Audio instructions

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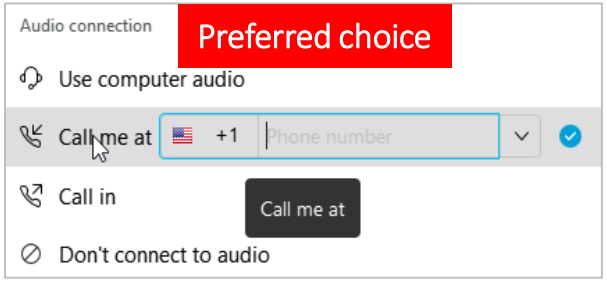
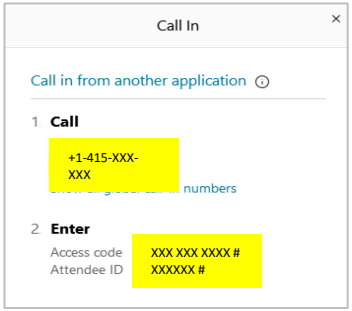
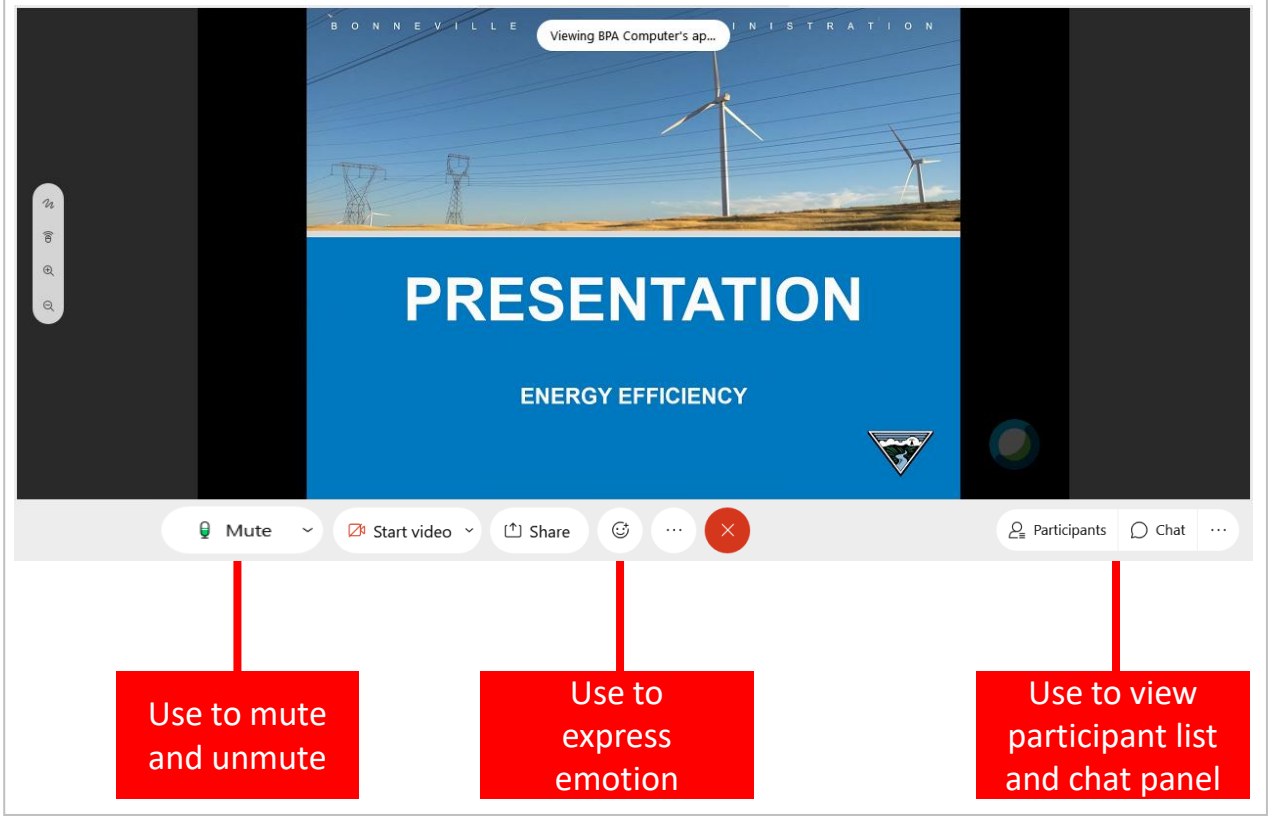


Note: The incoming call may be listed as **POTENTIAL SPAM**.

Second choice: In the example above, instead select **Call in** and use your phone to call into the webinar. A window will pop-up with your meeting **Call in** information.



Last choice: **Use Computer for Audio.** Connect a headset to your computer for best results.



IMPACT EVALUATION OF BPA'S RESIDENTIAL ASHP/VSHP MEASURES

May 29, 2025

Agenda

01 Background

02 Methodology

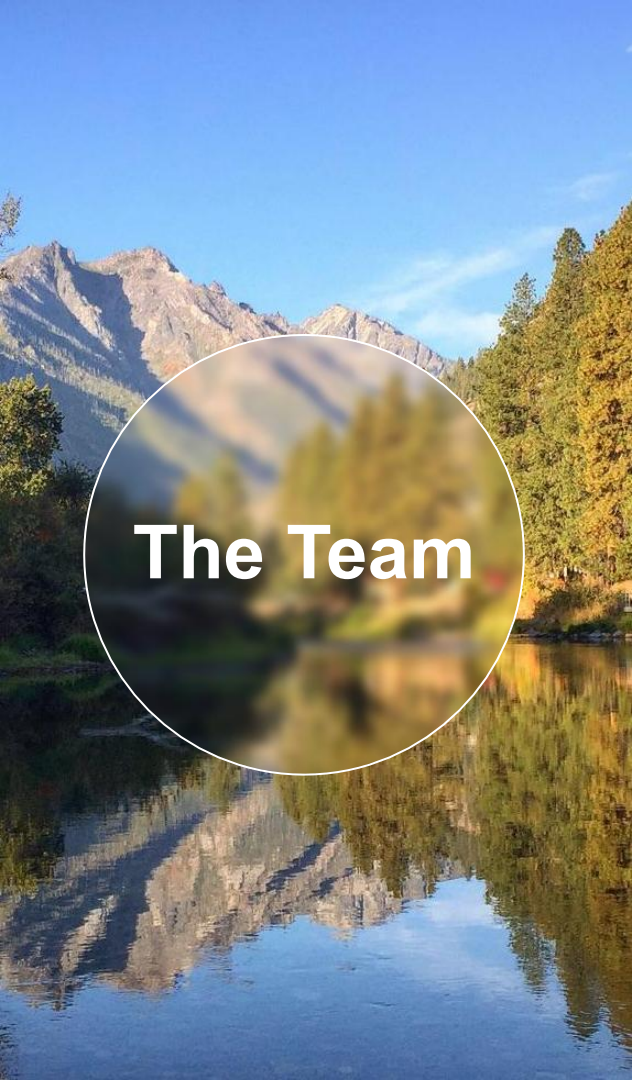
03 Findings

04 Program Response

05 Next Steps / Q&A

01

Background



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Residential ASHP/VSHP Evaluation Objective

Estimate energy savings for conversions of air-source heat pumps (ASHPs) and variable speed heat pumps (VSHPs).

Support the Regional Technical Forum (RTF) to move these measures from “Planning” to “Proven.”

Previous Residential HVAC Analysis (2019)

- ASHP
- VSHP
- Duct Sealing
- DHP

Analyzed savings through billing analysis.

Some measures moved to “Proven,” but not enough sample for some ASHP and VSHPs.

This evaluation focused on ASHPs in heating zones 2/3 and VSHPs in all heating zones.

02

Methodology

Sampling Strategy

The sample is designed to achieve the minimum requested sample size from RTF for the planning measures to move them to proven.

The sampling unit is an installed ASHP or VSHP (conversions only).

The sample frame is based on measures completed during FY2020, FY2021 and FY2022.

The sample frame is stratified by measure, heating zone and home type.

Sample Design

Measure	Heating Zone	Home Type	Population	Sample	RTF Minimum
ASHP	HZ 2/3	SF	232	172	100
		MH	113	85	75
VSHP	HZ 1	SF	895	459	100
		MH	246	149	75
	HZ 2/3	SF	144	105	100
		MH	31	23	75

Billing Analysis Methods

03

Findings

Key Findings

The evaluated savings differ from BPA's reported savings.

However, evaluated savings are very close to the most recent RTF UES values.

- The RTF UES values were updated in 2021 with new evaluation data, which became available after BPA reported savings.
- For 4 of the 6 measure combinations, the RTF savings falls within or below the 90% confidence interval of the estimated evaluated savings.
- BPA has since updated its savings estimates to the more current RTF UES values.
- Going forward, BPA will be comparing the evaluated savings to the latest RTF UES values.

Realization Rates (compared to 2021 RTF UES Values)

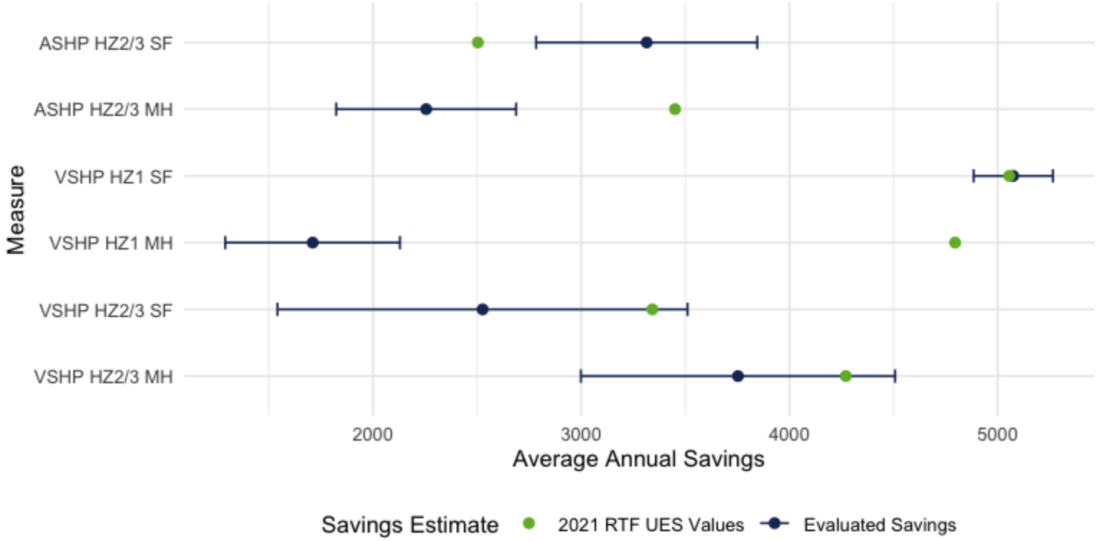
Measure	Heating Zone	Home Type	Program Population	2021 RTF UES Values (kWh)	Evaluated Savings (kWh)	Realization Rate
ASHP Conversion	HZ 2/3	SF	232	430,716	570,200	132%
		MH	113	293,371	191,763	65%
		Subtotal				**110%**
	HZ 1	SF	895	2,320,480	2,329,544	100%
		MH	246	714,609	254,879	36%
		Subtotal				**86%**
VSHP Conversion	HZ 2/3	SF	144	350,948	265,319	76%
		MH	31	98,232	86,321	88%
		Subtotal				**78%**

Evaluated savings were similar to RTF UES values, with realization rates of 110%, 86% and 78% for the 3 main categories.

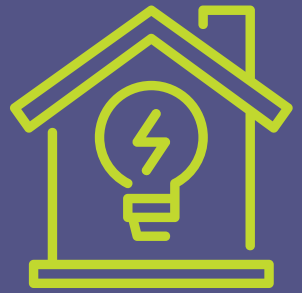
Realization rate:
The ratio of evaluation savings to reported savings.

Evaluated Results (confidence intervals)

Confidence intervals for average annual change in electricity use (in kWh) after installation



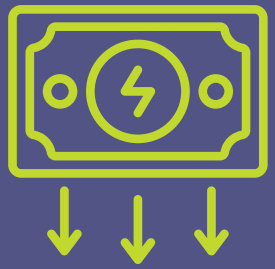
UES values for four of the six categories fall below or within the confidence intervals.



Drivers of Savings

- Participants with the highest usage experienced the greatest savings.
- Single-family homes in heating zone 1 that did not have AC increased their electricity usage after installation of a VSHP.
- Manufactured homes have lower savings due to lower usage.

Reasons why savings might be lower than expected



- End use customer snapback (increased use of efficient appliance for comfort).
- Addition of air conditioning.
- Contractor design choices (favoring comfort over efficiency).
- Displacement of non-electric heat (bulk fuels).

However, additional data collection (e.g., participating customer survey) would need to corroborate these assumptions.

Considerations for Further Research

Consider conducting an end-use customer survey.

- *To explore reasons for reduced realized savings.*

If the survey confirms the issues associated with lower-than-expected savings.

- *BPA could also consider updating savings assumptions to account for total fuel savings.*

Considerations for Further Research (cont'd)

Reconsider baseline assumptions for heat pump measures for homes that do not already have AC, since many may have planned on installing central AC in the future.

Consider documenting as additional program energy savings the reduction in bulk fuel usage associated with heat pump installations for homes that have bulk fuel or other heating sources.

Consider documenting as program benefits the increases in household occupant comfort and safety that are associated with the use of more efficient heat pumps.

04

Program Response

Response to Key Findings

Key Finding	Response
Overall Realization rates for ASHPs and VSHPs in single-family homes was less than 50%.	BPA claimed savings for single-family homes have been updated to align with current RTF savings values and closely match customer electricity savings.
Overall Realization rates for ASHPs and VSHPs in manufactured homes was less than 50%.	BPA claimed savings for manufactured homes have been updated to align with current RTF savings values.

Response to Key Findings

Key Finding	Response
The drivers analysis showed that pre-period electricity usage was the greatest indicator of energy savings. On average, participants that used more electricity in the pre-period experienced the greatest reductions in electricity use from the installation of an ASHP or a VSHP.	This seems logical. Higher pre-period electricity usage offers more opportunity for overall savings.
For single-family homes in heating zone 1, participants that did not have air conditioning as part of their previous HVAC system on average increased their electricity use after installation of an ASHP or a VSHP.	BPA suggests that code compliant AC be used as a baseline for cooling, as opposed to nothing (which results in a savings penalty). This would increase savings results and more closely reflect newly available cooling usage amongst participants.

Response to Considerations for Future Research

Key Finding	Response
Consider conducting a customer survey to explore the issues raised in this report that reduce realized savings, both to confirm and understand the magnitude of the various issues. The survey could explore more in-depth concurrent participation in other energy efficiency programs and behavioral habits of households.	BPA agrees with this consideration and should investigate further.

Response to Considerations for Future Research

Consideration for Future Research	Response
Consider conducting a customer survey to explore the issues raised in this report that reduce realized savings, both to confirm and understand the magnitude of the various issues. The survey could explore more in-depth concurrent participation in other energy efficiency programs and behavioral habits of households.	BPA agrees with this consideration. A significant number of households have added cooling (often A/C) in recent years. Baselines need to reflect this change.

Response to Considerations for Future Research

Consideration for Future Research	Response
Consider the reduction in bulk fuel usage when evaluating the benefits of heat pump installations for homes that have bulk fuel heating sources. By only viewing electricity savings (and excluding other fuel savings), total benefits may not be accurately assessed.	BPA agrees that savings based on total energy usage (such as in units of BTU) may more accurately reflect overall benefits to heat pump technologies.

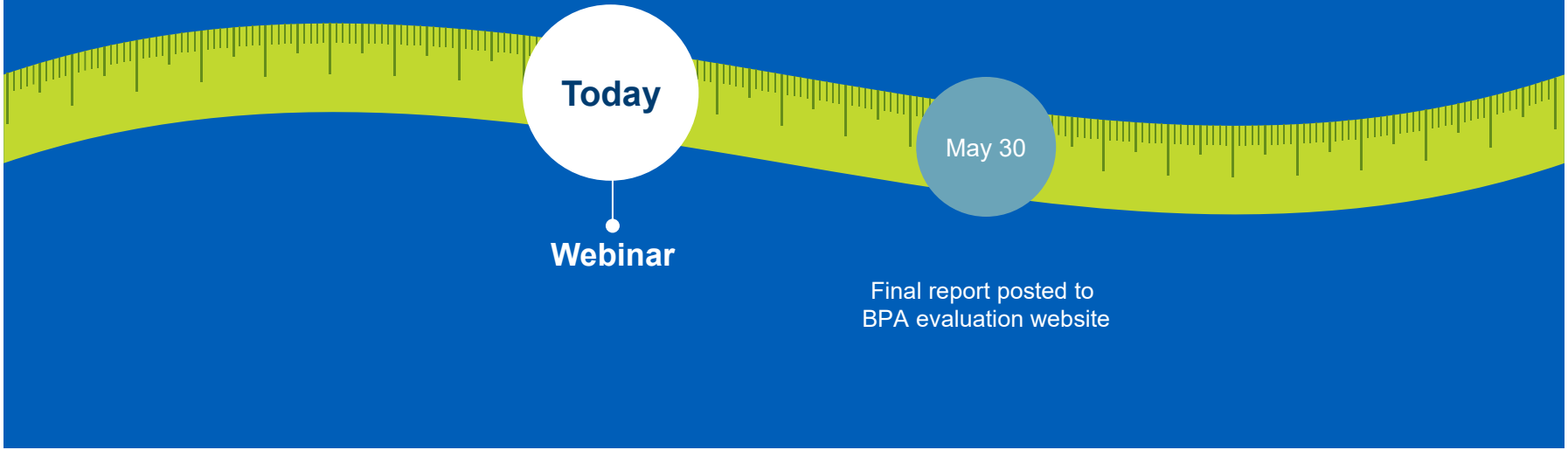
Response to Considerations for Future Research

Consideration for Future Research	Response
Consider increases in household occupant comfort and safety that are associated with the use of more efficient heat pumps as additional program benefits. There may be market segments, such as low-income customers, or relatively warmer geographic areas where negative billing analysis savings may be expected where health, comfort, and safety benefits should be explicitly considered.	BPA agrees that non-energy benefits, including increased comfort and health benefits, have tremendous value and are important to consider along with energy savings.

05

Next Steps and Q&A

Next Steps


Today
May 30
Webinar
Final report posted to
BPA evaluation website

Questions?