BUILDINGENERGY BOSTON

The Green Upgrade Calculator: A New Economic Modeling Tool for Home Decarbonization

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RMI is a non-partisan, non-profit organization that works to transform the global energy system to secure a clean, prosperous, zero-carbon future for all.

Our vision includes…

1 A Carbon-Free Grid…

2 to Power Key Sectors…

3 Accelerated by Market Catalysts…

4 Across Critical Global Geographies

Agenda

- **Calculator Overview**
- Demo for Individual Home Analyses
- Demo for Aggregated Analyses
- Example: Contractor Experiences
- Group Discussion

There are various barriers to home decarbonization

Technical: Limited electrical panel capacity, longer installation timeline, limited supply, etc.

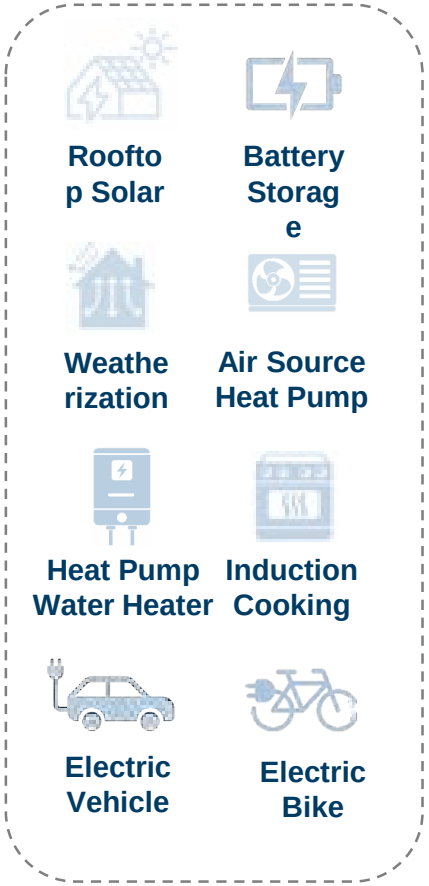
Economic: Higher upfront costs and increased energy bill in some cases

Consumer: Lack of clear understanding of the benefits of different upgrades (economic, climate, health, etc)

Workforce: Limited home contractors properly trained in and advocating for electrification to residents

RMI's Green Upgrade Calculator, coming April 2023, aims to address some, but not all, of these barriers

A sneak peak of the Green Upgrade Calculator: A free online tool for energy professionals to assess the economic and climate impacts of residential upgrades



The Green Upgrade Calculator has various use cases for energy professionals looking to analyze the impacts of residential upgrades, including:

1 Individual Home Analyses

Home contractors can…

A. Modify system design and specs (e.g., hybrid vs whole-home ASHPs)
B. Assess energy bill impacts (e.g., leverage specific utility tariffs)

Home technical advisors can…

A. Compare contractor quotes (e.g., lifetime cost savings between two quotes)
B. Quantify climate benefits (e.g., lifetime GHG benefit between HPWH and solar)

2 Aggregated Regional Analyses

Energy analysts can…

A. Analyze national impacts (e.g., Home Energy Rebate programs)
B. Analyze state policy impacts (e.g., Zero-emission equipment standard)
C. Analyze local policy impacts (e.g., AC-to-heat pump requirement)
D. Analyze utility regulation impacts (e.g., Clean Heat standard)

RMI

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Calculator Overview

Demo for Individual Home Analyses

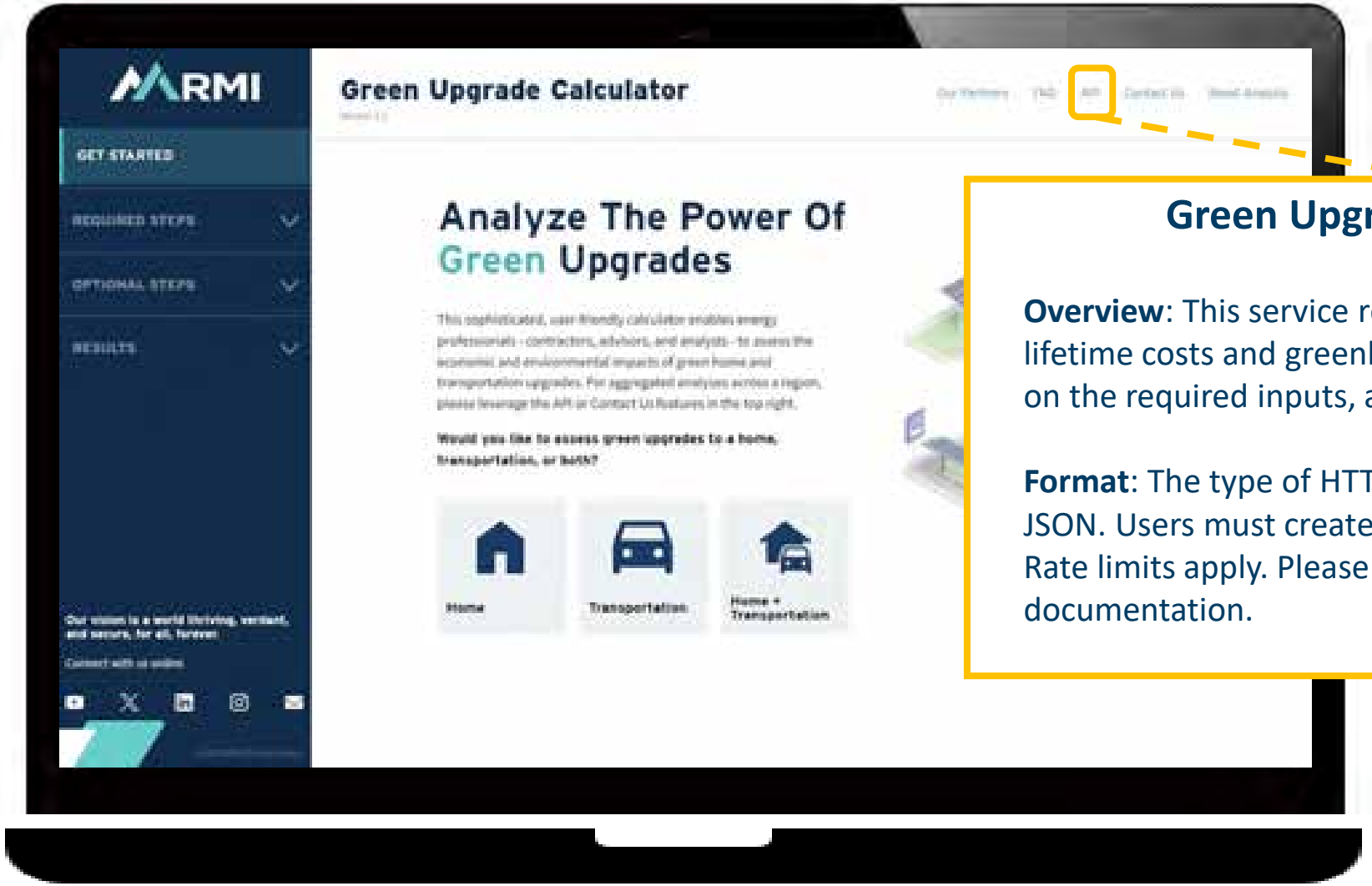
Demo for Aggregated Analyses

Example: Contractor Experiences

Group Discussion

3

The calculator's API can be leveraged against regional building inventories to perform aggregated analyses



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. Please reference this file for full documentation.

Example #1: Using the API and building inventories to analyze residential annual and lifetime costs from a proposed policy

1. Identify the green upgrades and results to analyze based on the policy (e.g., HPWH bill savings)
2. Identify the building inventory within the identified region to analyze (e.g., EIA RECS 2020)
3. Run the API to get results for each building type
4. Calculate the aggregated values based on the weights for each building prototype

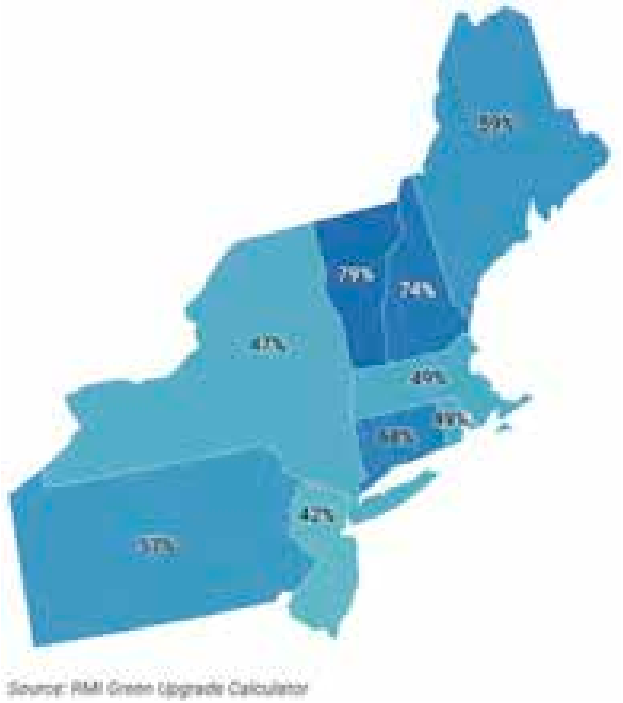
Simplified example below for a HPWH analysis for single-family detached homes in MA

Building prototype #	1	2	3	4	5	6	7	8	9	10	11	12
Home construction year	Pre-1980						Post-1980					
Current fuel	Electricity		Fuel oil	Propane	Natural gas		Electricity		Fuel oil	Propane	Natural gas	
Current water heater	Tank	Tankless	Tank	Tank	Tank	Tankless	Tank	Tankless	Tank	Tank	Tank	Tankless
Percentage of Homes	15%	2%	11%	0.3%	28%	6%	6%	1%	6%	2%	10%	3%
HPWH Annual Savings	$910	$860	$330	$400	$70	-$10	$1200	$1130	$435	$525	$90	-$20

Example #2: Using the API and building inventories to analyze the homes with lower utility bills across a region under different scenarios

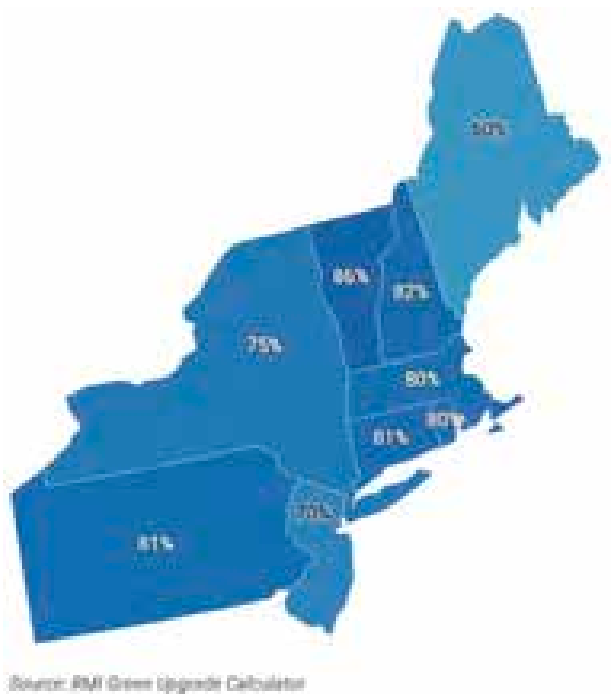
ASHP+HPWH

Northeast Avg: 52%



Hybrid ASHP+HPWH

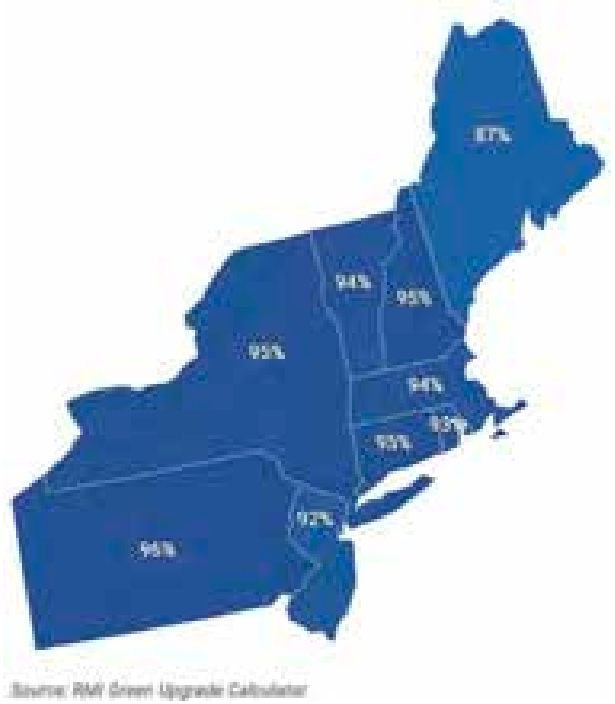
Northeast Avg: 77%



Note: Hybrid ASHP only applies to gas-powered homes.

Hybrid ASHP+HPWH+Weatherization

Northeast Avg: 94%



Note: Weatherization (adding insulation and sealing air leaks) only applies to homes built before 1980.

Agenda


Calculator Overview


Demo for Individual Home Analyses


Demo for Aggregated Analyses


Example: Contractor Experiences


Group Discussion

4

Abode Background

Utility Efficiency Programs

Mass Save® Home Performance Contractor Lead Vendor - National Grid & Eversource

- Trade ally management
- 50K home energy assessments
- 18K weatherization installations
- 10K quality assurance (QA) inspections

Municipal Light Plant Weatherization Quality Assurance

- Trade ally management
- Virtual and in-home QA inspections

Electrification & Decarbonization

Overall Customer Support

- 775 Quotes Compared for Air Source Heat Pumps
- Nearly 10,000 heat pump consultations

MassCEC & City of Boston Decarbonization Programs

- Technical lead consultant
- Implementation for single-family and triple-decker pilot

Energize Connecticut℠ and Mass Save® Heating Cooling Support, and Clean Heat Rhode Island lead vendor

- Statewide customer consultation services
- Heat Pump Installer Network (HPIN) management

Municipal Light Plant Community Heat Pump Support

- 18 communities

1% FOR THE PLANET — MEMBER —

abode
OUR PLANET. YOUR HOME.

Barriers contractors face in home electrification

- **Still a specialized marketplace**
  - o "PEMDAS" of electrification
  - o Project costs and timeline
  - o Decarbonization 'GC'
- **Transparency of heat pump performance**
  - o Analysis/Comparison tools bridging the gap
  - o Not on the contractor's radar? Interaction between gre upgrades
- **Comfort-level with savings analysis & design**
  - o Performance of legacy equipment vs heat pumps
  - o Limitations of the available equipment

Helping homeowners make informed decisions

Page 1: Summary

Equipment Summary

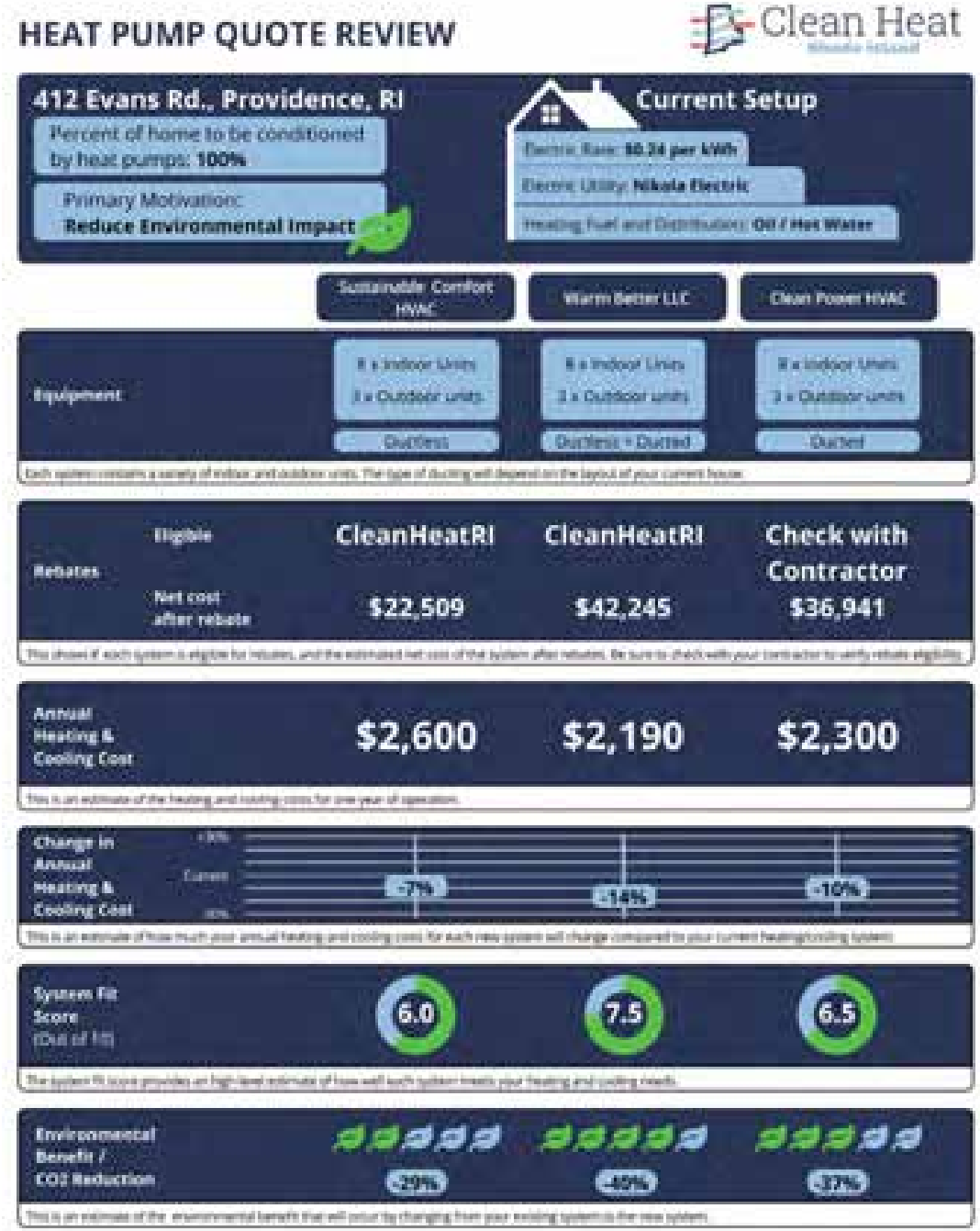
Qualified Product Lists
- Highlights equipment that meets rebate requirements

Operating cost
- Estimated annual heating and cooling cost

Change in Operating Cost
- Change relative to estimated existing operating cost

System Fit Score
- Explained on the next slide

Environmental benefit/CO2 reduction
- % change in CO2



Page 2: Summary

System Fit Score
- Evaluated based on analysis of six key measures of performance
- SCOP, Capacity maintenance, Aux electric resistance, Sizing for heating, Cycling temperature, Cooling turndown ratio

Equipment Visual
- Visual summary of the quoted equipment

System Sizing
- Sizing relative to the estimated heating load

Cost to Purchase and Annual Heating and Cooling Cost
- Compared to current heating and cooling costs

Other Considerations
- Dynamic list of considerations based on performance data and analysis results

RMI's Green Upgrade Calculator addresses key contractor barriers

- **Provide clarity in a specialized marketplace**
  - Differentiate conventional fossil fuel & AC systems from decarbonization pathways
- **Build confidence for in-industry professionals and their clients**
- **Numerous real-world opportunities**

Real world opportunities

- **Green Upgrade Calculator**
  - Building performance contractors, GCs, HVAC contractors, distributors
    - Sales tool
    - Model/evaluate commonly sold products
    - Internal training tool
- **How this breaks down barriers**
  - Reduce the complexity of entry for contractors into decarbonization
  - Flattens the learning curve
  - Help mitigate poor outcomes and confusion for all stakeholders

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Group Discussion

1. **Take 5 minutes at your table to discuss the following question**
   A. Where do you see this being most useful in your work?
   B. What are your top suggestions to make it more useful?
   C. How can this calculator standardize data analysis in the industry?
2. **Tables will then report out their answer to the group**