



Scaling up energy  
modeling

Arman Mottaghi, CEO







This house cannot have a  
heat pump.

**Why?**



“Energy assessment is hard and costly”

*-someone, probably*





**Got the  
energy  
model**



**What the  
homeowner  
knows**

"My goal is..."

"... saving money"

"... climate"

"... comfort"

**What the  
homeowner  
wants to know**

"Should I  
upgrade the..."

"... windows"

"... heating"

"... insulation"

**What the  
homeowner  
really  
wants to know**

"How much  
does it cost?"

"How long  
does it take?"

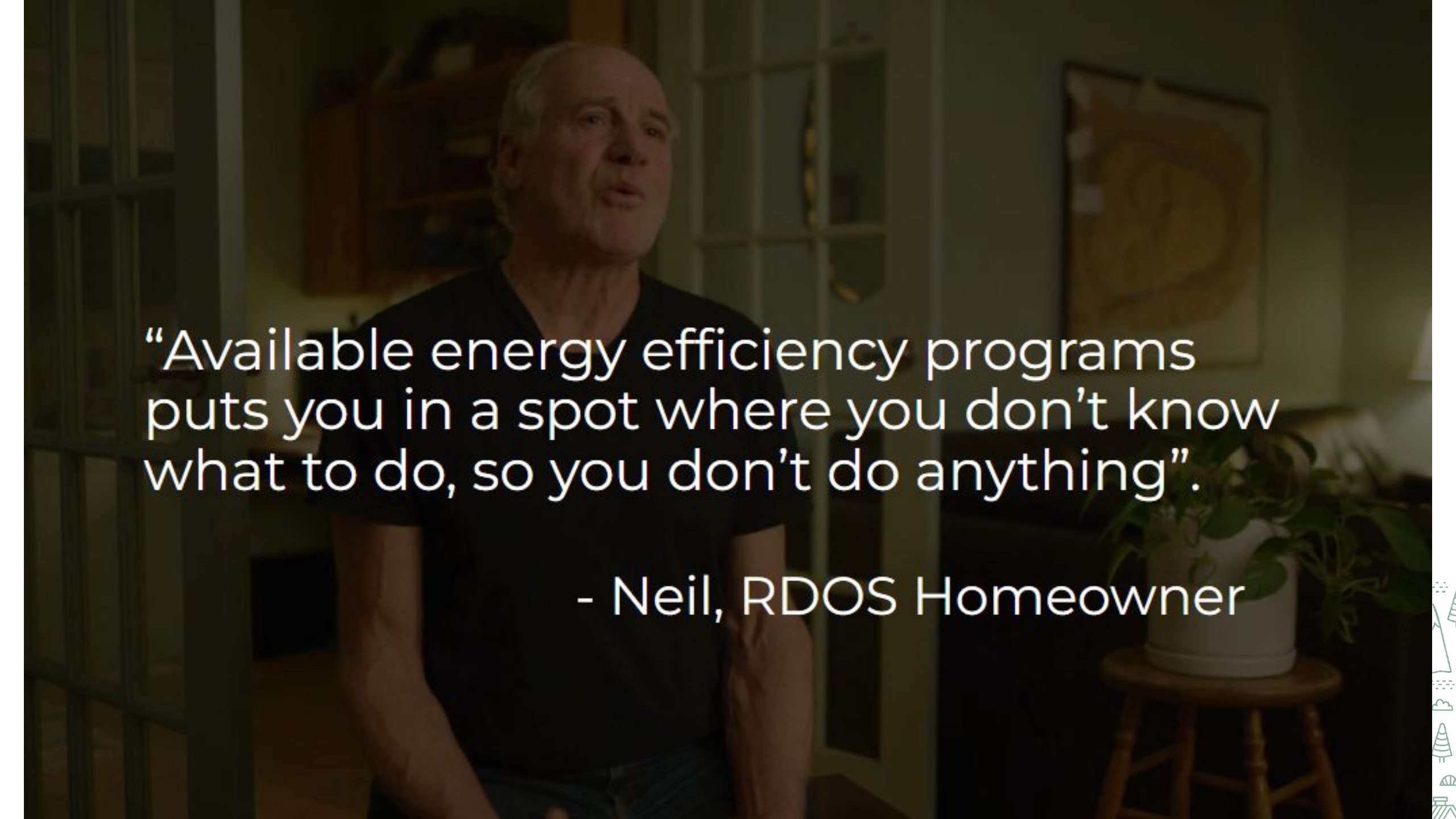
**What the  
homeowner  
Really, really,  
wants to know**

"What will I end  
up paying after  
rebates?"

"How much  
closer will I be  
to my goal?"





A man with grey hair, wearing a black t-shirt, is shown from the chest up, speaking. He is in a home environment with a glass-paned door behind him and a potted plant on a stool to the right. The image is dimly lit and has a dark overlay.

“Available energy efficiency programs puts you in a spot where you don’t know what to do, so you don’t do anything”.

- Neil, RDOS Homeowner

# What comes to mind when talking about energy modeling

[illegible]

Shouldn't be  
Energy assessment ~~is~~ hard and costly

We just have to break it down





## Virtual Assessment



## Remote Assessment



## On-site Assessment







## Virtual Assessment

Instant

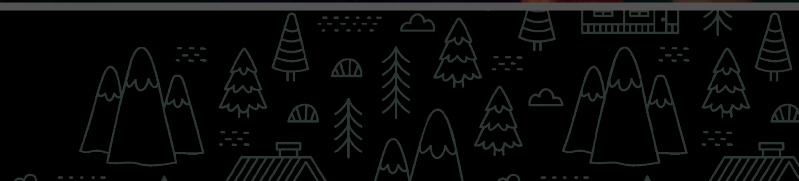
No homeowner  
involvement

$\pm 10\%$  error rate  
5% bias

## Remote Assessment



## On-site Assessment





? What does home's energy rating mean?

EnerGuide rating

2251 Old Hedley Rd, Princeton, BC, Canada

This home



Home energy rating estimate: ?

255

Carbon emissions estimate: ?

3

Refine your energy rating



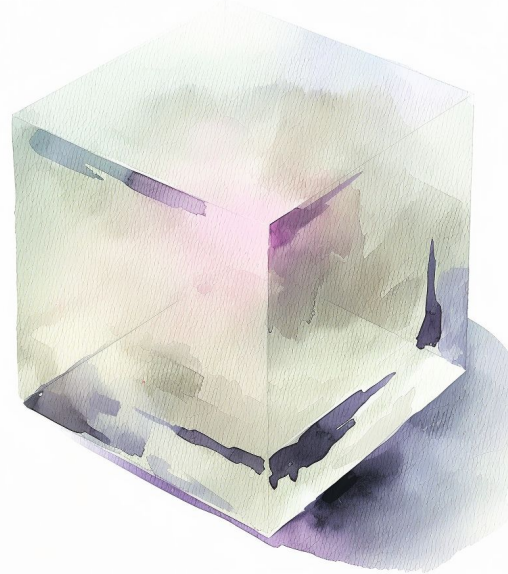
Our technology:

# Grey Box Energy Simulation

White Box → Black Box → White Box



Accessible



Accurate,  
Lightweight



Auditable,  
Reproducible

Read the  
Properate  
Whitepaper  
at  
[Properate.io](https://Properate.io)

## Properate: Property Rating Using A Novel Instant Energy Modeling Approach

Arman Motlaghi, Alex Lavoie, Amir Akhmetgareev, Noora Seifeldin

### Abstract

For mass-scale home energy upgrades, we present 4 criteria that no existing Building Energy Modeling tool provides simultaneously – Reproducibility, Expandability, Auditability, and Lightness. Reviewing the limitations of the common “White Box” (e.g. HVT2000, EnergyPlus) and “Black Box” (e.g. Machine Learning, AI) energy modeling tools, our novel “Grey Box” energy modeler, RHEST, excels in delivering on all 4 criteria. We then showcase RHEST within the software suite, Properate, to demonstrate how it enables Virtual and Remote Energy Rating when conventional On-Site Rating may not be feasible. 4,987 buildings in the Climate Zones 4 through 7 of North America are assessed with Properate, then their accuracy is compared to On-Site Rating. The results show that while Properate introduces new flexibility and scalability in the process, it maintains an average weighted accuracy of 92% compared to On-Site Rating. The results can pave the path for community-scale home deep energy retrofits across Canada.

### Background

With increasing declarations of climate emergency across the globe, communities and governments are looking for ways to understand their building stock and plan energy upgrades for them. Out of all building types, low-rise residential buildings have unique challenges in this regard: each building is unique and too small for programs that can operate at-scale. These challenges need to be addressed since the cumulative environmental impact of these buildings has been the largest amongst any building type [1][2].

The challenges are present from the “Energy Rating” (or “Energy Audit”) stage — the very first step of a building energy upgrade. As such, many governments are looking into ways of scaling Energy Rating for homes [3].

An Energy Rating has been historically done by a visit to the building. The “On-Site Rating” can create a comprehensive image of one building,

albeit, collecting accurate information from a home is time-consuming. This creates a tradeoff: if an Energy Rating increases the precision of the data they collect from each home, they will end up assessing fewer homes in a given timeframe. Since time is the major factor in Energy Rating costs, each home ends up paying more as well.

The Energy Performance Certificates (EPCs) in the EU are an example of this tradeoff. Each EU country can set their own EPC procedure. Depending on the economical and environmental dynamics in each country, the method of EPC creation can widely vary. Most countries require a visit to the home for issuing the EPC, but not all. The data collection fidelity and the tools for processing the EPC is also up to the individual member states, creating wide variance in the costs [4].

In Canada, the Rating is done under the EnerGuide For Homes program. The data



## Virtual Assessment

Instant

No homeowner  
involvement

$\pm 10\%$  error rate  
5% bias

## Remote Assessment

5 minutes

Homeowner  
involvement

$\pm 10\%$  error rate  
No bias

## On-site Assessment



## Have any of the following been replaced in the last 10 years?

- ☐ Heating System
- ☐ Ventilation System
- ☐ Hot Water System
- ☐ Windows
- ☐ Insulation in Walls
- ☐ Insulation in Roof
- ☐ Increased Air Tightness

→ Next

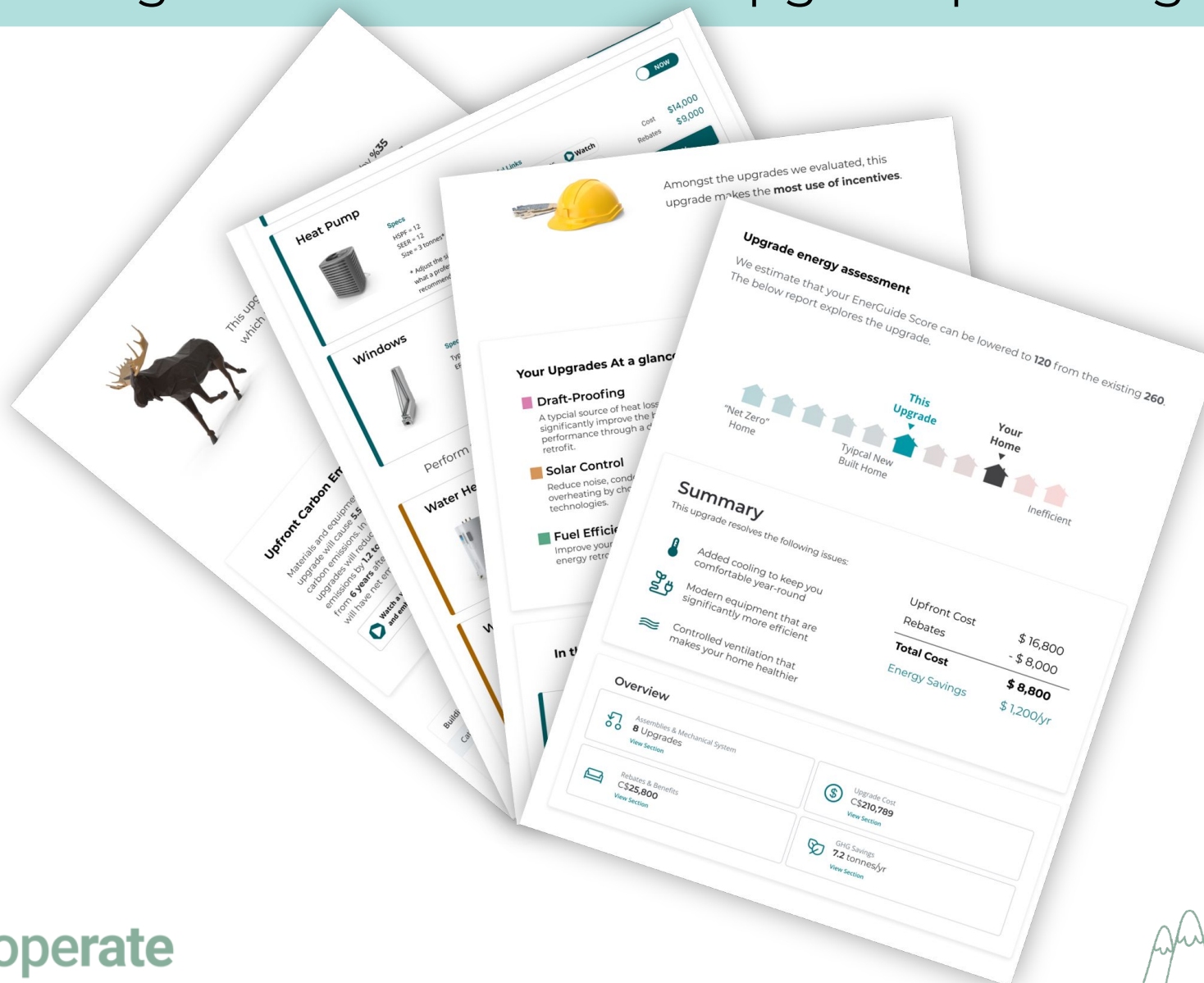


 Book A Free Consultation

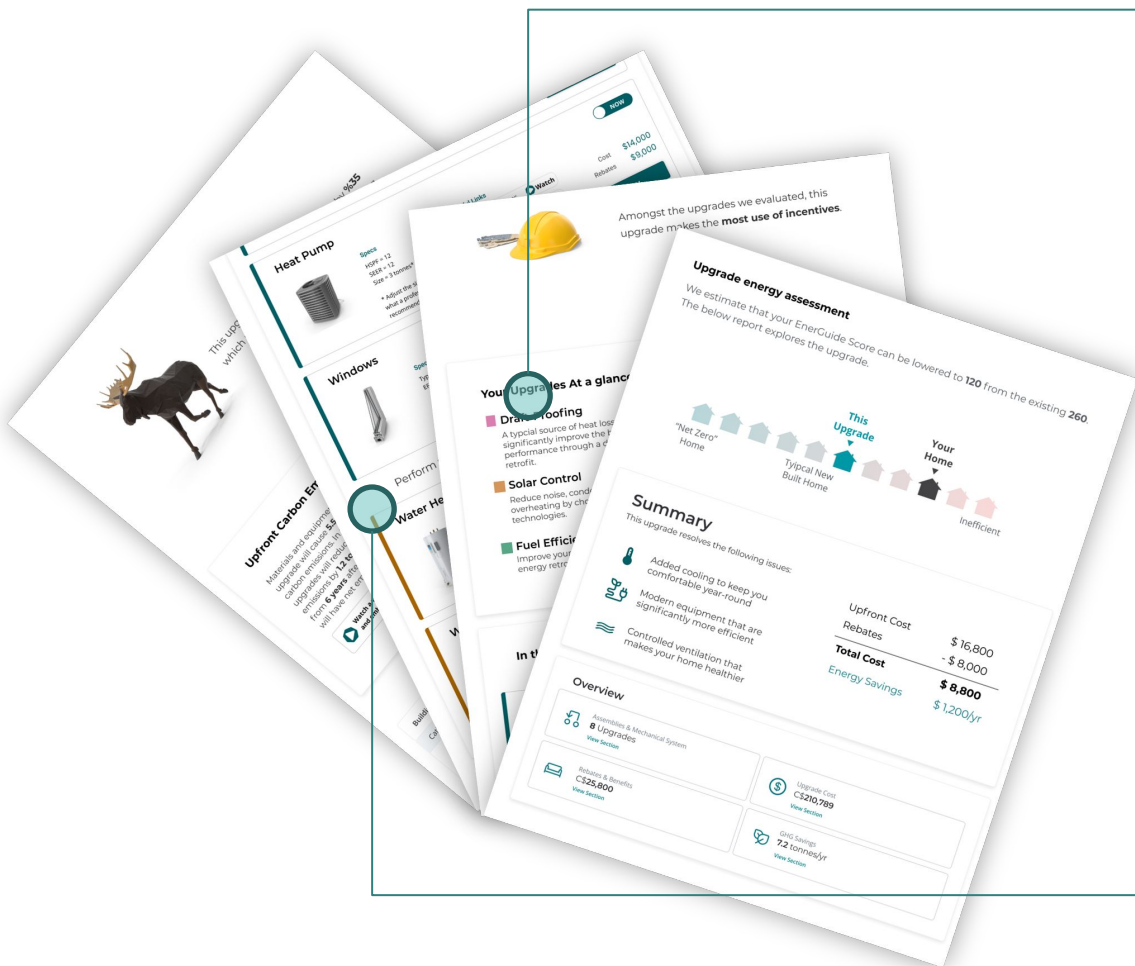




# Intelligent assessment and upgrade planning



# Intelligent assessment and upgrade planning



## Where does your energy go?

### Walls

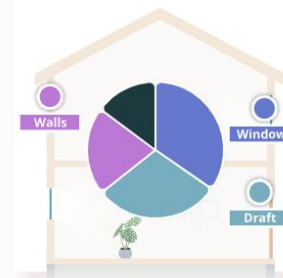
Walls are barriers to air, water, and energy leak. When walls don't work properly as a barrier, it can result in reduced comfort and can lower the durability of the building.

### Windows

Windows are usually the weakest point in energy loss of a home. Noise, air, and water can enter the building from around and within window systems that are past their lifetime.

### Draft

Without restricting air movement, even the best materials can't insulate the home well. Unwanted air leakage also reduces the effectiveness of your ventilation system.



## Heat Pump



### Specs

HSPF = 12  
SEER = 12  
Size = 3 tonnes\*

\* Adjust the sizing based on what a professional installer recommends.

### Useful Links

Types of Heat Pumps [Watch](#)

What to know before selecting

Cold Climate Heat Pumps

Cost **\$14,000**  
Rebates **\$9,000**

[Buy](#)

## Windows



### Specs

Type: Tankless  
EF: 0.89

### Useful Links

Window properties [Watch](#)

Maintenance Guide

Available Rebates

Cost **\$4,000**  
Rebates **\$1,500**

[Buy](#)

Perform this upgrades later or when the equipments stop working:

## Water Heater



### Specs

Type: Tankless  
EF: 0.89

### Useful Links

Tankless Systems [Watch](#)

Maintenance Guide

Available Rebates

Cost **\$4,000**  
Rebates **\$1,500**

[Remind](#)



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## Remote Assessment

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Homeowner  
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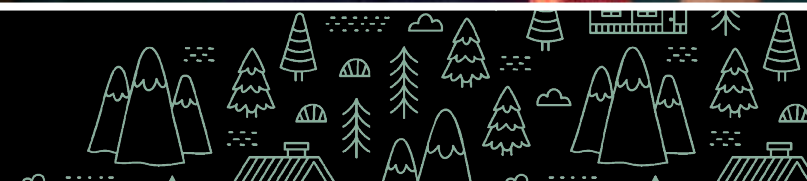


## On-site Assessment

30+ minutes

Professional  
involvement

Accuracy basis







Demo:

# Properate Stride





## Virtual Assessment

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No homeowner  
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## Remote Assessment

5 minutes

Homeowner  
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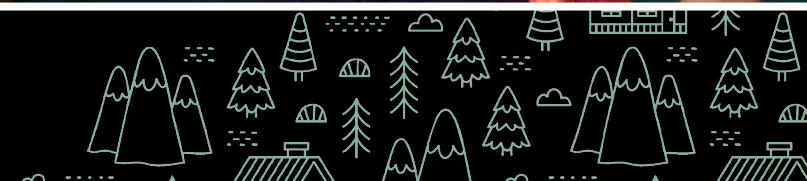


## On-site Assessment

30+ minutes

Professional  
involvement

Accuracy basis







## City Hall

Uses **Properate Maps** to **analyze** the housing stock



## Utility company

Use **Properate Community** to **engage** the homeowners



## Homeowners

Use **Properate Homes** to **learn** about their homes



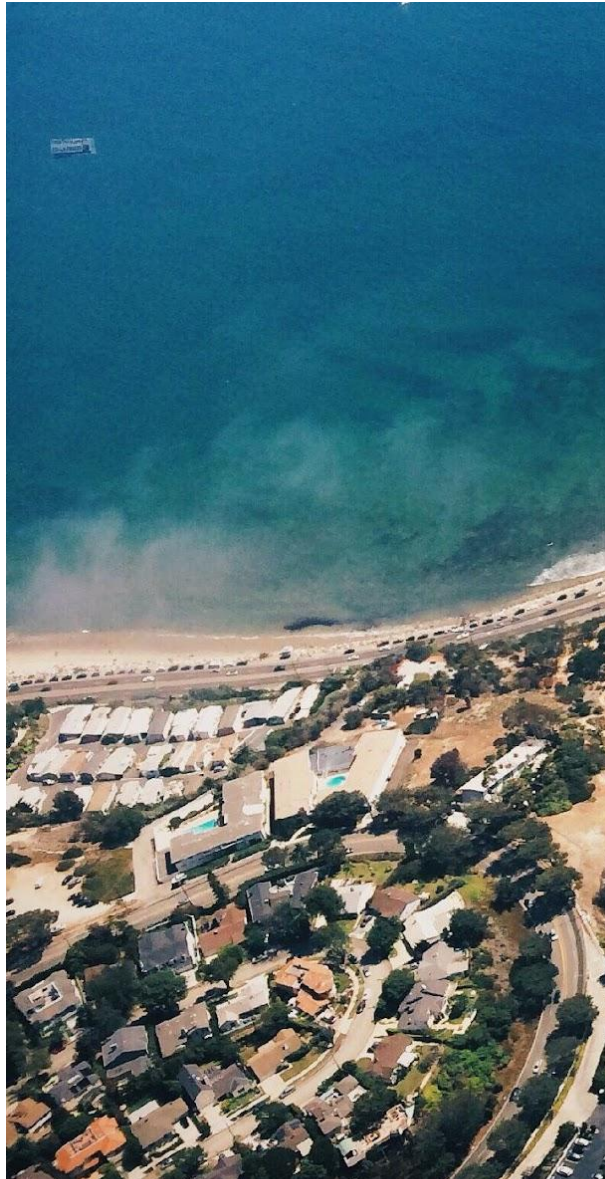
## Contractors

Use Properate tools to **consult** with the homeowners





# Project Spotlight:



- 50,000 Homes
- Local gov and utility support
- **Doubled** engagement to program
- New program design based on Maps insights

A close-up, slightly dimly lit photograph of an older man with white hair, smiling broadly. He is wearing a dark-colored shirt. The background is out of focus, showing some interior elements like a lamp and a wall.

Watch on Youtube:  
**@Properate**



# How You Can Help

Sign up for our newsletter at Properate.io

Contact:

**Stephen Wilson**

[stephen@properate.io](mailto:stephen@properate.io)

(604) 774 2996





# BC Home Energy Planner Introduction

Brett Auger, Senior Home Energy Rating System Lead

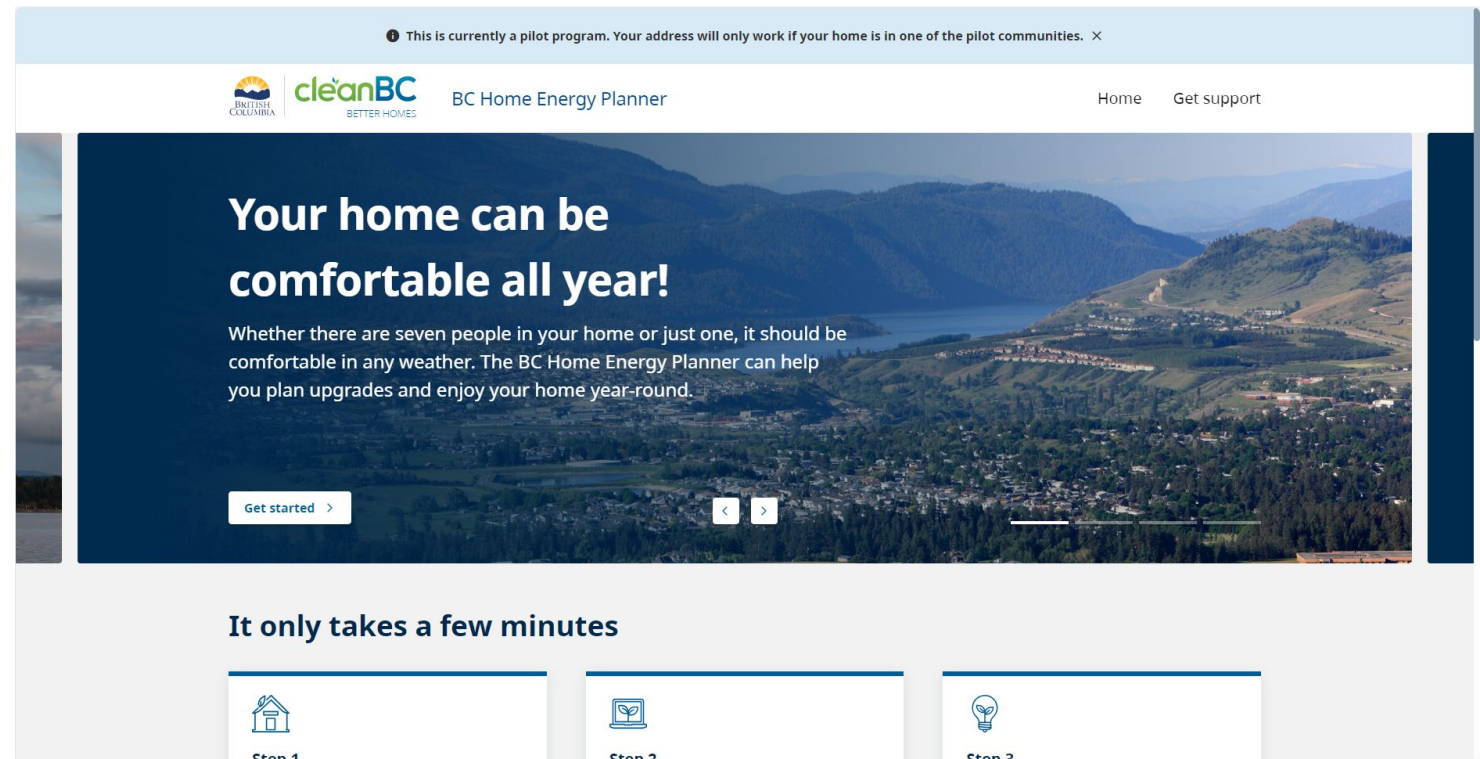
May 2, 2024





# What is the BC Home Energy Planner?

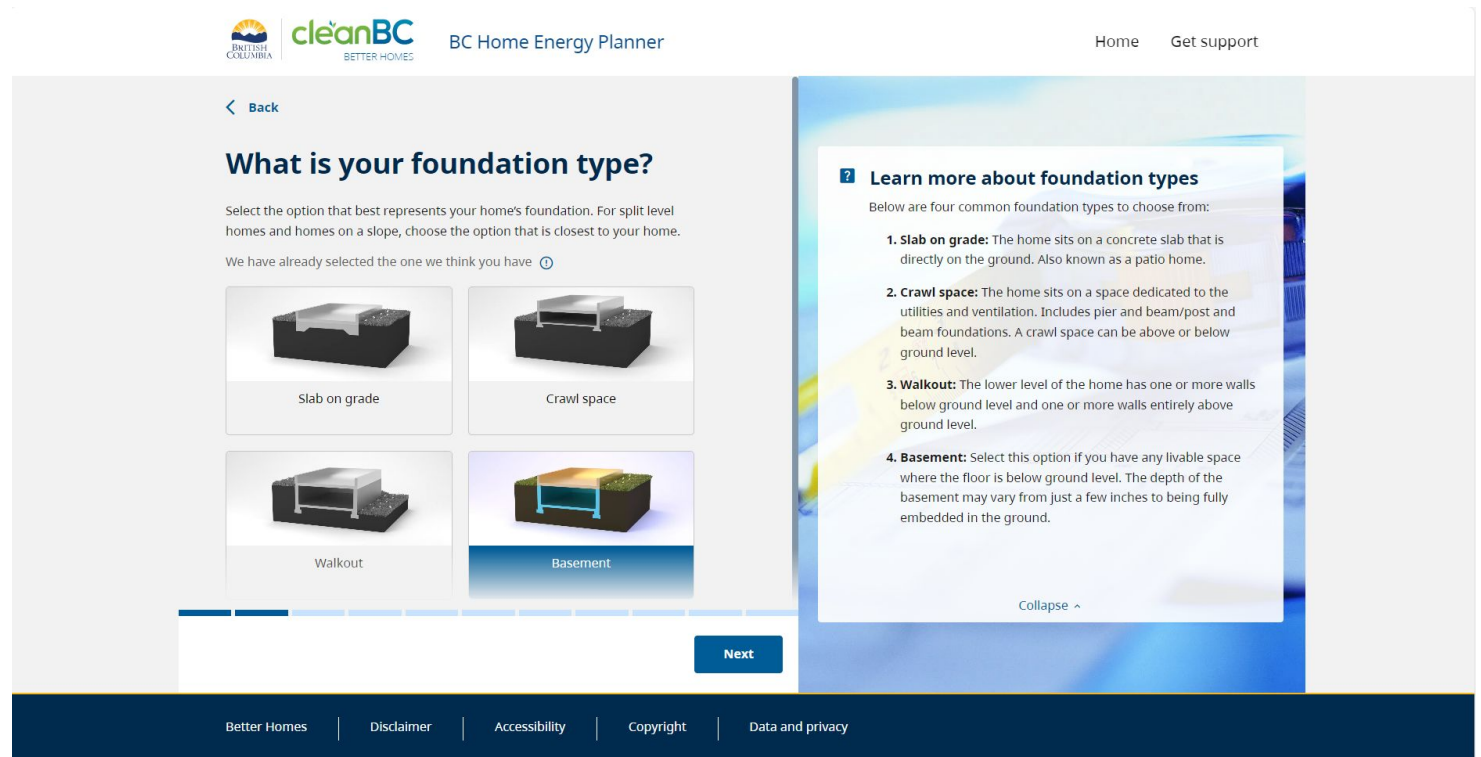
- A virtual labeling tool from the Province
- Powered by Properate virtual and remote assessment technology
- Entering pilot phase May in select communities across BC



The screenshot shows the BC Home Energy Planner website. At the top, a blue banner contains the text: "This is currently a pilot program. Your address will only work if your home is in one of the pilot communities. X". Below this, the header includes the British Columbia and cleanBC logos, the title "BC Home Energy Planner", and links for "Home" and "Get support". The main content area features a large image of a mountain landscape with a lake. Overlaid on this image is the text: "Your home can be comfortable all year!" followed by a paragraph: "Whether there are seven people in your home or just one, it should be comfortable in any weather. The BC Home Energy Planner can help you plan upgrades and enjoy your home year-round." Below this text is a "Get started >" button and navigation arrows. At the bottom, a section titled "It only takes a few minutes" shows a three-step process: "Step 1" with a house icon, "Step 2" with a laptop icon, and "Step 3" with a lightbulb icon.

# BC Home Energy Planner

- Homeowners answer up to 11 questions as part of a remote assessment
- Focused on building details including:
  - Age
  - Square footage
  - Recent upgrades

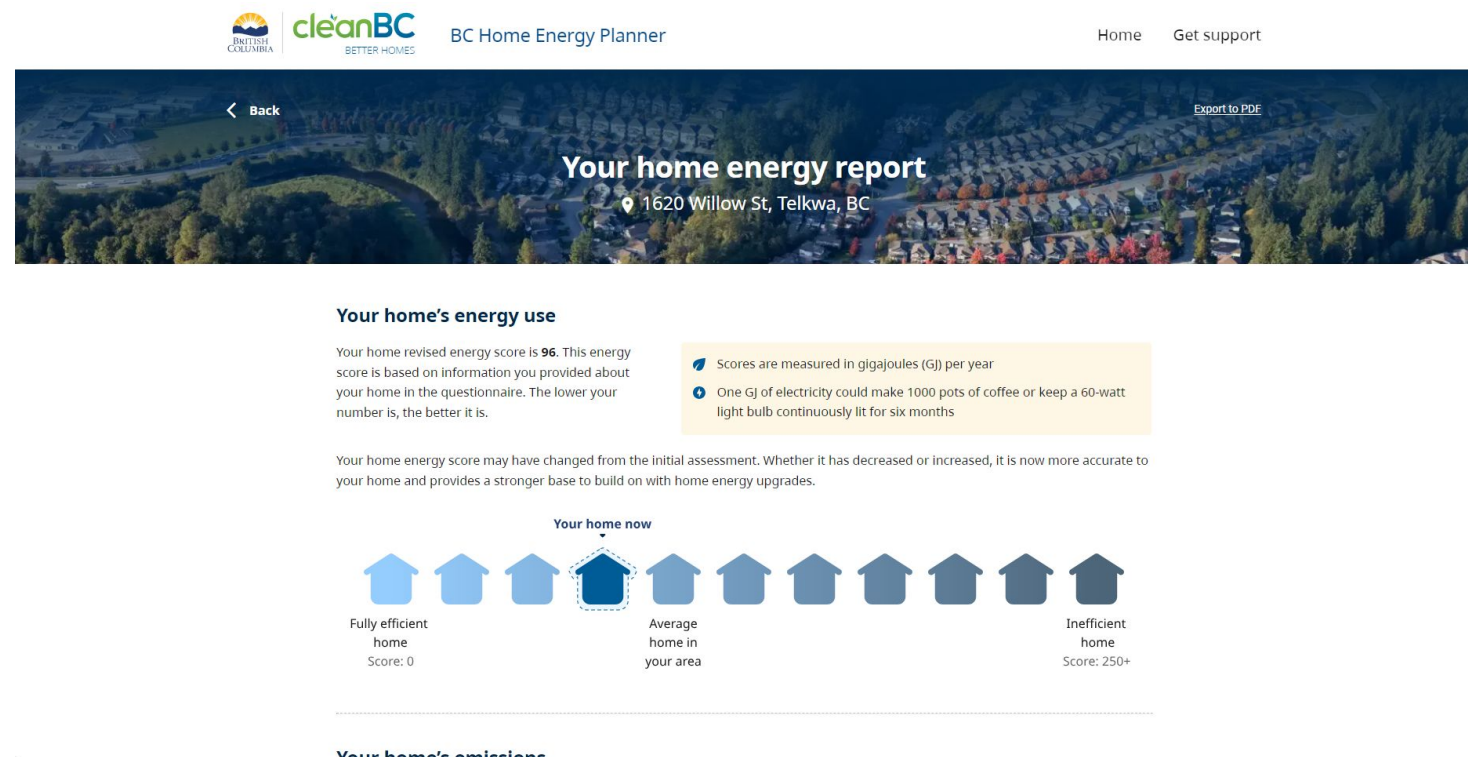


The screenshot displays the 'BC Home Energy Planner' interface. At the top, there are logos for 'BRITISH COLUMBIA' and 'cleanBC BETTER HOMES', along with the title 'BC Home Energy Planner' and navigation links 'Home' and 'Get support'. The main content area is titled 'What is your foundation type?' and includes instructions: 'Select the option that best represents your home's foundation. For split level homes and homes on a slope, choose the option that is closest to your home. We have already selected the one we think you have'. Below this, four foundation types are presented with 3D cutaway diagrams: 'Slab on grade', 'Crawl space', 'Walkout', and 'Basement'. The 'Basement' option is highlighted with a blue border and a blue bar at the bottom. A 'Next' button is located at the bottom right of the selection area. On the right side, a sidebar titled 'Learn more about foundation types' provides detailed descriptions for each option: 1. Slab on grade: The home sits on a concrete slab that is directly on the ground. Also known as a patio home. 2. Crawl space: The home sits on a space dedicated to the utilities and ventilation. Includes pier and beam/post and beam foundations. A crawl space can be above or below ground level. 3. Walkout: The lower level of the home has one or more walls below ground level and one or more walls entirely above ground level. 4. Basement: Select this option if you have any livable space where the floor is below ground level. The depth of the basement may vary from just a few inches to being fully embedded in the ground. A 'Collapse ^' link is at the bottom of the sidebar. The footer contains links for 'Better Homes', 'Disclaimer', 'Accessibility', 'Copyright', and 'Data and privacy'.



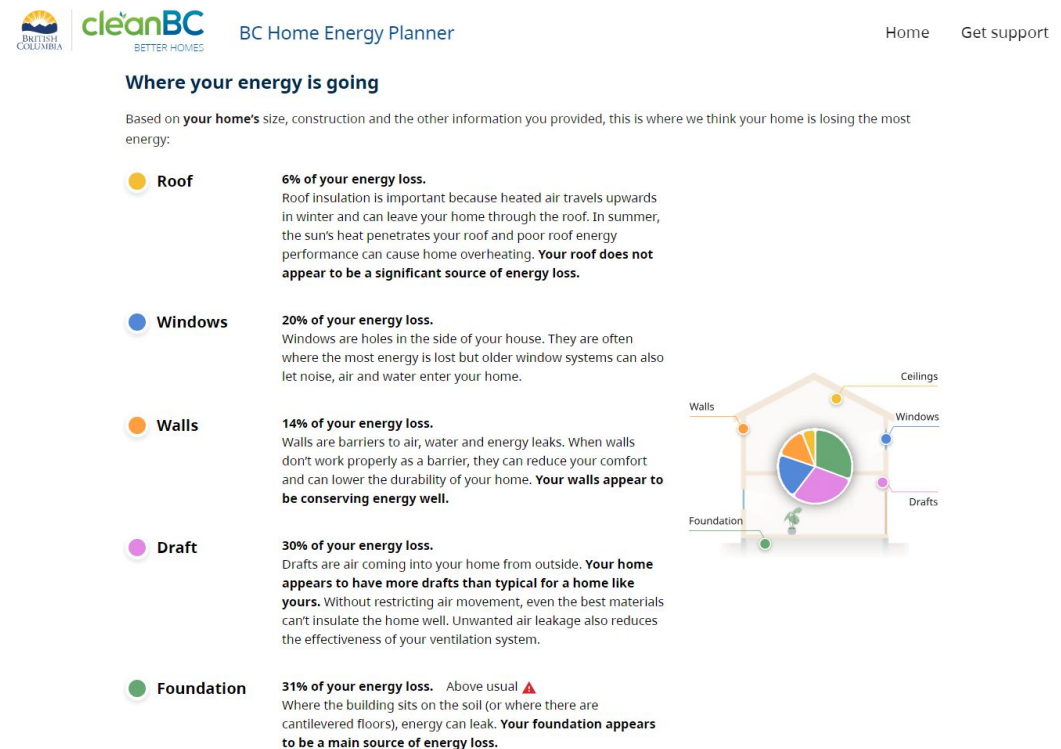
# Home Energy Report

- Focus on energy efficiency and ghg emissions
- Provides insight for the homeowner about their home
- Compared energy score to EnerGuide, GJ per year



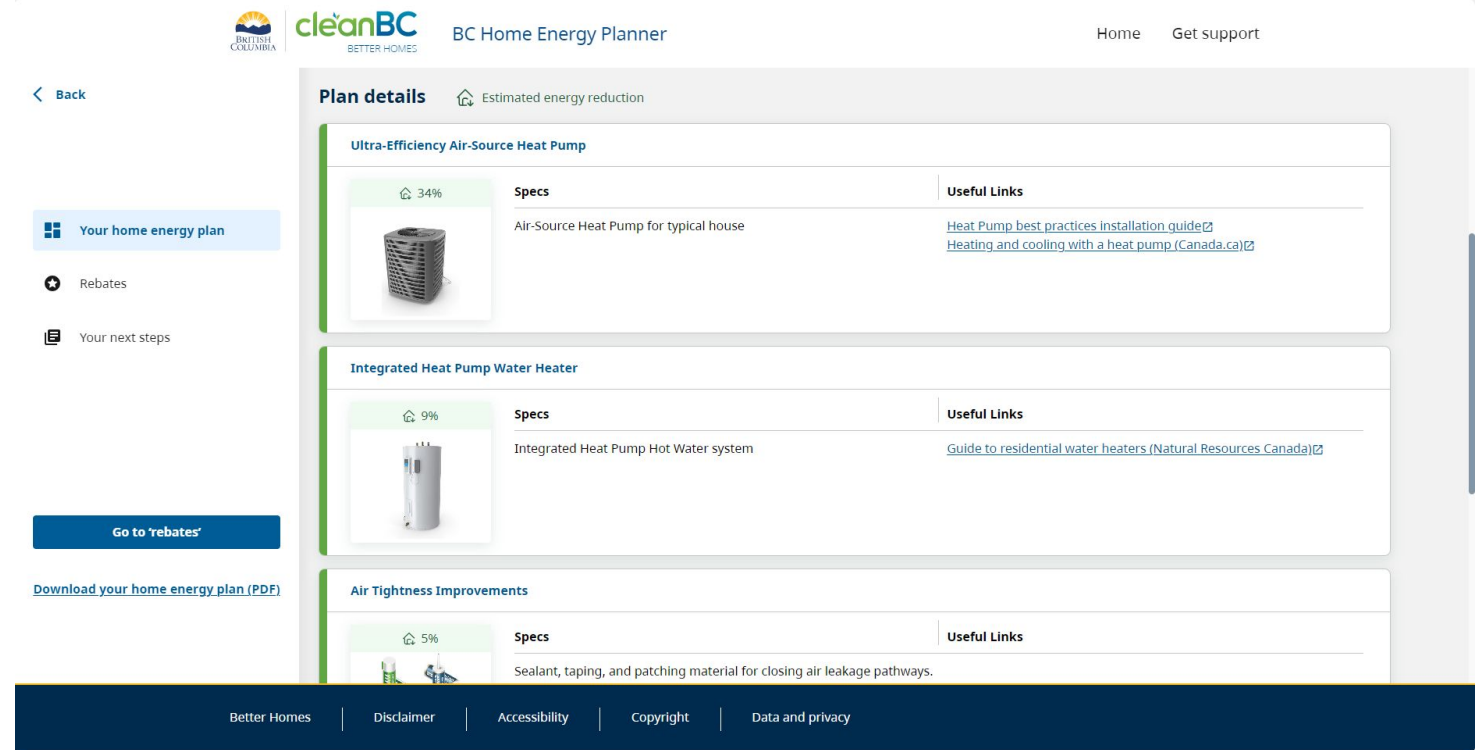
# House as a system

- System estimates where your energy is going
- Helps homeowners understand the components of their home
- Dynamic results based on modelling and question answers



# Home Energy Plan

- Answering 3 additional questions provides the homeowner with a Home Energy Plan
- Focused upgrades based on motivations and greatest need



The screenshot displays the 'BC Home Energy Planner' web application. The header includes the British Columbia and cleanBC logos, the title 'BC Home Energy Planner', and navigation links for 'Home' and 'Get support'. A left sidebar contains a 'Back' link, a 'Your home energy plan' section with icons for 'Rebates' and 'Your next steps', and a 'Go to rebates' button. Below the sidebar is a link to 'Download your home energy plan (PDF)'. The main content area, titled 'Plan details', shows 'Estimated energy reduction' and lists three upgrade categories: 'Ultra-Efficiency Air-Source Heat Pump' (34% reduction), 'Integrated Heat Pump Water Heater' (9% reduction), and 'Air Tightness Improvements' (5% reduction). Each category includes a 'Specs' column with a description and a 'Useful Links' column with relevant guides. The footer contains links for 'Better Homes', 'Disclaimer', 'Accessibility', 'Copyright', and 'Data and privacy'.

cleanBC  
BETTER HOMES

BC Home Energy Planner

Home Get support

< Back

Your home energy plan

Rebates

Your next steps

Go to 'rebates'

Download your home energy plan (PDF)

Plan details Estimated energy reduction

Ultra-Efficiency Air-Source Heat Pump

34%

Specs

Air-Source Heat Pump for typical house

Useful Links

[Heat Pump best practices installation guide](#)

[Heating and cooling with a heat pump \(Canada.ca\)](#)

Integrated Heat Pump Water Heater

9%

Specs

Integrated Heat Pump Hot Water system

Useful Links

[Guide to residential water heaters \(Natural Resources Canada\)](#)

Air Tightness Improvements

5%

Specs

Sealant, taping, and patching material for closing air leakage pathways.

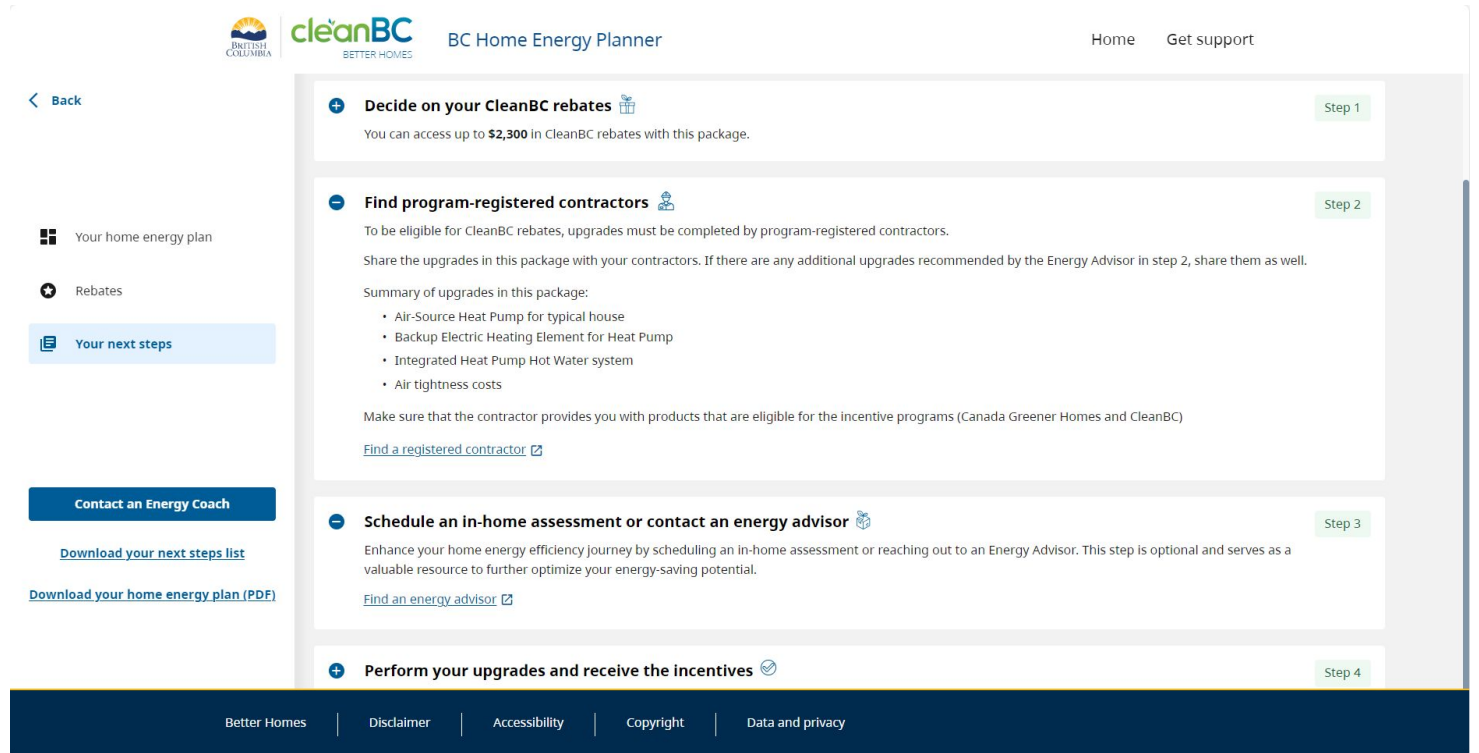
Useful Links

Better Homes | Disclaimer | Accessibility | Copyright | Data and privacy



# Checklist

- Call to action for the homeowner
- Includes specific actions to contact program registered contractors
- Step for homeowners to contact an energy advisor if they would like to continue their efficiency journey



The screenshot shows the 'BC Home Energy Planner' website. The header includes the British Columbia logo, 'cleanBC BETTER HOMES', and the title 'BC Home Energy Planner'. Navigation links for 'Home' and 'Get support' are in the top right. A left sidebar contains a 'Back' link, a menu with 'Your home energy plan', 'Rebates', and 'Your next steps' (highlighted), and buttons for 'Contact an Energy Coach', 'Download your next steps list', and 'Download your home energy plan (PDF)'. The main content area displays a four-step checklist:

- Step 1: Decide on your CleanBC rebates** (with a gift icon). Text: 'You can access up to **\$2,300** in CleanBC rebates with this package.'
- Step 2: Find program-registered contractors** (with a person icon). Text: 'To be eligible for CleanBC rebates, upgrades must be completed by program-registered contractors. Share the upgrades in this package with your contractors. If there are any additional upgrades recommended by the Energy Advisor in step 2, share them as well. Summary of upgrades in this package: Air-Source Heat Pump for typical house, Backup Electric Heating Element for Heat Pump, Integrated Heat Pump Hot Water system, Air tightness costs. Make sure that the contractor provides you with products that are eligible for the incentive programs (Canada Greener Homes and CleanBC). [Find a registered contractor](#)'
- Step 3: Schedule an in-home assessment or contact an energy advisor** (with a person icon). Text: 'Enhance your home energy efficiency journey by scheduling an in-home assessment or reaching out to an Energy Advisor. This step is optional and serves as a valuable resource to further optimize your energy-saving potential. [Find an energy advisor](#)'
- Step 4: Perform your upgrades and receive the incentives** (with a checkmark icon).

The footer contains links for 'Better Homes', 'Disclaimer', 'Accessibility', 'Copyright', and 'Data and privacy'.