Maximizing the Potential of Heat Pumps in Vermont: Opportunities and Challenges

Josh Valentine

EAN Summer Intern

August 2023

About Me

Project Purpose

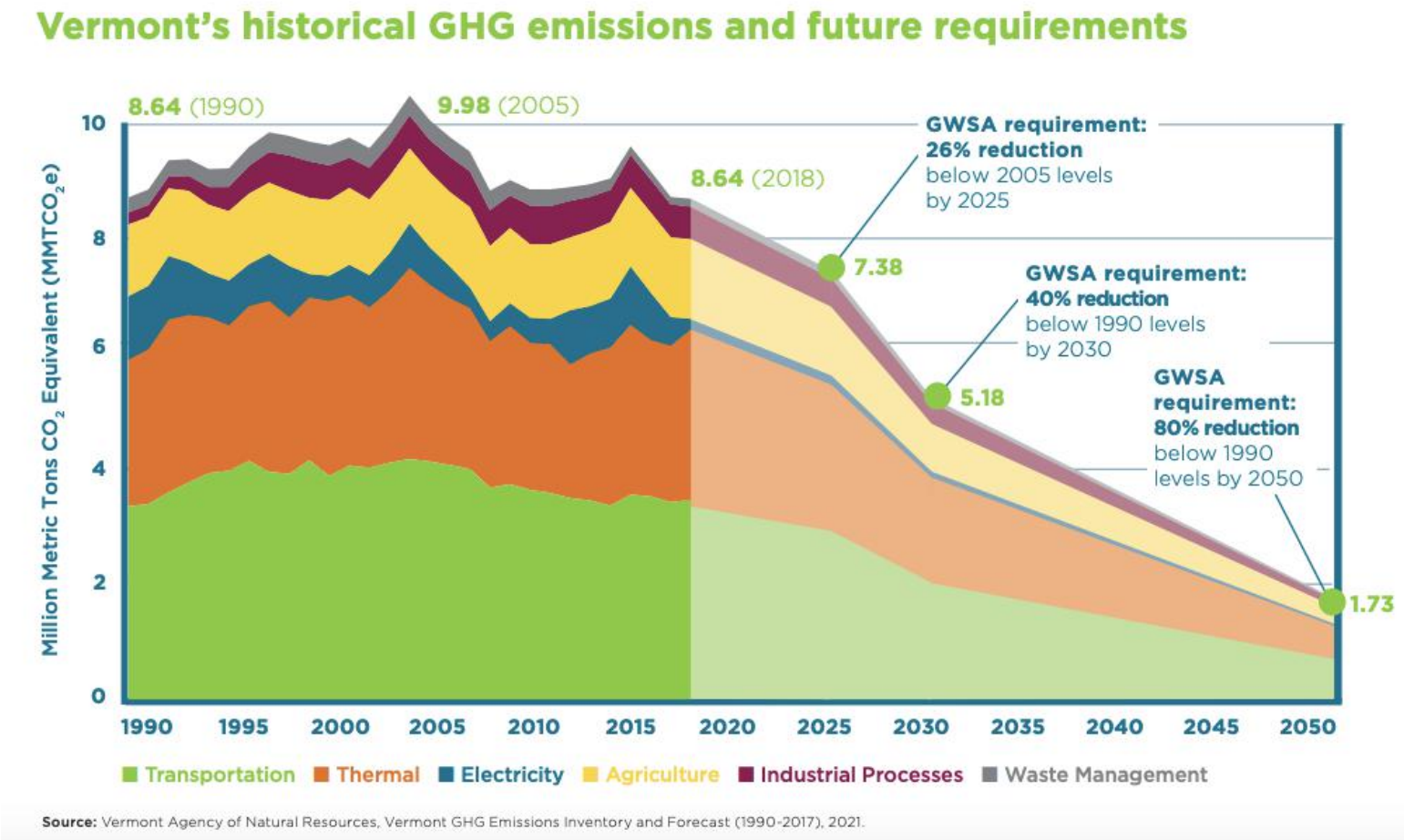
- Research and document the current market for heat pumps in Vermont.
- Identify key opportunities and challenges affecting the ability to rapidly scale up heat pump use in order to meet legally-binding GHG reduction targets.
- Suggest future strategies and actions for addressing key challenges.

Methodology

- Through literature review and interviews with industry experts, the following key questions were addressed:
  - What is the level of market activity and utilization needed to meet GHG reductions modeled for heat pumps for the Vermont Climate Action Plan?
  - What is the level of current market activity and use of heat pumps and who are the key market players?
  - What is working well in Vermont and where is their room for enhancement in order to achieve rapid market scale up?
  - What activities or initiatives are needed (or underway) to address the opportunities and challenges?

The Context for Rapidly Scaling Heat Pump Use

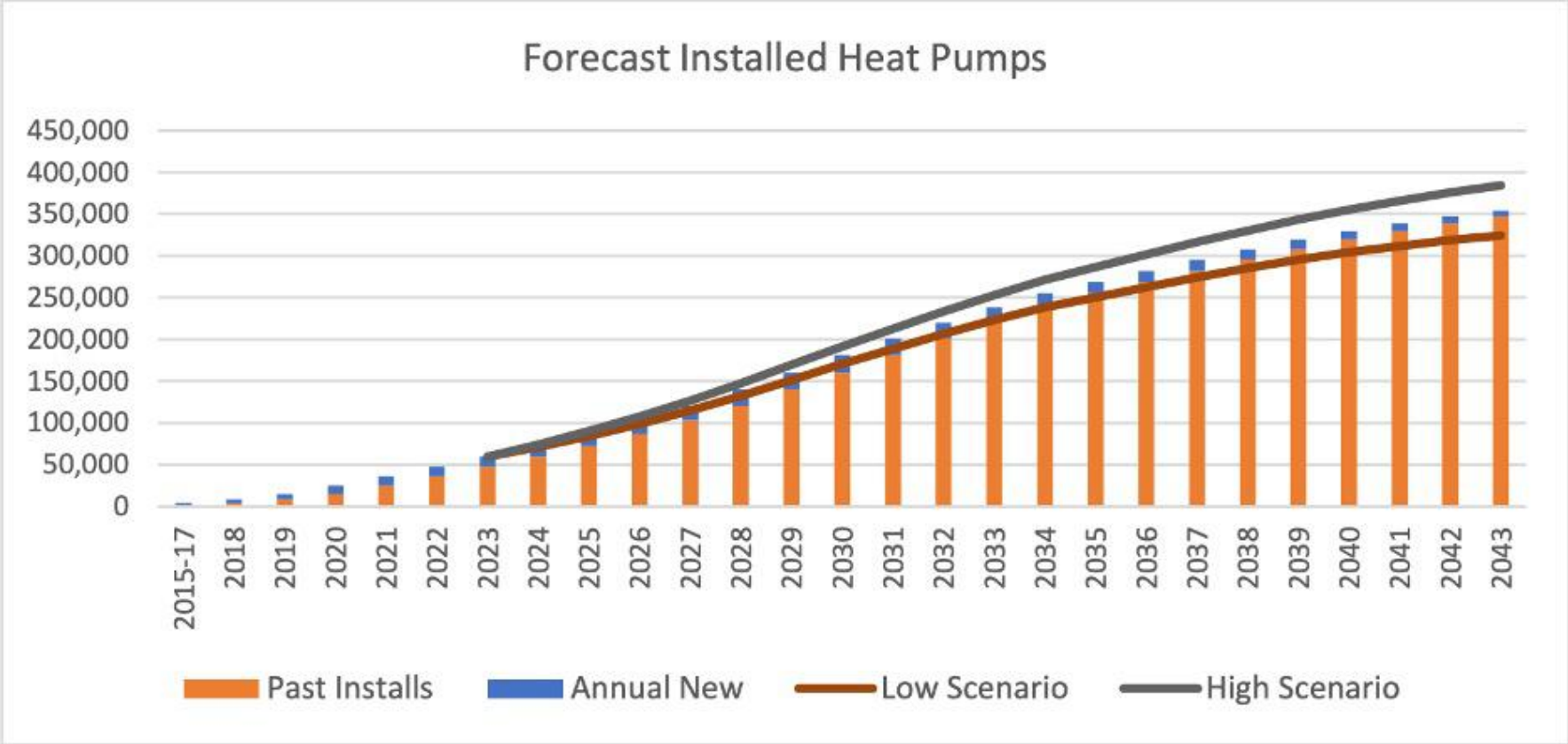
- GWSA:
  - 26% below 2005 levels by 2025
  - 40% below 1990 levels by 2030
  - 80% below 1990 levels by 2050
- To meet the requirements of the GWSA, thermal sector emissions will need to be dramatically reduced. Heat pumps are one potential solution.



Heat Pump Use Modeled for the Climate Action Plan

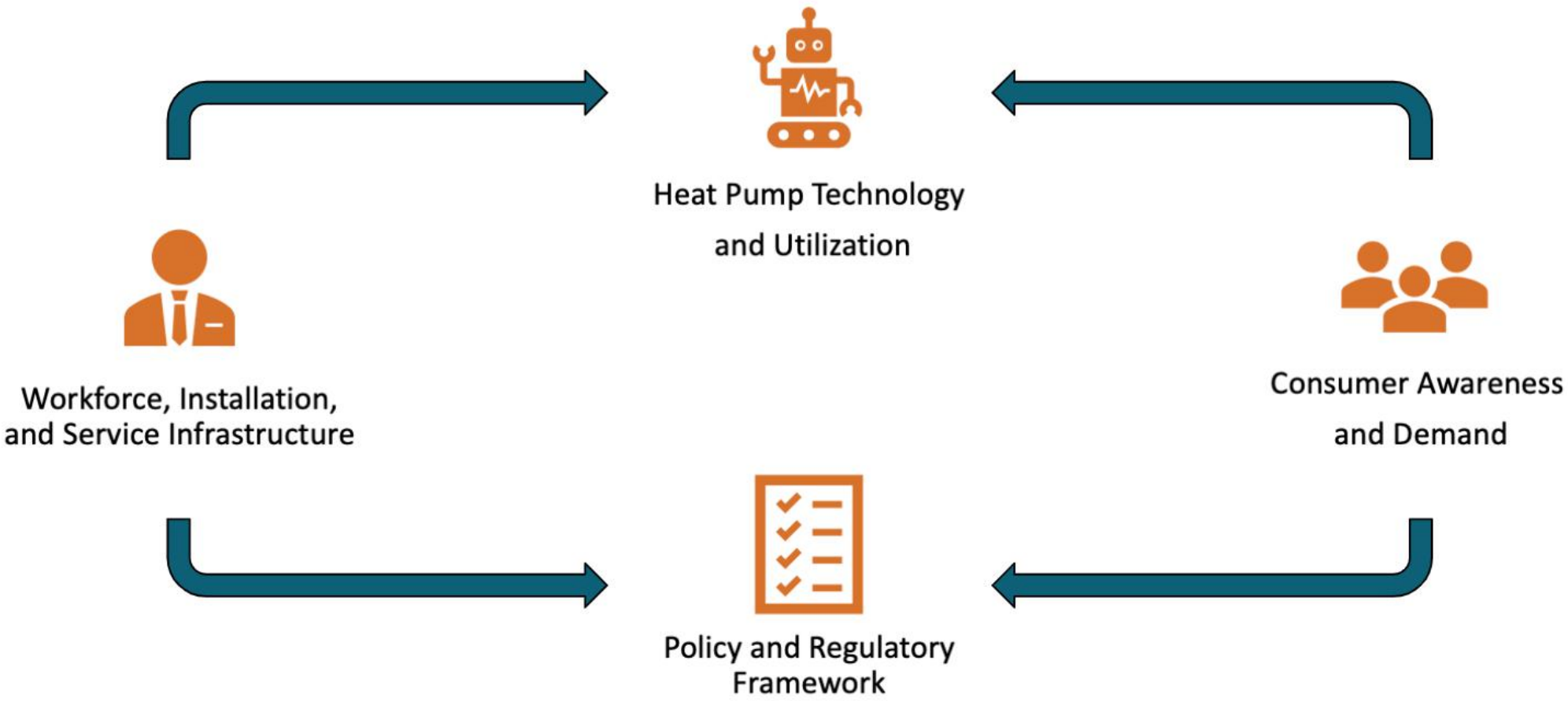
Potential concerns:

- Assumed consistency in installations
- Market saturation as installations increase could lead to a smaller market as demand shifts to servicing and replacements



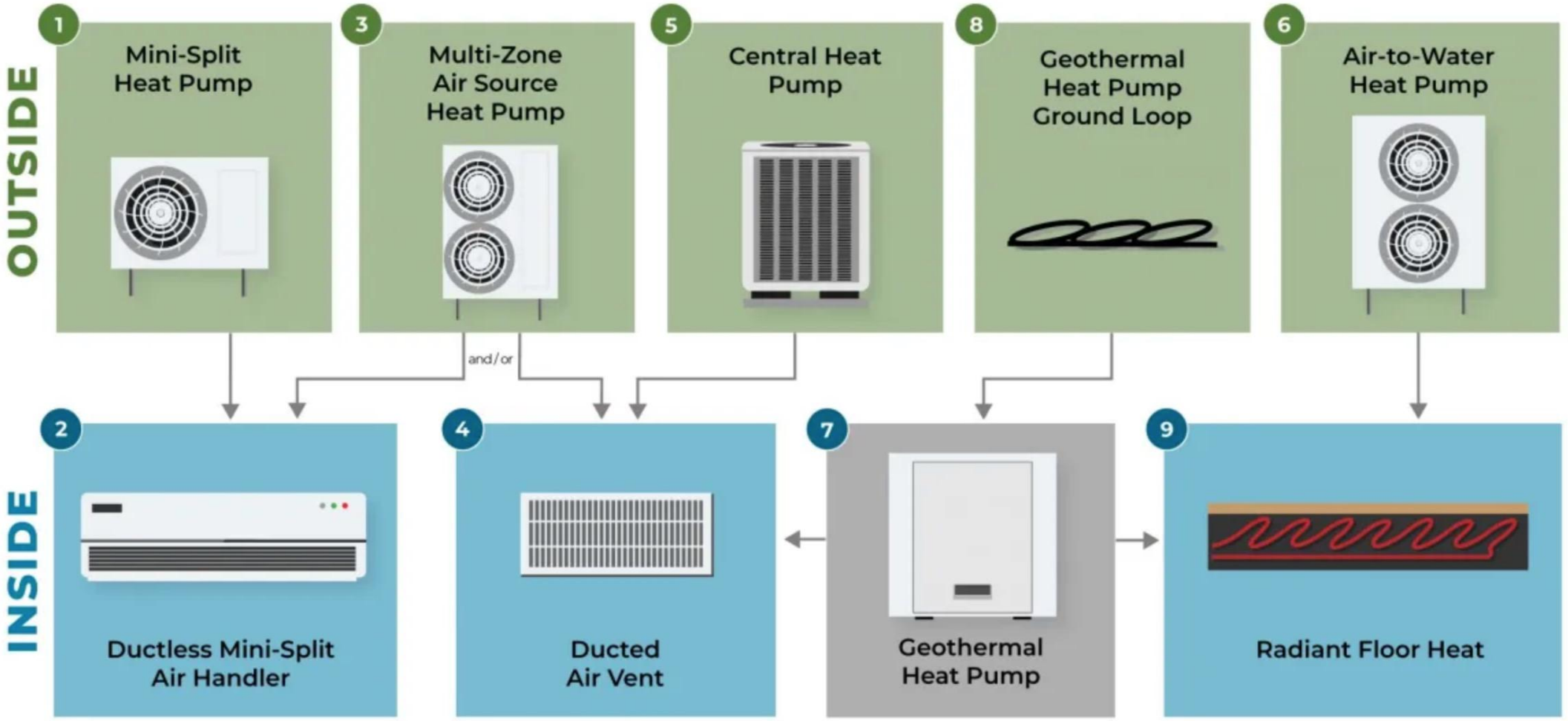
Source:https://publicservice.vermont.gov/sites/dps/files/documents/2023%20Vermont%20Annual%20Energy%20Report_0.pdf

Key Components for Successful Adoption



Heat Pump Technology and Utilization

Heat Pump Technology



Source: https://www.capelightcompact.org/your-heat-pump-options/

Heat Pump Utilization

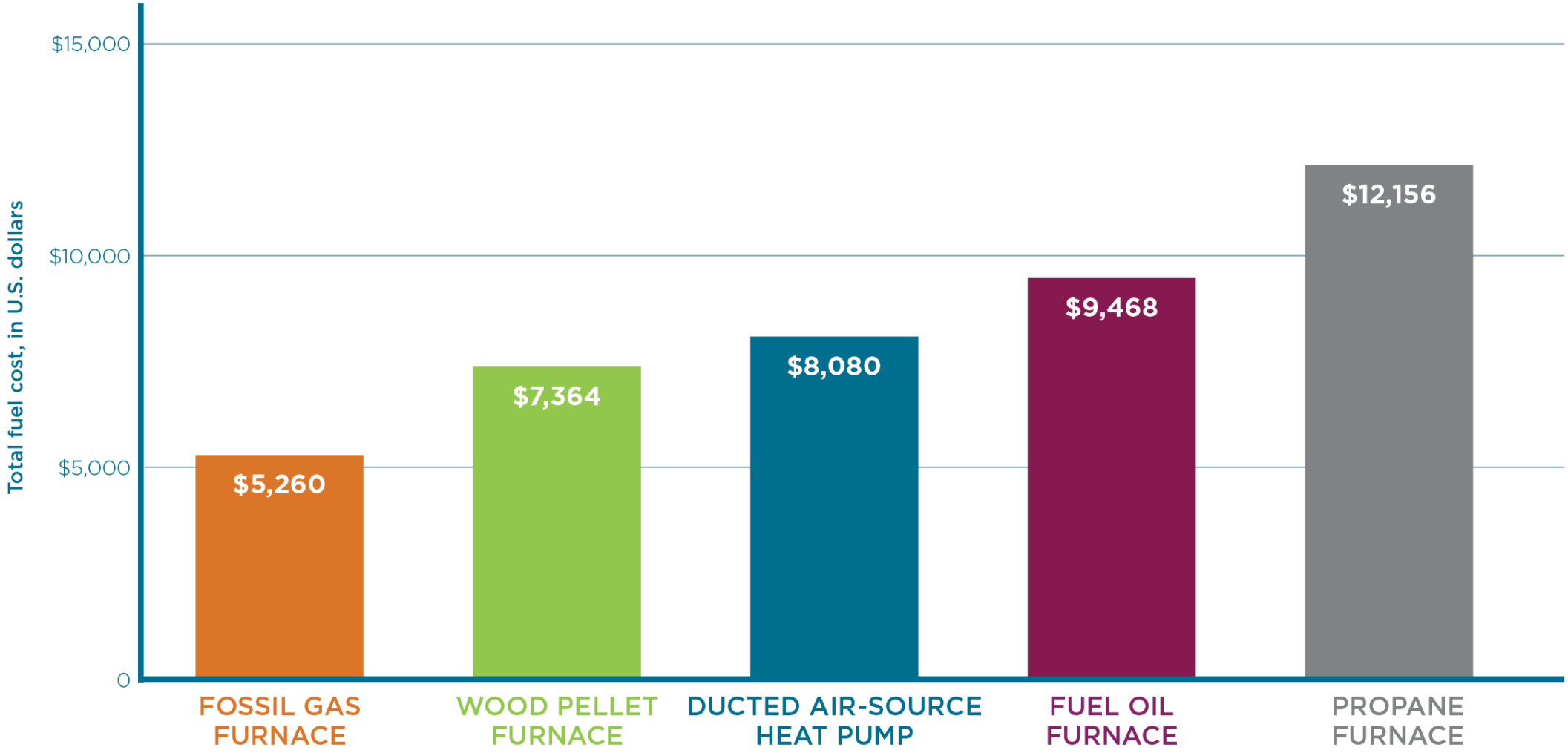
While continued increases in the number of heat pump installations are essential to meeting GHG targets, it is also important customers use heat pumps to their full potential

A recent Burlington Electric Department (BED) study indicates almost 25% of BED heat pump customers are using them for cooling only, however this may not be a statewide trend

Estimated vs Verified Savings from Heat Pump Use by BED Customers

Type of Project	BED Reported kWh Saved	BED Reported Winter Peak kW	BED Reported Summer Peak kW	PSD Verified kWh Saved	PSD Verified Winter Peak kW	PSD Verified Summer Peak kW
MOP	348,307	84.091	8.594	128,066	32.657	39.912
Retrofit	-18,862	-4.125	-0.433	-10,233	-3.186	-0.182
Totals	329,445	79.966	8.161	117,832	29.471	39.730
Verified Totals	329,445	79.966	8.161	117,832	29.471	39.730

Average total 5-year heating costs by fuel in VT, 2018-2022



Sources: Propane and fuel oil prices: Vermont Department of Public Service, Retail Prices of Heating Fuels, 2023. Electricity prices: EIA, 2023. Fossil gas prices: VGS, 2023. Wood pellet prices: Biomass Energy Resource Center, 2023. Monthly heating degree days: NOAA/National Weather Service, 2023. Average efficiency rates of heating equipment and average heating load of a VT household: TAG Tier III Annual Report, 2021.

What's Working Well and Should Be Continued?

- Continued R&D by manufacturers has increased the efficiency of cold-climate heat pumps.
- Messaging about the effectiveness of the "set it and forget it" method for using heat pumps.
- Lots of properly installed heat pumps by HVAC contractors.
- Rapid increase in usage for cooling.

Where is there opportunity for enhancement?

- Shift towards using verified values of actual heat pump output in Vermont, and away from the use of widely differing estimates from outside Vermont in future modeling and forecasting efforts. This is important to ensure expectations about heat performance in the field align with actual verified performance in the state.

- Place more attention during installer training and consumer outreach on using the "set it and forget it" method.

- Conduct a study on the effectiveness of multiple single-zone ductless mini-splits versus a multi-headed ductless mini-split system.

Consumer Awareness and Demand

What's Working Well and Should Be Continued?

- Demand for heat pumps is growing and there are now many consumers with properly sized, installed, and operating heat pumps.
  - An estimated 55,000 heat pumps are now installed, with 45,000 of those being high-efficiency models.

- We now have demonstrated market uptake of heat pumps in Vermont.
  - 2017 PSD study determined friend-to-friend recommendation was top source for awareness of the technology for consumers.

- Various distribution utilities are promoting heat pumps on their websites and offer rebate programs as an incentive to stimulate consumer demand.

- Variety of well-established and properly trained HVAC contractors and licensed electricians with 5 to 10 years of experience successfully serving heat pump customers in Vermont.

Where is there opportunity for enhancement?

- Consumer experiences using the technology vary and can inadvertently result in market confusion potentially impeding the rapid scale up in the use of heat pumps.
- Need for further marketing by the ”boots on the ground”, aka the actual installers, to further stimulate consumer demand. Successfully done by Vermont Energy, and most recently Vermont Gas Systems (VGS)
- Need to address mixed reporting from trusted sources on cold-climate heat pump potential and cost-effectiveness quickly and directly during early market adoption.

Workforce, Installation, and Service Infrastructure

What's Working Well and Should Be Continued?

- Workforce development efforts and initiatives are underway to help expand the blue-collar workforce needed to install and service heat pumps.
  - "Talent Pipeline Management" planned for Vermont
  - "Home Energy Efficiency Contractor Training Grants" from federal funding from the IRA

- As the market continues to mature, established contractors and staff continue to gain valuable knowledge and experience.

- Energy Co-op of Vermont, VGS, and Vermont Energy's in-house apprenticeship programs have proven to be effective.

Where is there opportunity for enhancement?

- As demand for heat pumps grow, more HVAC companies, plumbing and heating businesses, and electrical contractors are adding heat pumps to their offerings.
- Although there is an HVAC-related license, Vermont does not require HVAC service professionals to be licensed, only EPA certified for disposing of refrigerants.
- In addition, there is no specific national or state-level certification to be a heat pump installer, although large manufacturers (such as Mitsubishi) offer factory training and brand such training as a certification.

(con't)

- Heat pump sizing, installation, and/or servicing may be included in various broader HVAC training courses as part of high school or post-secondary school, but it does not appear that there is one, standardized curriculum used widely (yet).

- An updated and consistent curriculum in trades schools and licensing programs addressing proper installation, servicing, and usage practices could address this

- In addition, established companies in Vermont already offering in-house training and apprenticeships report needing financial support to scale such efforts.

Policy and Regulatory Framework

What's Working Well and Should Be Continued?

- Establishment of aggressive, quantitative GHG reduction targets in Vermont.
- Passage of the Affordable Heat Act intended to result in a sustained, orderly transition away from fossil fuels currently used for heating in most Vermont buildings.
- Multiple state policies that incentivize key market players, such as Distribution Utilities, to be proactive in incentivizing a shift away from fossil fuels and towards electrification that is generated from carbon-free fuels.
- State policy that sets quantitative goals for electricity to be primarily sourced from renewable energy sources so increased electrification of buildings (and transportation) directly result in a reduction in fossil fuel usage.

Where is there opportunity for enhancement?

- If the PUC's proposal for achieving the Affordable Heat Act is not legislatively approved in 2025, immediate action will be needed on an alternative pathway for achieving the thermal sector goals needed to meet the GWSA's legally-binding GHG reduction targets.
- In the meanwhile, it is important to continue assessing early heat pump market trends, installers' practices, and customer use.
- Factors potentially limiting continued market scale up should be watched for and policy and program changes should be implemented that:
  - Further stimulate market uptake
  - Ensure high quality installations
  - Enhancement in licensing and training requirements, if / as needed

Conclusion

Underutilization	• Need to better understand and solve -> Continued evaluation, measurement, and verification (EM&V) analysis
Continued rebates and incentives	• Necessary market driver to keep the market maturing
Listen to the “boots on the ground”	• Involve installers in continuous program review and adjustments, hear their needs and challenges
Use verified heat pump output values	• In future models and forecasts to help ensure realistic expectations about “real world” performance

Conclusion

"Boots on the ground" marketing	• Important for consumers to hear from the installers as well as the rebate providers
Employer and Employee Incentives	• Can't have increasing consumer demand without the workforce to meet it
A strong focus on equity	• Need to keep a close-eye on how effective the low-to-moderate income programs are
Need for a consistent user journey and experience	• It is essential that realistic expectations are set for a consumer and those expectations are met

Thank you!

Questions and Comments?

Josh Valentine
(603) 707-6211
jvalentine@middlebury.edu