

VSHP Deep Dive Research Plan

March 5, 2026

BONNEVILLE POWER ADMINISTRATION

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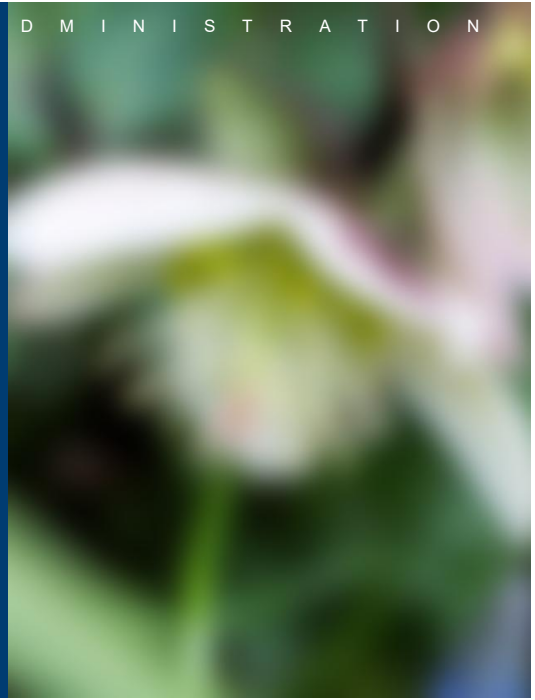

01

Introductions



Teams

Core Team

Bonneville POWER ADMINISTRATION

David Tripamer
Planning and Evaluation

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Energy Conservation Account Executive

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EVERGREEN ECONOMICS

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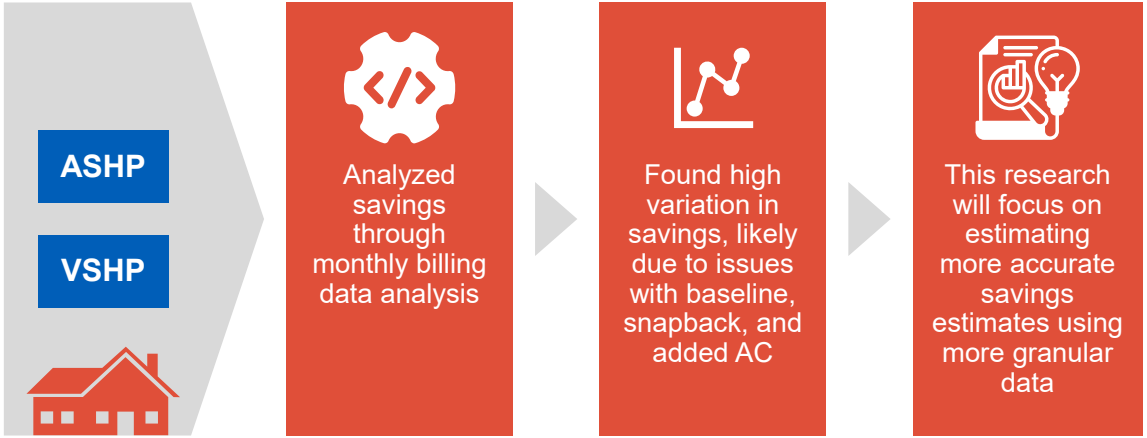
Research Background

VSHP Deep Dive Research Objective



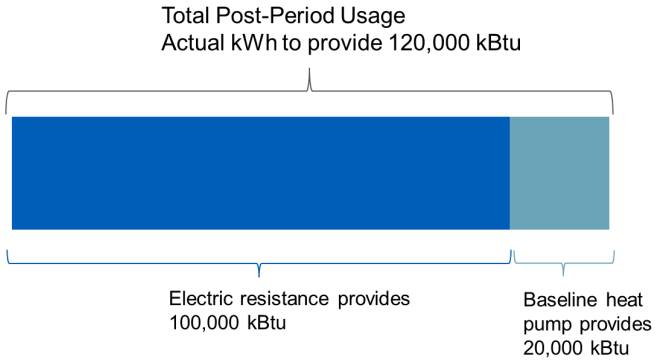
Estimate energy savings for conversions and upgrades of variable speed heat pumps (VSHPs) and air-source heat pumps (ASHPs) by using **Advanced Metering Infrastructure (AMI) data** to overcome the drawbacks of previous research efforts.

Previous Residential HVAC Analysis (2023)



Capturing Marginal Heat with AMI

More convenient to think in terms of "heat" rather than electricity, or kilo British Thermal Units (kBtu)



- Monthly billing data is easy to request but lacks detail
- Heat pumps usually **provide more heat in the post-period**
- Monthly billing data can't tell if the heat pump isn't performing well or displacing other heat
- **With AMI data, this is possible**

03

Sampling Plan

Sampling Strategy



The sample is designed to achieve estimates of electricity savings through AMI analysis for each planning measure.



The sampling unit is an installed VSHP or ASHP (conversion or upgrade).



The sample frame is based on measures completed between FY 2023 and FY 2025.



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

Sample Design

Measure Type	Home Type	Conversions		Upgrades	
		HZ1	HZ2/3	HZ1	HZ2/3
VSHP	SF	179	133	806	216
	MH	110	61	120	22*
ASHP	SF	242	117**	279	86**
	MH	112	137	64**	20*
Total		**1,091**		**1,613**	

* The population is too small to satisfy the RTF sample targets in these strata.

** While there are more measures in the population, requesting data from additional utilities would be inefficient, with each utility contributing n<15 heat pumps to the targets.



Utility Sampling

Benton PUD
Central Electric Cooperative
Central Lincoln
Clallam
Clearwater
Consumers
Cowlitz
EWEB
Emerald
Flathead
Inland
Klickitat
Mason PUD 3
Midstate Cooperative
Okanogan PUD
Peninsula
Richland
Tacoma Power
Umatilla Electric Cooperative

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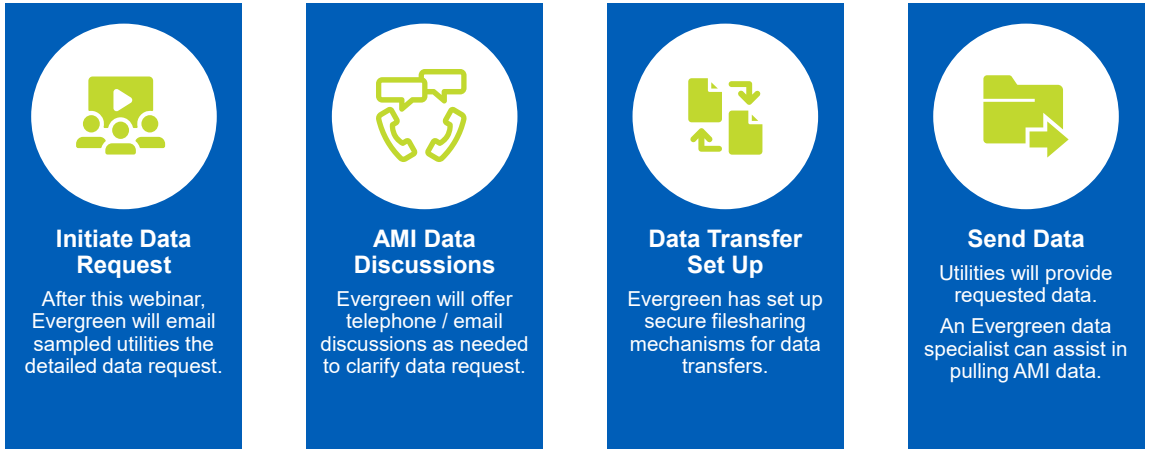
Data Collection

AMI Data Collection



Data Security Is a Priority

Secure file transfer options

Anonymized data, remove customer PII

Optional NDA with Evergreen Economics

Data Request

Covered Measures	• Selected measures that were completed between FY 2023 and FY 2025
Data Requested	• 15-minute or hourly AMI data (from 2022 to the most recent billing cycle) • Move-in/Move-out information; Rate code • Customer contact information (mailing address, email, phone number)
Key Data Fields	• Unique customer account number • Technology / Activity / Practice (TAP)



Data Request Workbook

We will provide:

- Sampled project information
- Template for uploaded data
- Answers to FAQs

We will request:

- 15-minute interval data for the sampled projects from 2022 through 2025
- End-user customer contact information

EVERGREEN ECONOMICS

Evergreen is here to help!

We will provide a **walkthrough video** for how to fill out the data request workbook, and can provide **personalized help to pull data**, including email support, phone calls to walk through the request, or IT support to manage the transfer.

05

Analysis Methods

Overarching Analysis Approach



HPHC and HEMS Analysis

Daily and hourly estimates of consumption from High Performance, High Capacity (HPHC) pilot and Home Energy Metering Study (HEMS) site-level data



Participant AMI Analysis

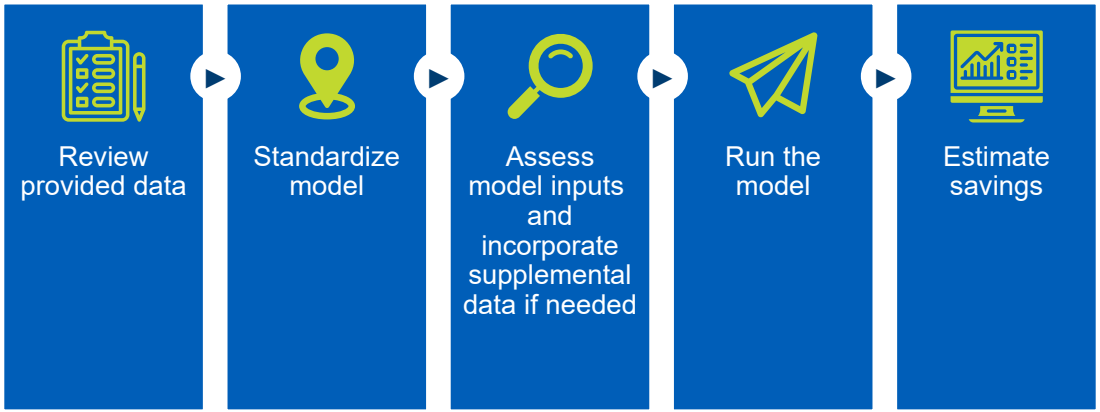
Estimates of participant electric heating load and associated savings built from utility-provided data



Participant End-User Surveys

- Confirmation of baseline conditions and heating usage by equipment type
- Health, comfort, and safety context of participant behavior

Participant AMI Analysis Process



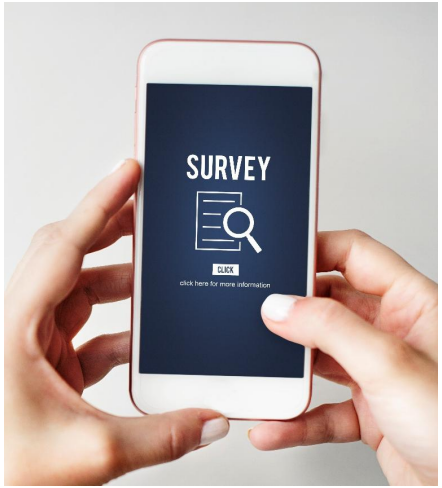
Survey Approach

Approach

- Follow approved communication protocols (which the utilities can approve)
- Mixed-mode recruitment methods (mail, email, phone)
- Evergreen will pay respondents

Topics for the survey include

- Changes in behavior after installation
- Equipment use before and after installation (include AC)
- Other heat displaced (e.g., wood stove or propane reductions)
- Health, comfort, and safety impacts
- Satisfaction with heat pump



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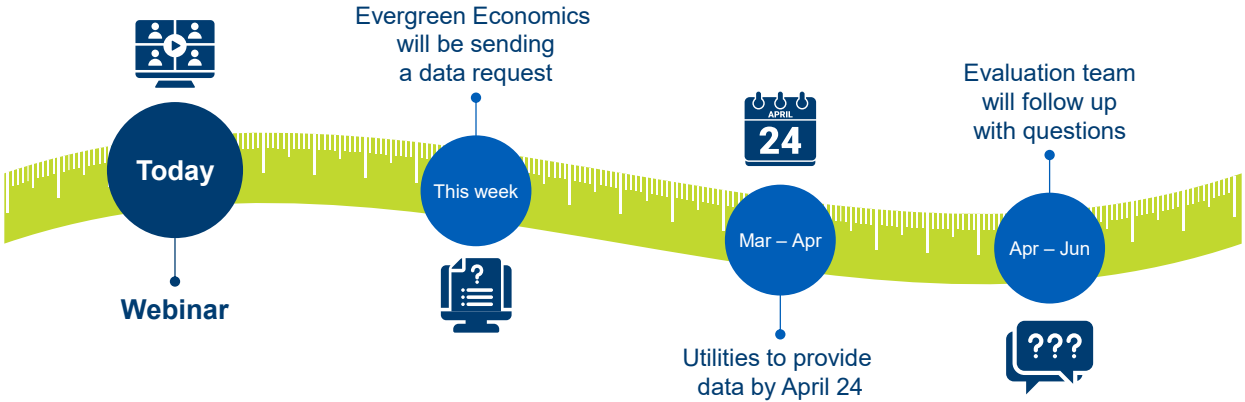
Next Steps and Q&A

Next Steps


Today
Webinar
Evergreen Economics will be sending a data request
This week
APRIL
24
Mar – Apr
Utilities to provide data by April 24
Evaluation team will follow up with questions
Apr – Jun
???

Research Overview

May	June	June	Summer
Participant AMI analysis	Participant survey data collection	Interim findings from HPHC analysis	Report combined findings

Optional Analysis Offerings

- Heat Pump Load Shapes and Operating Costs
- Energy Usage Metrics
- Identify Proportion of Customers with Electric Heat or AC
- Energy Burden Analysis
- Customer Load Profiles

Optional Analysis Offerings (1/2)

Load Shapes	**Desc:** Load shapes and operating costs tailored to local weather and rates **Value:** Estimate load / bill impacts
Energy Usage Metrics	**Desc:** Heating and cooling kWh, baseload, discretionary, evening ramp, etc. **Value:** Targeting customers, baseline assumptions, IM measure prioritization
% with Heating & AC	**Desc:** Identify percent of customers that use electric heating and percent that have AC **Value:** Targeting customers, baseline assumptions

Optional Analysis Offerings (2/2)

Energy Burden Analysis

Desc: Energy burden analysis tailored to utility service territory
Value: Targeting customers

Customer Load Profiles

Desc: k-means clustering, link to known characteristics of the home
Value: Targeting customers, IM data prioritization



Summary of Options

	Description	Data needs	Potential Uses
Load Shapes	Load shapes tailored to local weather conditions and rates	Public	Estimate load / bill impacts
Energy Usage Metrics	Heating and cooling kWh, baseload, discretionary, evening ramp, ramp ratio, seasonal metrics	Random sample of AMI data	Targeting customers, baseline assumptions, IM measure prioritization
Percent with Heating and AC	Identify percent of customers with electric heat / AC	Random sample of AMI data	Targeting customers, baseline assumptions
Energy Burden Analysis	Energy burden analysis tailored to utility service territory	Public	Targeting customers
Customer Load Profiles	k-means clustering and link these to known characteristics of the homes	Random sample of AMI data, select customer data	Targeting customers, IM measure prioritization

Utilities can choose TWO each



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