



*Better Buildings Residential Network
Peer Exchange Call Series*

*New Contractor Resources – Decision Tools for Retrofits,
Heat Pump Water Heaters, and Cold Climate Heat Pumps*

September 12, 2024

Agenda and Ground Rules

- Moderator
 - **Jonathan Cohen**, Better Buildings Residential Network, Residential Buildings Integration
- Agenda Review and Ground Rules
- Residential Network Overview and Upcoming Call Schedule
- Opening Poll
- Featured Speakers
 - **Cheryn Metzger**, Pacific Northwest National Laboratory (PNNL)
 - **Josh Butzbaugh**, PNNL
 - **Vrushali Mendon**, PNNL
 - **Ryan Shea**, RMI
- Open Discussion
- Closing Poll and Announcements

Ground Rules:

1. **Sales of services and commercial messages are not appropriate** during Peer Exchange Calls.
2. Calls are a safe place for discussion; **please do not attribute information to individuals** on the call.

The views expressed by speakers are their own, and do not reflect those of the Dept. of Energy.

Better Buildings Residential Network

Join the Network

Member Benefits:

- Recognition in media, social media and publications
- Speaking opportunities
- Updates on latest trends
- Voluntary member initiatives
- One-on-One brainstorming conversations

Commitment:

- Members only need to provide *one number*: their organization's number of residential energy upgrades per year, or equivalent.

Upcoming Calls (2nd & 4th Thursdays):

- *9/26: The Latest in Educating Homeowners on the Benefits of Energy Efficiency*
- *10/10: TBA*

Peer Exchange Call summaries are posted on the Better Buildings [website](#) a few weeks after the call



Cheryn Metzger
PNNL



Decision Tool for Retrofits

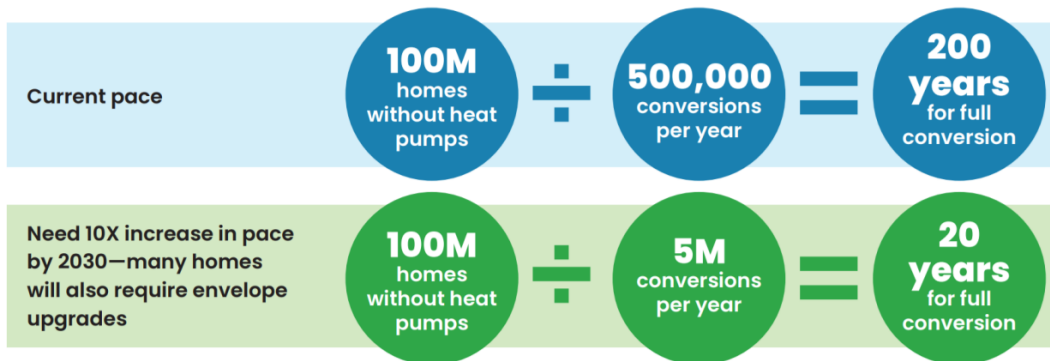
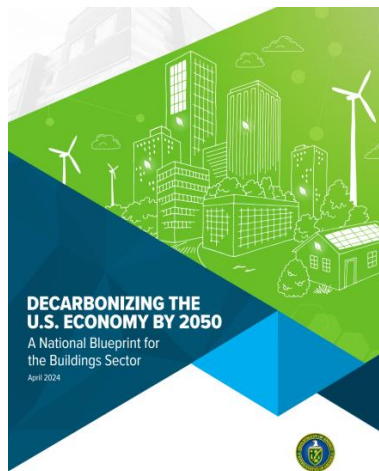
Cheryn Metzger



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Why Do We Need A Retrofit Decision Tool?



- Unfortunately, homes in the US are all different, which mean they require different solutions for decarbonization
- While an energy audit is recommended in every situation, the speed and scale at which decarbonization needs to occur will not enable that every time, and we need a way to make decisions at scale – backed by robust analysis

What Led to The Retrofit Decision Tool?

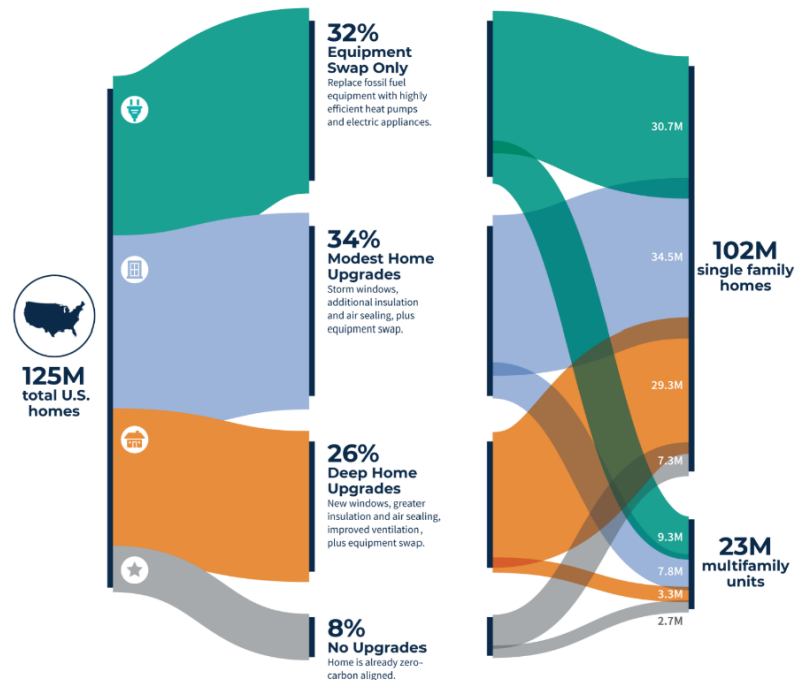
Market Guidance Report

- Simplifying the building stock and decisions associated with retrofits
- Makes package recommendations based on zero carbon alignment (ZCA) – defined on next slide
- Led by RMI, supported by PNNL, LBNL, and NREL
- More than 100 pages of background, methods, analysis and results

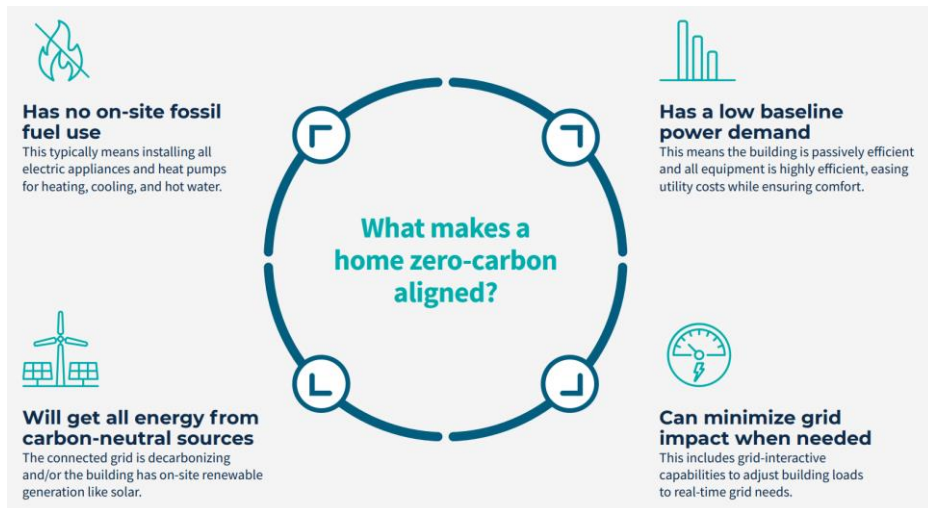
Retrofit Decision Tool

- Navigates the results of the Market Guidance Report
- Led by PNNL, supported by LBNL, RMI, and NREL
- Takes less than 5 minutes to complete

Retrofit packages needed to make homes zero-carbon aligned fall into three categories, each applying to roughly a third of US housing units.



Zero Carbon Alignment Definition



https://advancedbuildingconstruction.org/wp-content/uploads/2024/03/ABC_Industry-Guidance-Report_2023_v6.pdf

A zero carbon aligned (ZCA) building:

- Has no net on-site carbon emissions (~all end uses are electrified);
- Eases the decarbonization of its end uses by having low power and thermal loads.
- Sources all energy from a carbon-neutral grid and/or local source—or will do so before 2050 under a reasonable targeted scenario.
- Supports decarbonization of the grid by minimizing its grid impact through reduced peak loads, energy-efficient operation, and grid interactivity (or, alternatively, off-grid operation).

Upgrade Package Options

Building Component	All Equipment Swap-Out	Equipment + Conventional Envelope	Equipment + IECC Envelope	Equipment + Phius Envelope
Water Heater	Heat pump water heater; 80 gallons; UEF 2.4			
Heating and Cooling	- Air-source heat pump (homes with ducts): SEER 22; 10 HSPF (not cold-climate) - Mini-split heat pump (homes without ducts): SEER 29.3; 14 HSPF (cold-climate)			
Duct Sealing/Insulation	All ducts in unconditioned spaces sealed to 10% and insulated to R-8			Ducts entirely within thermal envelope, no losses
Lighting	100% LED, 83 lumens/W			
Appliances	- ENERGY STAR (refrigerator and dishwasher) - ENERGY STAR Most Efficient (heat pump dryer and clothes washer) - Induction cooktop and electric resistance oven			
Window U-Value, Solar Heat Gain Coefficient (SHGC)	No upgrade	Low-e storm windows, U-value 0.29–0.69; SHGC 0.42–0.59	U-value 0.3–0.4; SHGC 0.25–0.4, by climate	U-value 0.12–0.5; SHGC 0.25–0.4, by climate
Wall/Floor R-Value	No upgrade	R-6.5 continuous if existing <R-19 and home older than 1990	R-13 to R-30, by climate	R-22 to R-51, by climate
Roof/Attic R-Value	No upgrade	R-29 to R-51, by climate	R-30 to R-60, by climate	R-51 to R-82, by climate
Foundation Wall R-Value	No upgrade	No upgrade	R-0 to R-15, by climate	R-7 to R-30, by climate
Slab Edge R-Value	No upgrade	No upgrade	No upgrade	2 ft, R-7 to R-30, by climate
Air Leakage	No upgrade	7%–62% reduction	3 ACH ₅₀	1 ACH ₅₀
Mechanical Ventilation	No upgrade	ERV/HRV if post-retrofit infiltration <7 ACH ₅₀	ERV/HRV	ERV/HRV

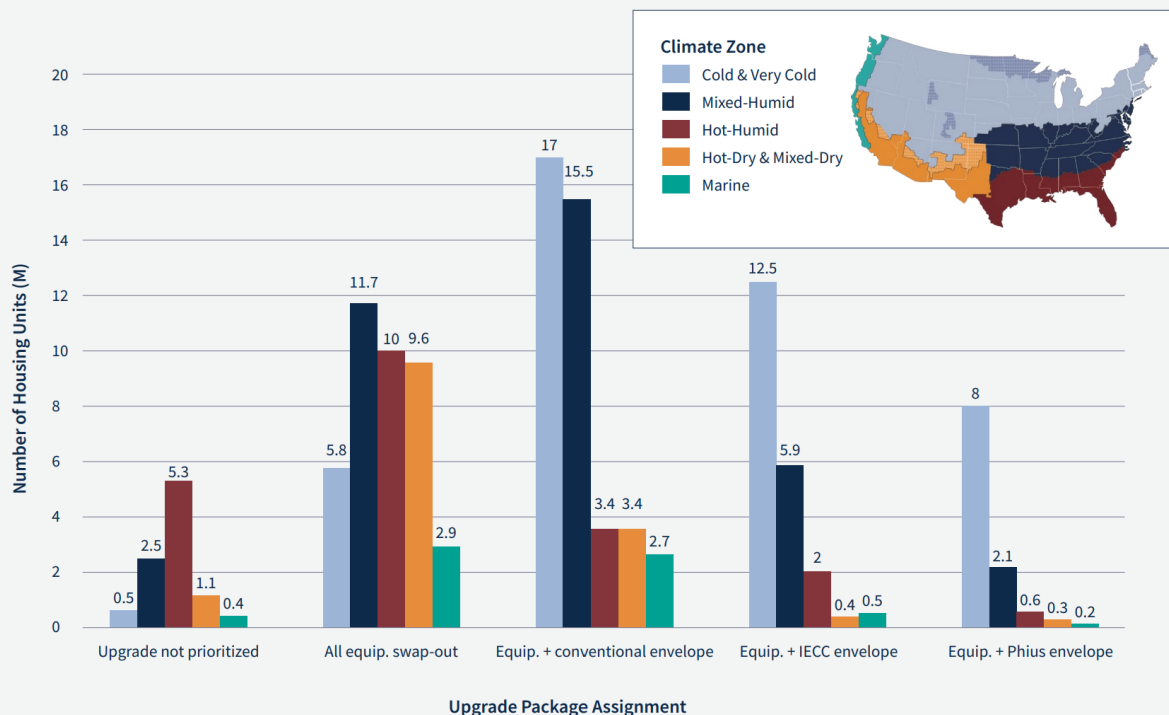
Results by Package Type

Building Type	Prioritized Upgrade Package	Number of Housing Units (million)	Share of Stock
Single-family/small multifamily - Single-family detached - Single-family attached - Multifamily, 2–4 units	Upgrade not prioritized	7.3	7%
	All equipment swap-out	30.7	30%
	Equipment + conventional envelope	34.4	34%
	Equipment + IECC envelope	18.8	19%
	Equipment + Phius envelope	10.4	10%
Large multifamily housing - Multifamily, 5+ units, 1–3 stories - Multifamily, 5+ units, 4–7 stories - Multifamily, 5+ units, 8+ stories	Upgrade not prioritized	2.7	12%
	All equipment swap-out	9.3	40%
	Equipment + conventional envelope	7.8	34%
	Equipment + IECC envelope	2.6	11%
	Equipment + Phius envelope	0.7	3%

https://advancedbuildingconstruction.org/wp-content/uploads/2024/03/ABC_Industry-Guidance-Report_2023_v6.pdf

Unfortunately, there is no single package that works for each building type

Results by Climate Zone



https://advancedbuildingconstruction.org/wp-content/uploads/2024/03/ABC_Industry-Guidance-Report_2023_v6.pdf

Unfortunately, there is no single package that works for each climate zone

Retrofit Decision Tool



12 Easy Questions
1 Recommended Package



The screenshot shows a circular view of the Retrofit Decision Tool interface. It includes the following sections:

- Building Type:** Options include "Multifamily with 5+ units, 1-3 stories" and "Multifamily with 5+ units, 4-7 stories".
- Building built?:** Options include "Before 1940", "1940-1979", and "1980 or Later".
- Area:** A question "What is the floor area of your building in square feet?" with options "Less than 1500 sq ft", "1500 to 2800 sq ft", and "Greater than 2800 sq ft".
- Heating Fuel:** A question "What is the existing heating system?" with options "Electricity", "Fuel Oil", "Propane", and "Other".

PARTNERS

WEB LINK:

https://basc.pnnl.gov/retrofit_decision_tool



Retrofit Decision Tool Inputs

Building America Solution Center

PROGRESS & GUIDES • RESOURCES • PUBLICATIONS & FORUMS

Home > BTO > Building America > Solution Center > Retrofit Decision Tool

Retrofit Decision Tool

Get make recommendations to help homeowners reduce energy costs and help fight climate change.

- About Retrofit Decision Tool (RDT)
- Our Goal: Zero Carbon Aligned (ZCA)
- What the Output Looks Like

Retrofit Decision Analysis Form

1. Where is the building located? *

State/Country OR Zip code

Enter either the ZIP code or the state/country in which your building is located. You may start typing to filter the list.

2. What is the type of building? *

 Single-family detached	 Single-family attached	 Mobile home	
 Multifamily with 3-4 units	 Multifamily with 5-9 units, 1-2 stories	 Multifamily with 10+ units, 4-7 stories	 Multifamily with 10+ units, 8+ stories

3. When was the building built? *

Before 1940	1940-1979	1980 or later
-------------	-----------	---------------

4. What is the square footage of your building? *

Less than 1200 sq ft	1200 to 2800 sq ft	Greater than 2800 sq ft
----------------------	--------------------	-------------------------

5. What is the primary fuel for the existing heating system? *

 Natural Gas	 Electricity	 Fuel Oil	 Propane	 Other Fuel	 None
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- Audience: Contractors and homeowners
- Inputs for a particular house – compared to an analysis of more than 500,000 simulations
 - County or zip code
 - Building type (single family, multifamily, manufactured home)
 - Year built range (e.g. before 1940)
 - Square footage range (e.g. less than 1500 sq.ft)
 - Primary heating fuel
 - Existing cooling method
 - Does the building have ducts?
 - Wall type (e.g. wood frame, brick)
 - Wall insulation?
 - Ceiling insulation?

Tool Outputs - Current



HOME > RET > Building America > Solution Center Home > Retrofit Decision Tool > Retrofit Decision Tool Subdomain HOME

Retrofit Decision Report

Near-Match Recommended Package for your home: Basic Envelope + Equipment Electrification

This recommendation is based on an analysis of similar buildings that achieve zero carbon alignment.

In these simulations, **41%** required Basic Envelope + Equipment Electrification upgrade, **33%** required Current Code Envelope + Equipment Electrification upgrade, **17%** required Beyond Code Envelope + Equipment Electrification upgrade, and **9%** required Equipment Electrification upgrade in order to be zero carbon aligned.

Basic Envelope + Equipment Electrification

Below provides more details about the recommended package to your building based on the building characteristics provided on the input page. The first column lists the equipment or building feature to be upgraded, and the second column lists the recommended attributes associated with that upgrade.

[Share via email](#) [Print / PDF](#)

Systems	Systems		
Appliances	EQUIPMENT	UPGRADE DETAILS	BASIC RESOURCES
IECC Climate Zone	Heat pump water heater	Minimum Energy Factor (MEF) 2.0 or higher, with a rating tool coming soon.	Home Improvement Expert™ Checklist: Heat Pump Water Heater
	Heat pump HVAC	Minimum Energy Factor (MEF) 13.0 or higher, with a rating tool coming soon.	Home Improvement Expert™ Checklist: Heat Pump Replacement
My input	Ventilation	Energy Recovery Ventilator (ERV). Select an ERV that utilizes the recirculation pathway method.	Home Improvement Expert™ Checklist: Heat Pump Replacement
	Windows	Add low-E exempt windows.	Guide: Low-E Exempt Windows
	Attic, Rse air-sealing and insulation	R-40 or higher for homes with vented attic and attic R-30 or less than R-30.	Home Improvement Expert™ Checklist: Attic Air Sealing and Insulation
	Wall insulation with re-siding	Add 1 inch of continuous wall insulation under new siding, for homes older than 1990 with less than R-13 wall insulation.	Guide: Rigid Foam Insulation for Existing Exterior Walls

Note: If your building already has equipment of the characteristics listed in the table, there is no need to replace that feature. For example, if the table recommends upgrading all lighting to LED and your building already uses all LED lighting, then there is no need to upgrade the lighting further.

[See more information about other packages](#)

Energy audit

These results represent solutions for buildings that are similar to yours. To get recommendations that are specific to your building, it is highly recommended that you consult with an energy professional (or energy auditor) and work with a contractor to understand real costs associated with these packages.

Tell your Contractors about Buildxact

Connect now to Buildxact for the complete bill of materials for these assemblies. In just a few clicks, you can send them in a purchase order to your supplier, putting you in the perfect position to get a rebate for your home buyer and saving you hours and hours of time.

- Recommendation page is less than 30 seconds to load
- Always recommends an audit for best practice
- Printable
- Provides general recommendations based on similar modeled results
- Leads user to expert installation guidance where possible

Tool Outputs – Changes In Progress

☐ DONE



Weatherization

Difficulty: ★ Initial cost: \$

Add attic insulation to reach R-60 or higher for homes with vented attic

- When to complete this measure? At any time
- Non-energy benefits:
 - Higher comfort
 - Better indoor air quality if air sealing is complete
- IRA Rebates up to: \$1200
- Savings up to: \$50/year

BASC resource to help: Guide - [Low-E Exterior Storm Windows](#)

☒ DONE



Other Insulation

Difficulty: ★★ Initial cost: \$\$

Add attic insulation to reach R-60 or higher for homes with vented attic

- When to complete this measure? When you re-side
- Non-energy benefits:
 - Higher comfort
 - Better indoor air quality
- IRA Rebates up to: \$1200
- Savings up to: \$200/year

BASC resource to help: Guide - [Rigid Foam Insulation for Existing Exterior Walls](#)

- More graphical outputs
- Range of difficulty of retrofit
- Initial cost ranges
- Links to incentives
- Where heat pumps and/or heat pump water heaters are suggested, the corresponding decision tools are linked to



Thank you





Josh Butzbaugh
PNNL



Heat Pump Water Heater Installation Tool

September 12, 2024

Josh Butzbaugh
Alek Parsons



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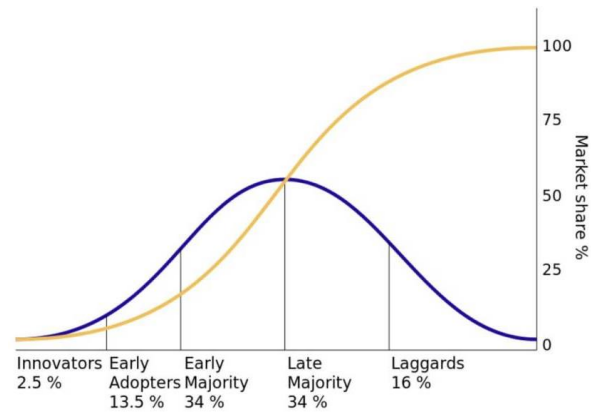
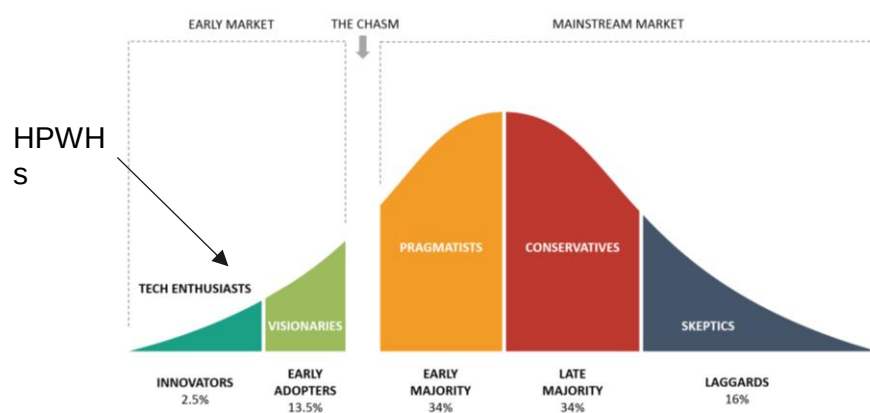


Agenda

- Background
- Purpose of the Tool
- Key Barriers Addressed by Tool
- Tool Inputs
- Tool Results
- Next Steps

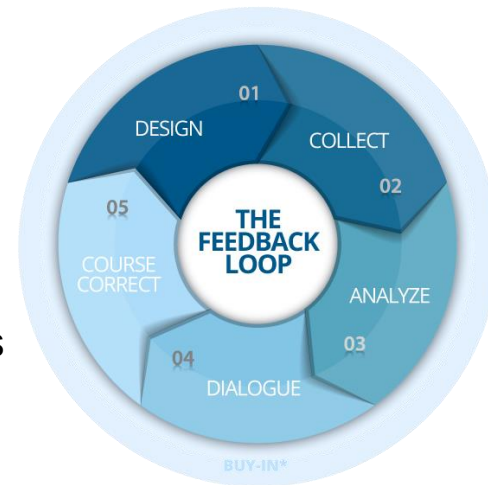
Background

- Heat pump water heaters (HPWH) consume 60-70% less electricity than electric-resistance water heaters, and reduce greenhouse gas emissions substantially compared to gas water heaters
- Major manufacturers have offered HPWHs since 2009, and more than 200 models are in the market
- HPWHs have a low (~3%) but rapidly growing market share (26% growth from 2021 to 2022)
- Inflation Reduction Act incentivizes HPWHs for 10 years, reducing the first cost barrier
- DOE published a final rule requiring minimum energy efficiency standards that only HPWHs can achieve for electric storage water heaters greater than 35 gallons (compliance date: May 6, 2029)



Purpose

- In retrofit scenarios, HPWHs are more complicated to install than a like-for-like replacement – so installers are less likely to recommend them!
- Identified a need for comprehensive guidance on HPWH sizing and installation process for the supply chain, namely:
 - Installers and installer call center staff
 - Sales associates (retail and wholesale)
 - Do-it-yourself homeowners
- Built upon industry best practices and latest research
- Refine the tool through feedback from installers, REEOs, program managers, and other subject matter experts



based on the Constituent Voice Methodology™

Key Barriers Addressed by Tool

- To address installation barriers, guidance is needed for how to approach different home installation scenarios, focusing on key barriers:
 - Sizing to home's peak water heating load
 - Space constraints
 - Air volume or flow requirements
 - Condensate management
 - Electrical considerations
- Tool results are tailored to each installation by asking **simple questions** about the home and existing water heater
- Installers with limited HPWH experience can **learn** the skills

Tool Inputs

Web address for online version of tool:
https://basc.pnnl.gov/hpwh_installation_tool

In the first section, the tool begins with asking users for high-level information on the home

Home Information (Section 1 of 3)

All fields are required unless otherwise noted

Zip Code

Number of Bedrooms

This tool is limited to homes with 6 or fewer bedrooms.

Number of Bathrooms

This tool is limited to homes with 3 or fewer bathrooms.

**Indoor soaker tub, spa, or jacuzzi
fed by water heater?**

☐ Yes ☐ No

**Occupants take long showers or
baths consecutively?**

☐ Yes ☐ No

Tool Inputs

Location of the Existing Water Heater (Section 2 of 3)

All fields are required unless otherwise noted

Location ?

- Select -

Sufficient space? ?

☐

Yes

☐

No

At least 700 cubic feet of air
volume? ?

☐

Yes

☐

No

Near a thermostat? ?

☐

Yes

☐

No

Sound/vibration OK? ?

☐

Yes

☐

No

Drain available for condensate? ?

☐

Yes

☐

No

In second section, the tool asks users about water heater location

Tool Inputs

In the third section, the tool asks for additional water heater information

Water Heater Information (Section 3 of 3)

All fields are required unless otherwise noted

Existing water heater type

Gas storage

Existing tank size ?

- Select -

gal

Existing input rate ?

- Select -

BTU/h

Does hot water run out more than
5 times per year?

☐ Yes ☐ No

Panel capacity and open slot for
30-amp circuit? ?

☐ Yes ☐ No

Available dedicated 15-amp
circuit? ?

☐ Yes ☐ No

Available 120-volt receptacle? ?

☐ Yes ☐ No

Tool Inputs

In final section, if selected by user, an electrical panel calculator (via pop-out page) is available to help users in need of panel capacity guidance

Electrical Panel Calculator



This calculator is for existing electrical panels. This calculation is based on the National Electric Code (NEC) Article 220.83 and will help determine what the electrical load will look like after installing a heat pump water heater (and other electrical equipment that may be installed, such as solar PV, electrical vehicle chargers, or a heat pump).

* denotes required fields. This tool provides estimates and does not replace an evaluation conducted by a licensed electrician.

Amperage rating at panel * ?

Square footage of home *

of kitchen countertop circuits * ?

of laundry circuits * ?

Select all **electrical** appliances and power losses below. If known, enter the exact wattage of the appliance. Look for the nameplate rating of large appliances. If the value cannot be determined, leave the field blank and a default value will be used.

Oven ?

Stovetop (2 burner) ?

Stovetop (4+ burner) ?

Electric vehicle charger ?

Other ?

HVAC System * ?

Calculate

Tool Results

- After the user selects responses and submits, the tool returns guidance
- First section of the guidance is the Recommended HPWH model based on the home's peak water heating load

Recommended model: 50-gallon 240V model

This heat pump water heater is suggested based on the home's estimated potential hot water usage as determined by the number of bedrooms and bathrooms, water heater location, and climate zone.

[List of ENERGY STAR-certified models matching recommendation](#)

Tool Results

Second section is the customized installation guidance with specific guidance on location, condensate, and electrical.

Installation Guidance

The following is general installation guidance. Refer to manufacturer literature for guidance specific to each heat pump water heater model. Ensure that proper permitting occurs and follow all applicable codes.

LOCATION GUIDANCE	
Current water heater location is sufficient for installation of a HPWH. Prior to installing the HPWH, refer to best practices.	
Air Volume	Ensure that the air volume in the room is not decreased below the limit by adding items (ex. Storage boxes) to the space. Consult product literature for exact air volume requirements as they vary by manufacturer.
Sound / Vibration	Install a R-10 rigid foam pad and rubber mat/shims underneath the water heater to reduce potential sound and vibration.
CONDENSATE	
Install a condensate cleanout "T" connection to the HPWH condensate outlet so the line can be cleared of blockage if necessary. Use PVC pipe or tubing (typically 3/4-inch diameter or larger) to connect the condensate T connection to the existing condensate drain or line.	
If the condensate line is gravity fed, the minimum drain line pitch should be 1/8-inch fall for every 12 inches of horizontal run. If the drain line calls for supports, they should be installed every 4-feet of horizontal run (while maintaining proper pitch) and every 10-feet of vertical run. If a condensate pump is needed, install a 2 gallon-per-minute pump with the condensate line. If the HPWH is located in a basement, select a pump with double the lift to the highest point in the drainage line. If the HPWH is located near an HVAC system with an existing condensate pump, consider using the same pump for the HPWH condensate line by tying it in with a T connector.	
Do not utilize an extension cord for the condensate pump unless it is approved by the code.	
ELECTRICAL	
If an existing or new 30-Amp circuit is used, an electrician should route 10-gauge wire and conduit to the 240-volt heat pump water heater, connect the wiring at the water heater's junction box, and ensure the wiring is grounded. The retrofit process will include capping the gas line and sealing the chimney/vent.	

Tool Results

Final section includes non-customized, static information:

Installation Best Practices

Note: this is not the full list!

Verify that the following installation best practices are followed to ensure proper heat pump water heater operation:

- Proper wire gauge is used and wire is grounded for safety.
- Temperature and pressure relief (T&P) valve is operational and drains properly.
- Condensate is safely conveyed to the drain, sink, or exterior.

Incentives and Tax Credits

- [ENERGY STAR Rebate Finder](#)
- [ENERGY STAR Heat Pump Water Heater Tax Credits](#)

Installer Finder

- [ENERGY STAR Installer Finder](#)
- Consider printing or creating a PDF of the tool's results to provide to the installer. The Print/PDF button is in the upper right corner.

Informational Resources

- [RHA Best Practices for the Retrofit Installation of Heat Pump Water Heaters](#)
- [Hot Water Solutions Training Resources](#)

Next Steps

- Help us publicize and promote the tool!!!
 - Presentations
 - Demonstrations
 - Outreach to stakeholders to include tool in their programs and on their websites
 - Energy efficiency programs
 - Training programs
 - Utility rebate or incentive offers
- Tool is available at the following web address:
https://basc.pnnl.gov/hpwh_installation_tool
- Continue improving tool through user feedback

Thank you

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joshua.butzbaugh@pnnl.gov





Vrushali Mendon
PNNL



Cold Climate Heat Pump Decision Tool

September 12, 2024

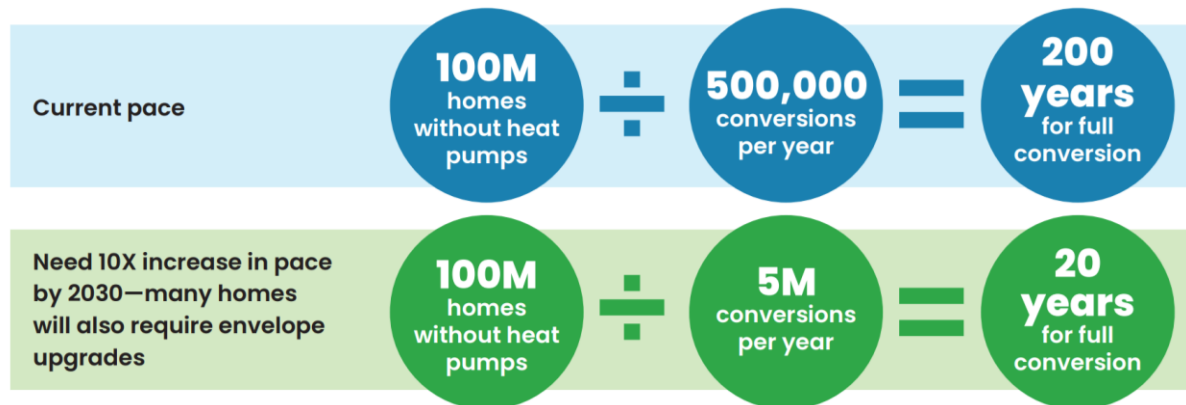
Vrushali Mendon



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DOE's Decarbonization Goal



A Key Barrier: HVAC Contractor Knowledge Gap

Electrification of existing residential buildings is crucial for meeting regional and national decarbonization goals. **HVAC contractors responding to retrofit requests find heat pumps to be more confusing than like-for-like furnace replacements, so they often don't recommend them!**

The result is a lost opportunity for decarbonization.

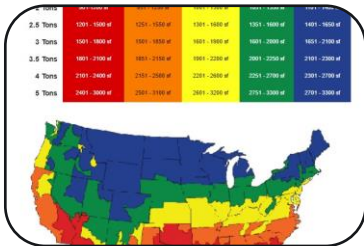


What is Needed?

- Support for the Efficiency Workforce
 - New technologies require new skills: upskilling current workforce
 - Creating a pipeline of next generation of skilled HVAC contractors
- Specifically, HPs
 - Need more holistic approaches based on application, as it relates to equipment sizing and selection



How Can a Decision Tool Help?



Sizing Guidance
and Best Practices



Preliminary Electrical
Panel Assessment



HP selection guidance



Guidance on
Control Systems



Installation and
Commissioning Best
Practices



Projected Energy and
Cost Savings
(Future Work)

Decision Tool Process Overview

Determine system configuration

- Series of questions about the home and existing system that feed into a “Project Objective”

Specify design loads

- Sensible heating and sensible and latent cooling loads
- For older homes, weatherization is recommended along with relevant Building America resources

Evaluate ducts for centrally ducted systems

- Brief set of questions about the size of the supply and return trunks, quality of air sealing and insulation

Evaluate electrical panel

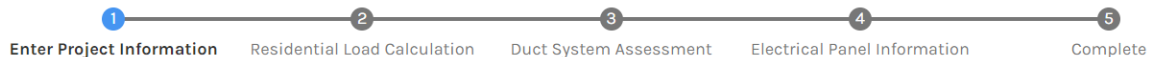
- Built-in electrical calculator based on NEC 220.83

System Guidance

- Recommended HP configuration with additional options
- Action Items
- Connection to NEEP's CCHP Database for suitable products
- Information related to available incentives and tax credits

Step 1: Determine System Configuration

Cold Climate Heat Pump Decision Tool



Welcome to the Cold Climate Heat Pump Decision Tool. The goal of this tool is to help guide contractors and installers through the decision-making process for heat pump (HP) sizing and selection, with a focus on retrofit applications in cold climates. Users will provide information below. The tool will provide HP size, configuration, and further installation guidance. Completion of the tool may take between 15 and 30 minutes.

Please start by providing information about the home, existing heating and cooling equipment, and the project objective below.

Project Location

Zip Code *

When was the building built?

Conditioned Floor Area sq. ft.

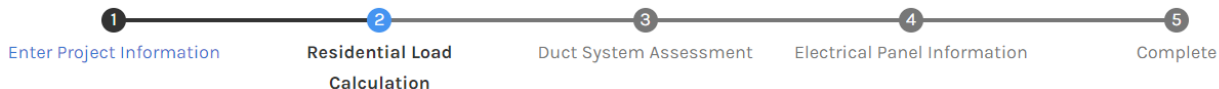
Project Details

Will the new heat pump serve the whole home or part of the home?

What is the existing heating fuel?

Step 2: Residential Load Calculation

Cold Climate Heat Pump Decision Tool



Perform heating and cooling design load calculations for **the whole home**. These are required to properly size a heat pump system. Do not use 'rules of thumb' to estimate loads as these are highly inaccurate and lead to poor performance of equipment. Be sure to include recent or planned envelope improvements, such as insulation, weatherization, or new windows, in the load calculation.

Heating Design Load  * Btu/hr

Sensible Cooling Design Load  * Btu/hr

Latent Cooling Design Load  * Btu/hr

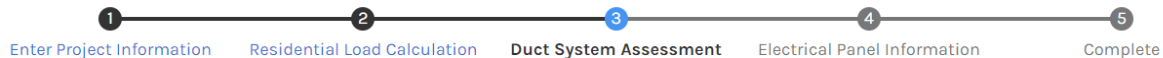
Total Cooling Design Load  38000 Btu/hr

Resources: (links open in new tab)

- [Improving the shell efficiency of a building can reduce loads and the size of heating equipment: Building America Solution Center - Weatherization](#)
- [ACCA Manual J](#)
- [ACCA Approved Software](#)

Step 3: Duct System Assessment

Cold Climate Heat Pump Decision Tool



The condition and capacity of the duct system are important to the efficiency and comfort of a centrally ducted heat pump. If the following information cannot be determined, conduct a duct system evaluation before installing centrally ducted equipment.

Existing ducts

Provide a response to at least one of the following two questions. Filling out both is optional.

☐ Duct airflow measurement * CFM

OR

☐ Main supply trunk shape *

☐ Main return trunk shape *

Are the ducts located entirely within conditioned space? *

Resources: (links open in new tab)

- [Seal and insulate ducts - Building America Solution Center](#)
- [ACCA Approved Software - Manual D](#)

Step 4: Electrical Panel Information

Cold Climate Heat Pump Decision Tool



Use the [Electrical Panel Estimator](#) to check if you have sufficient panel space.

Does the panel have adequate service capacity to add a new HP? *

- Select -

Is there physical space on the electrical panel to install a new double pole breaker? *

- Select -

Resources: (links open in new tab)

- [HVAC Electrical Panel Assessment - Building Science Education Solution Center](#)
- [Building Science Education Solution Center - Electrical Panels Level 3 Materials \(Word document\)](#)
- [Worksheets based on the 2017 NEC \(Excel document\)](#)

Electrical Panel Estimator

This estimator is for existing electrical panels. This calculation is based on the National Electric Code (NEC) Article 220.83 and will help determine what the electrical load will look like after installing a heat pump (and other electrical equipment that may be installed, such as solar PV, electrical vehicle chargers, or a heat pump water heater).

* denotes required fields. This tool provides estimates and does not replace an evaluation done by a licensed electrician.

Amperage rating at panel *

Square footage of home *

of kitchen countertop circuits *

of laundry circuits *

Select all **electrical** appliances and power losses below. If known, enter the exact wattage of the appliance. Look for the nameplate rating of large appliances. If the value cannot be determined, leave the field blank and a default value will be used.

Oven

No

Stovetop (2 burner)

No

Stovetop (4+ burner)

No

Electric vehicle charger

No

Electric Water Heater

No

Other

No

Heat pump to be installed

Heat Pump

* Btu

Electric Resistance

None

Calculate

Guidance for System Selection & Action Items

Cold Climate Heat Pump Recommendation

Review my inputs



System Review Guidance

- **System Selection**

Select a heat pump that can provide a majority of the load at design conditions and optimize auxiliary heat sizing.

- **Building Envelope**

Consider improving the building envelope prior to installing new equipment. Adding insulation, weatherizing, and air-sealing may lower heating and cooling loads and improve comfort. See the [Retrofit Decision Tool](#) for more details.

Scenario Summary

Selection Criteria

Heat Pump Details

Backup Heating System

Duct Guidance

TOP RECOMMENDATION

Ducted heat pump + backup

Serve the whole home with a ducted heat pump using existing ducts.

Centrally ducted heat pump

Serve heating load: 45,000 Btu/hr with the existing undersized ducts, while meeting the rest of the load with supplemental systems.

Electric resistance backup heating

Upgrade ductwork to match capacity of selected heat pump.

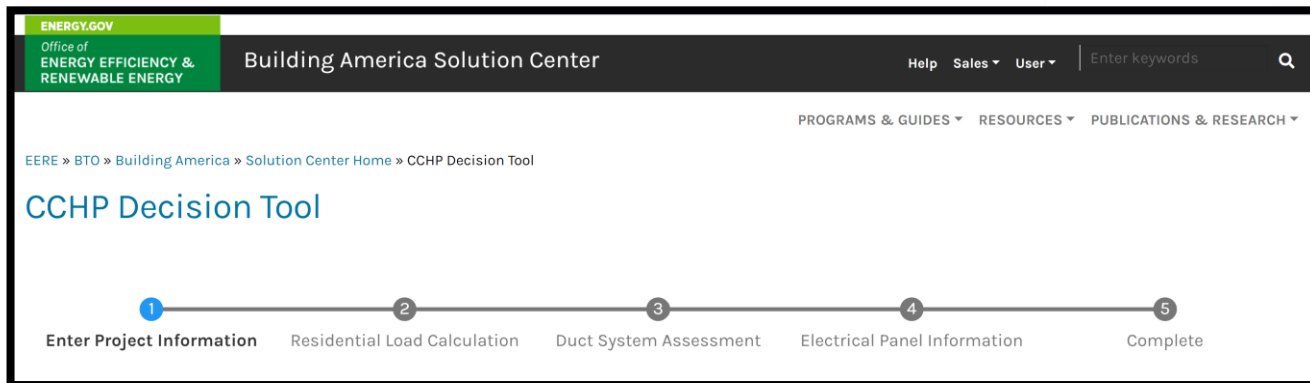
Key Residential HP Installation Scenarios

- Complete centrally ducted forced-air gas furnace to heat pump upgrade
- Centrally ducted heat pumps to shift most of the heating to the heat pump while maintaining existing fossil system as a backup (colder climates)
- Complete centrally ducted forced-air electric resistance furnace to heat pump upgrade (warmer climates)
- Add-on ductless heat pumps for supplementing isolated zones or to address comfort issues
- Addition of cooling in heating dominated climates

Cold Climate Heat Pump Decision Tool

Training tool for contractors to work through the decision points of heat pump design in residential retrofits

https://basc.pnnl.gov/cchp_decision_tool





Thank you





Ryan Shea
RMI

The Green Upgrade Calculator

A New Home Decarbonization Modeling
Tool for Energy Professionals

September 12th, 2024

Ryan Shea

rshea@rmi.org



Agenda



Calculator Overview



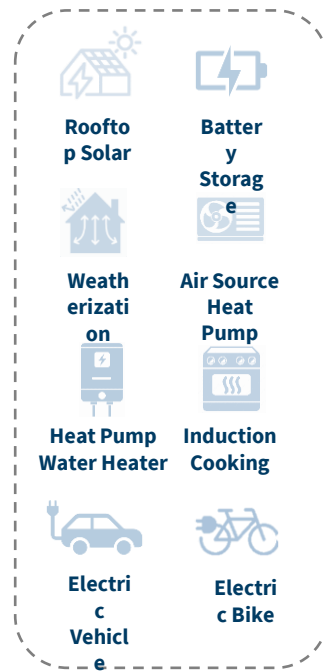
Calculator Demo



Q&A

1

Introducing the Green Upgrade Calculator: A free online tool for energy professionals to assess the lifetime cost and climate impacts of residential upgrades



Green Upgrade Calculator use cases for HVAC and plumbing contractors and their sales staff

- **Cost-motivated customers**

- Estimate ASHP and HPWH **energy bill benefits** leveraging system specs (e.g., 65 gallon, 3.75 UEF) and real-time electric rates (e.g., time-of-use, electric water heating) to include in customer quotes
- Adjust **system designs** to be most cost-effective for customers (e.g., hybrid ASHP with 20F switchover temp to natural gas backup or using the HPWH's efficiency vs hybrid mode)

- **Environmentally-focused customers**

- Estimate HPWH **carbon benefits** using time-of-day electric grid intensity (e.g., reducing 10 tons of CO₂) to include in customer quotes

Agenda



Calculator Overview



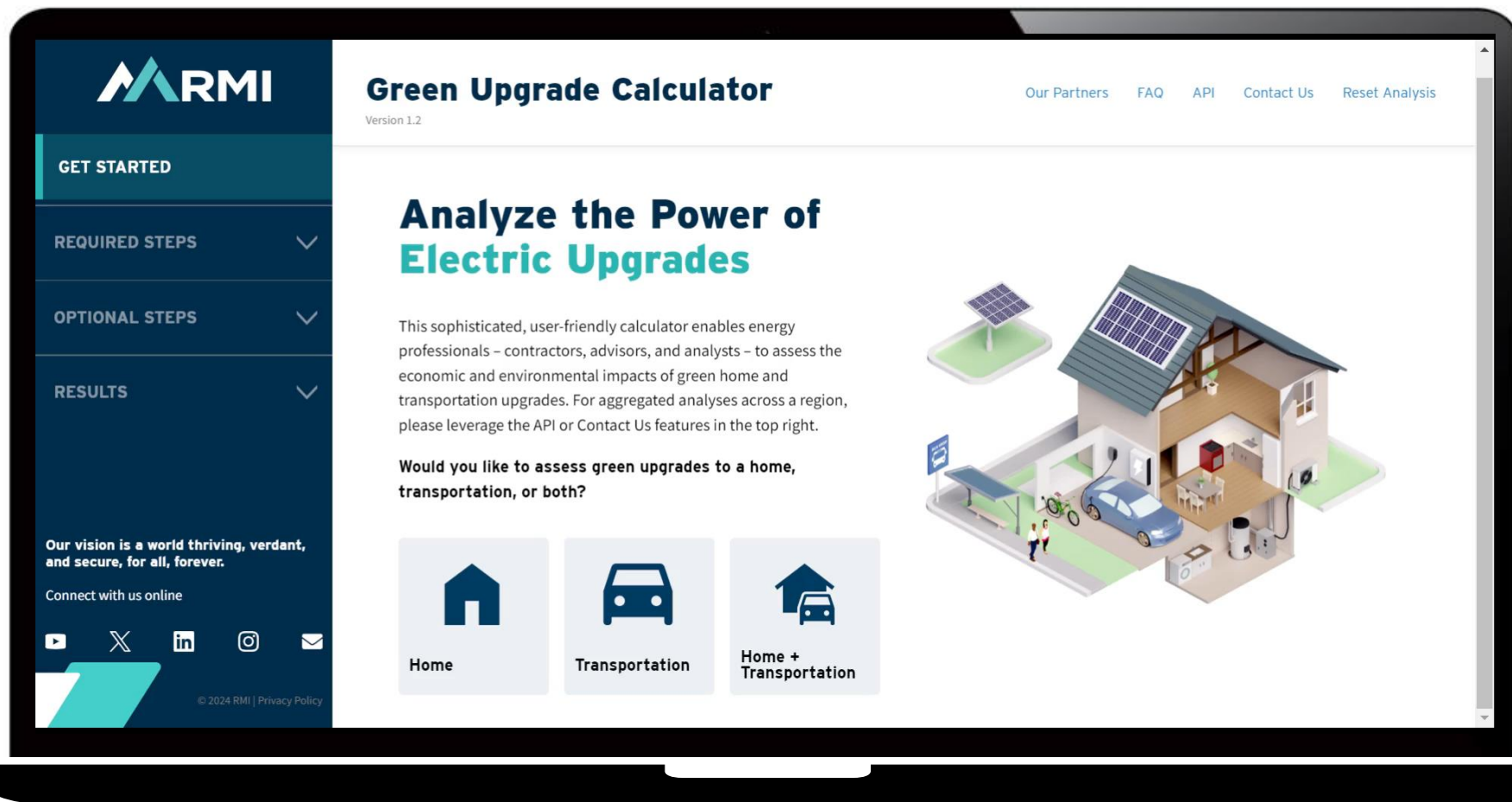
Calculator Demo



Q&A

2

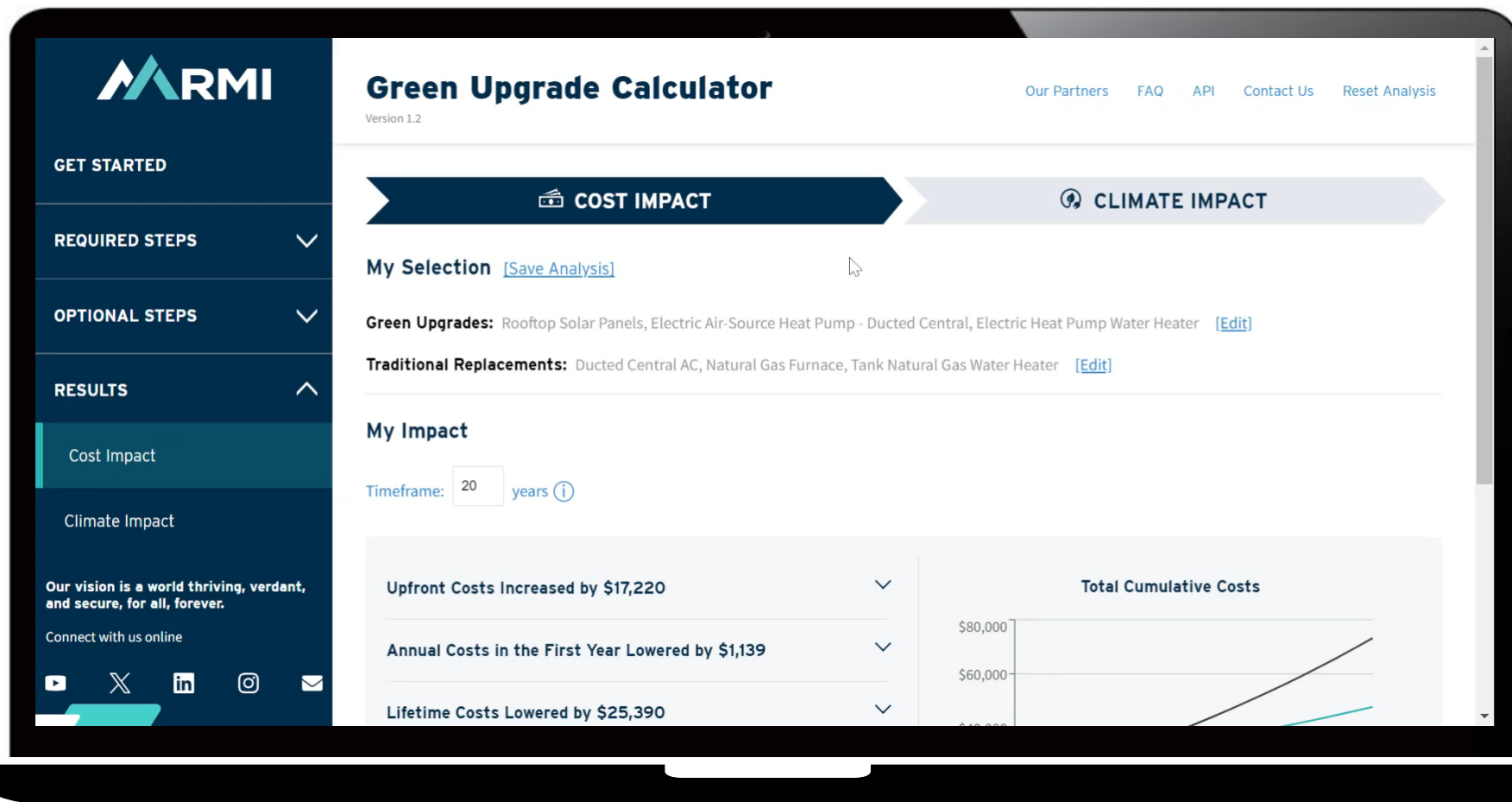
First, enter the home's basic info, green upgrades, and traditional alternatives



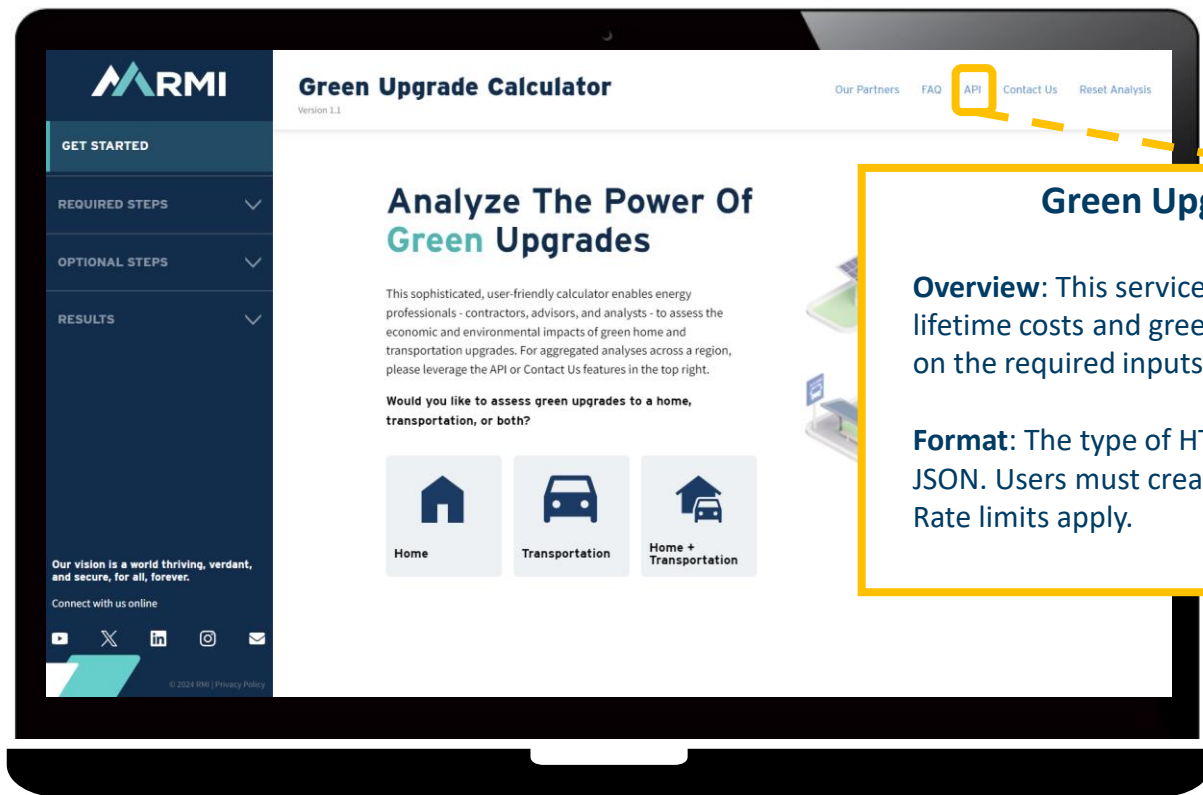
Second, modify any defaults in technical details, O&M, upfront costs, and financing



Last, view the lifetime cost and climate impact results



The calculator's API can be leveraged to integrate the results within your existing HVAC or water heater sales system



Green Upgrade Calculator API

Overview: This service returns the upfront, operating, and lifetime costs and greenhouse gas emissions results based on the required inputs, and any additional optional inputs.

Format: The type of HTTP requests are POST and inputs are JSON. Users must create an account to access this service. Rate limits apply.



Agenda



Calculator Overview



Calculator Demo

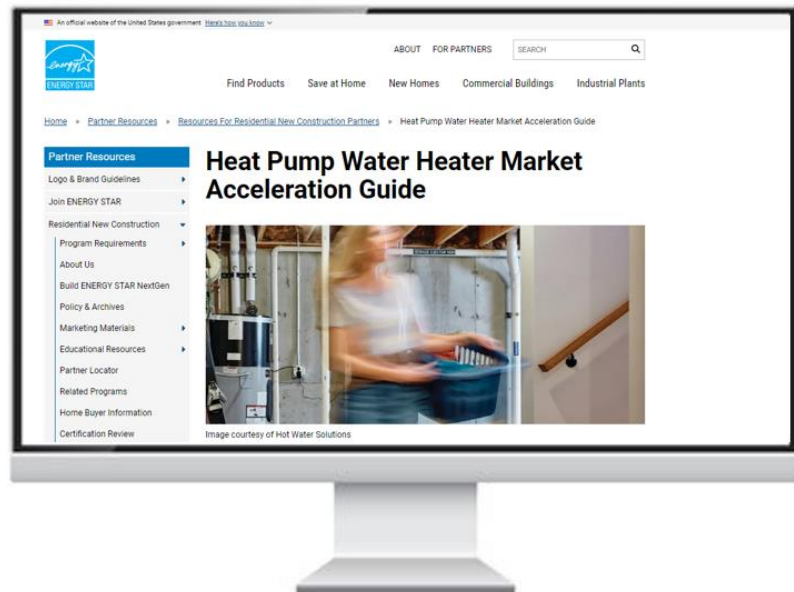


Q&A

3



ENERGY STAR Market Acceleration Guide for Heat Pump Water Heaters



[View the New Guide](#)

Introducing the new [ENERGY STAR Market Acceleration Guide](#) for heat pump water heaters. Created with input from experienced program designers, water heating experts, and key industry players, the Guide is a comprehensive resource offering proven strategies and best practices for program development and implementation.

A Living Resource:

The Market Acceleration Guide is intended to be a living resource continuously informed by industry voices that represent all segments of the market. This is made possible by your feedback!

Explore the Residential Program Guide

Resources to help improve your program and reach energy efficiency targets:

- [Handbooks](#) - explain *why* and *how* to implement specific stages of a program.
- [Quick Answers](#) - provide answers and resources for common questions.
- [Proven Practices](#) posts - include lessons learned, examples, and helpful tips from successful programs.
- [Technology Solutions](#) **NEW!** - present resources on advanced technologies, **HVAC & Heat Pump Water Heaters**, including installation guidance, marketing strategies, & potential savings.
- [Health + Home Performance Infographic](#) – spark homeowner conversations.



<https://rpssc.energy.gov>

Health + Home Performance Infographic



DOE’s Health + Home Performance Infographic reveals the link between efficiency and health – something everyone cares about. Efficiency programs and contractors can use the question-and-answer format to discover a homeowner’s needs.

The infographic is ideal for the “kitchen table” conversations where people decide what to do – and who they want to do it. It also has links for homeowners to find a qualified contractor if they do not already have one.

[Download](#) this infographic from DOE’s Better Buildings Residential Network.

Looking for photos to help tell your energy efficiency story? Visit our image libraries:
<https://www.energy.gov/eere/better-buildings-residential-network/articles/image-libraries>

Thank You!

Follow us to plug into the latest Better Buildings news and updates!



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Please send any follow-up questions
or future call topic ideas to:
bbresidentialnetwork@ee.doe.gov