump water heater penetrations rose significantly between 2015 and 2024. Heat pumps were found in 6% of the homes studied in 2015. In 2024, 26% of homes studied have at least one heat pump installed. Heat pump water heaters were found in 19% of homes studied in 2024 compared to only 5% in 2015.

10. What are some of the key findings from this study regarding future program activity?

The study found that significant opportunity remains for heat pump and heat pump water heater installations. The study found that 47% of the remaining square footage is an exceptional candidate for being heated with a heat pump and that most homes without a heat pump water heater have suitable conditions for a heat pump water heater installation. But there remain perceived barriers for homeowners and landlords to install these measures without program intervention. The report states, “over one-quarter of survey respondents (27%) disagree with the statement ‘Heat pumps are less expensive to install than other heating and cooling systems’ and 35% disagreed that heat pumps have lower maintenance costs than other systems.”

Cooling is becoming a common amenity in Maine homes. The study found 84% of homes sampled have mechanical cooling compared to just 31% in the 2015 baseline study. Homeowners are adding cooling with room air conditioners at approximately twice the rate as heat pumps with 40% of homes adding room air conditioners and 20% of homes adding cooling with heat pumps in the past three years.²

Manufactured homes constructed before 1990 have the highest energy consumption based on prototyping performed for the baseline study. This energy consumption is driven by heat loss through walls, air infiltration, and duct leakage. With over 52% of manufactured homes built before 1990, this subsector may present significant savings opportunities for weatherization projects.

Efficiency Maine discontinued rebates on air purifiers and dehumidifiers based on internal studies that determined the baseline for these appliances may have already moved to the efficient options. The

¹ The 2015 Residential Baseline Study included 4 manufactured homes – a sample too small to assess independently.

² 65% of room air conditioners installed in the last three years * 62% of homes with room air conditioners = 40%.
79% of heat pumps installed in the last three years * 25% of homes with heat pumps = 20%.

baseline study confirmed this assessment, finding 94% of air purifiers and 90% of dehumidifiers are Energy Star certified.

11. What are the implications of the revised average annual heat load for an average Maine home?

The current study found a large difference between the annual heat load estimated in the 2015 Residential Baseline Study (92 MMBtu/y) and the annual heat load derived from the 2020 RECS data³ (63 MMBtu/y). The study authors believe that homes have become more efficient but that random sample error may be a contributing factor to the magnitude of the difference. The study researchers recommend Efficiency Maine adopt an average annual heat load of 77 MMBtu/y for single family homes – an average of the two studies’ findings. This is a 16% drop in heat load from the value established with the 2015 Residential Baseline Study.

The recommended 77 MMBtu/y is in line with annual heat loads reported to the program for whole home heat pumps. The average annual heat load for projects completed between September 2023 and April 2024 was 75 MMBtu/y.

While changing from 92 MMBtu/y to 77 MMBtu/y is a significant change, it has limited impact on active efficiency measure energy impact calculations. The only active measure that uses annual heat load in its impact calculations is the ground source heat pump TRM entry. The heat pump and weatherization TRM entries rely on project specific reported parameters rather than a statewide average annual heat load.

Scaling the energy impacts by 84% does not change the cost-effectiveness status of the ground source heat pump measure. The Technical Reference Manual entry for ground source heat pumps has been updated to reflect the new estimated annual heat load of 77 MMBtu/y.

The Trust is using/will use the new value of 77 MMBtu/y in all single-family home example calculations that rely on annual heat load such as the default values used in the Compare Home Heating Costs calculator hosted on the Trust’s website⁴.

12. Does this conclude your testimony?

Yes.

³ Energy Information Administration’s (EIA’s) 2020 Residential Energy Consumption Survey (RECS) microdata for Maine.

⁴ <https://www.energymaine.com/at-home/heating-cost-comparison/>