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Increasing Transparency on Costs of Lower Carbon Buildings

How cost optimization forms the cornerstone for NRCan's industry engagement

March 11th, 2021

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Local Energy Efficiency Partnerships (LEEP)

Housing Technology Assessment Platform (HTAP)

Cost Benefit Analysis Tool (CBAT)

01 LEEP + HTAP + CBAT

02 Costing + Energy Modeling

03 How is Industry using CBAT

04 CBAT for Renovations + costing study

Drivers, vision and value (why?)

Drivers:

- PCF, 3% EE, NZC 2050
- Affordable new and retrofit housing
- Industry demand for resources

Vision:

- Increasing industry capacity to deliver cost-effective NZER new and retrofit homes

Value:

- Code adoption
- Accelerated market transformation
- Updated costing data



LEEP Accelerates Home Builder Innovation

Builders use LEEP to:

- **reduce their time and risk** in finding and trying innovations that can help them build higher performance homes better, faster and more affordably.
- **use federal research results** to inform their technology decision making.
- **pool their buying power** regionally to make it worthwhile for manufacturers to address the builder group's issues.

Canadian
Home Builders'
Association



"LEEP assists with bringing innovation into the market in a well thought out and responsive way."



CanmetENERGY
LEEP LOCAL ENERGY EFFICIENCY PARTNERSHIPS



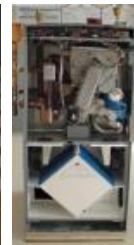
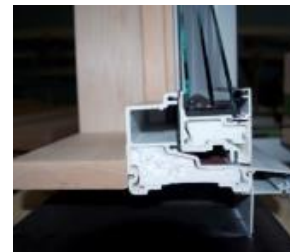
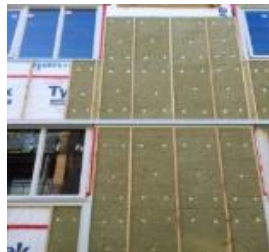
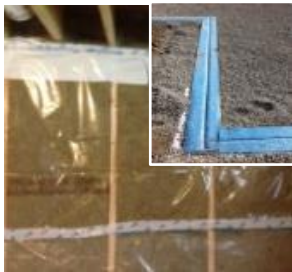
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The builder viewpoint:

Change can lead to cost, schedule and call back problems... There are many options... which to consider & why?



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LEEP Delivery Model

Step 1

Builder Planning Workshop: where technologies are selected



Step 2

LEEP Technology Forums: enabling 'apples to apples' comparison



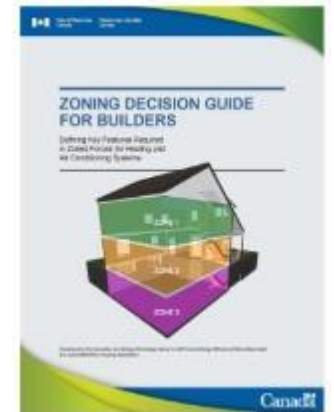
Step 3

Builder Technology Trials: unlocking market change & inform NRCan



Step 4

New LEEP knowledge products: market support tools



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Responsive to regional builder needs

Content and presenters change according to market interest.



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LEEP's Key Drivers

- Market Transformation & Capacity Building
- Supply chain engagement
- Innovation through partnership
- Knowledge transfer & dissemination of R&D from the CanmetENERGY labs and industry partnerships
 - High performance walls, optimization
 - High performance heating systems
- Industry feedback and field trials
 - Costing data collection
 - Industry needs
 - Monitoring and data collection (Mattamy hybrid project, Williams lake recovery centre)
- Industry decision support



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Cost Optimization is a Key Decision Support Resource for LEEP Delivery

- LEEP builders value HTAP's ability to find cost effective solutions; LEEP also provides HTAP researchers with critical feedback on cost data and "buildability".
- Together, LEEP & HTAP teams worked to transfer optimization tools and know-how to home energy consultants.
- Even so, industry's appetite for these insights is growing far faster than capacity to deliver.



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Why HTAP & CBAT housing analytics?

Homeowners and industry need tools to accelerate the transition to a low carbon housing stock

COST & BENEFIT key for decision making

No business case = No Innovation

- Homeowners
- Home builders and renovators
- Energy Advisors
- Municipalities and provincial agencies

NEED analytical tools to cost effectively meet codes and programs.



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02 Combining Costing and Energy Modeling

HOT2000

Supports Energuide, ENERGY STAR & CHBA Net Zero programs

Evaluates upgrade scenarios one-at-a-time

No support for costing or optimization

HTAP

Housing Technology Assessment Platform

Used in research, program & code design

Automates HOT2000 simulations; runs 100,000's of scenarios at once

Includes costing data, Requires additional software for optimization or cost customization

CBAT

Cost Benefit Analysis Tool

Excel tool to help builders find cost-optimal pathways

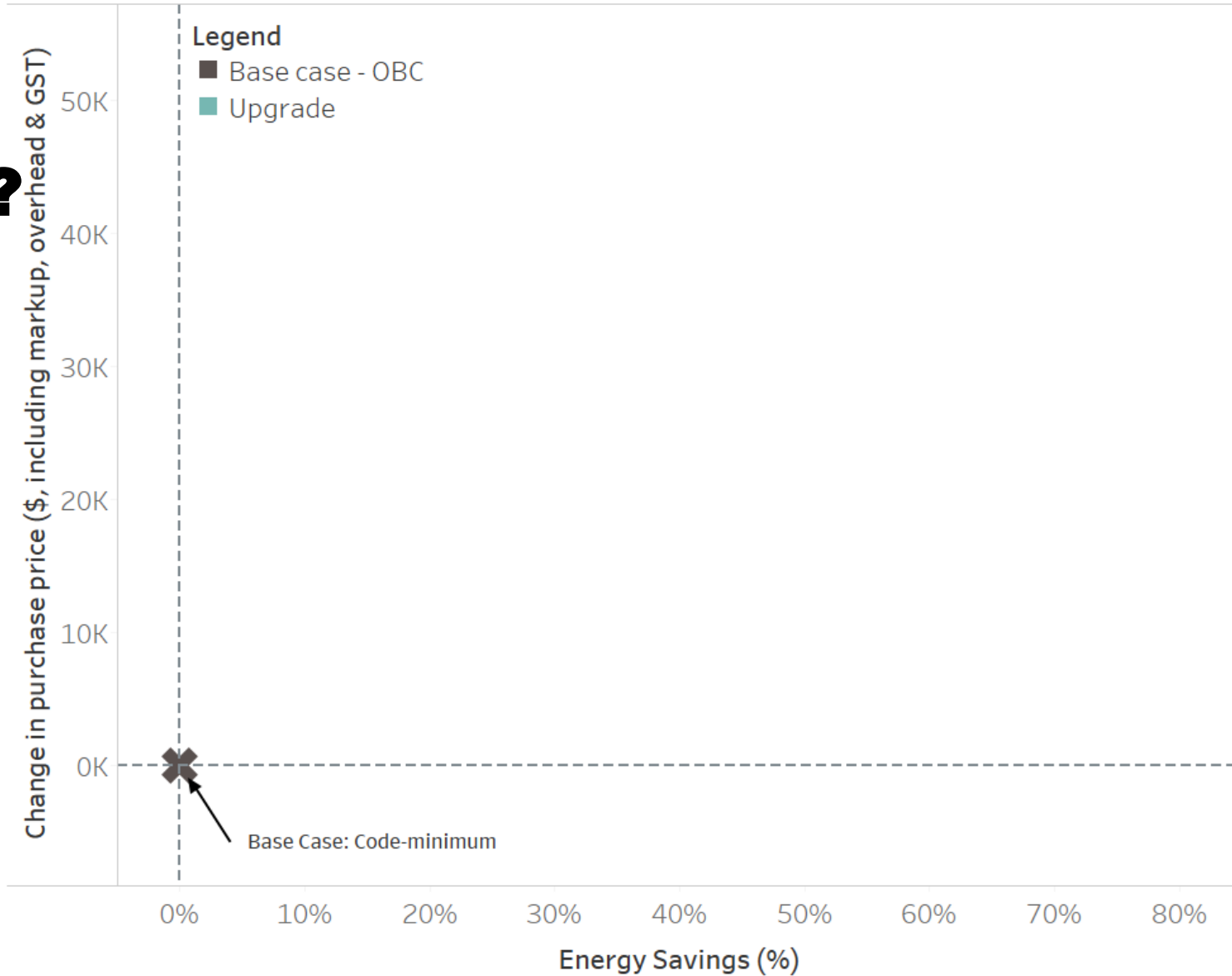
Searches through databases of HTAP results for best pathways

Allows EAs & builders to customize and optimize costs



What Kind of Data Does HTAP Generate?

HTAP allows users to examine how upgrades impact energy use and costs.



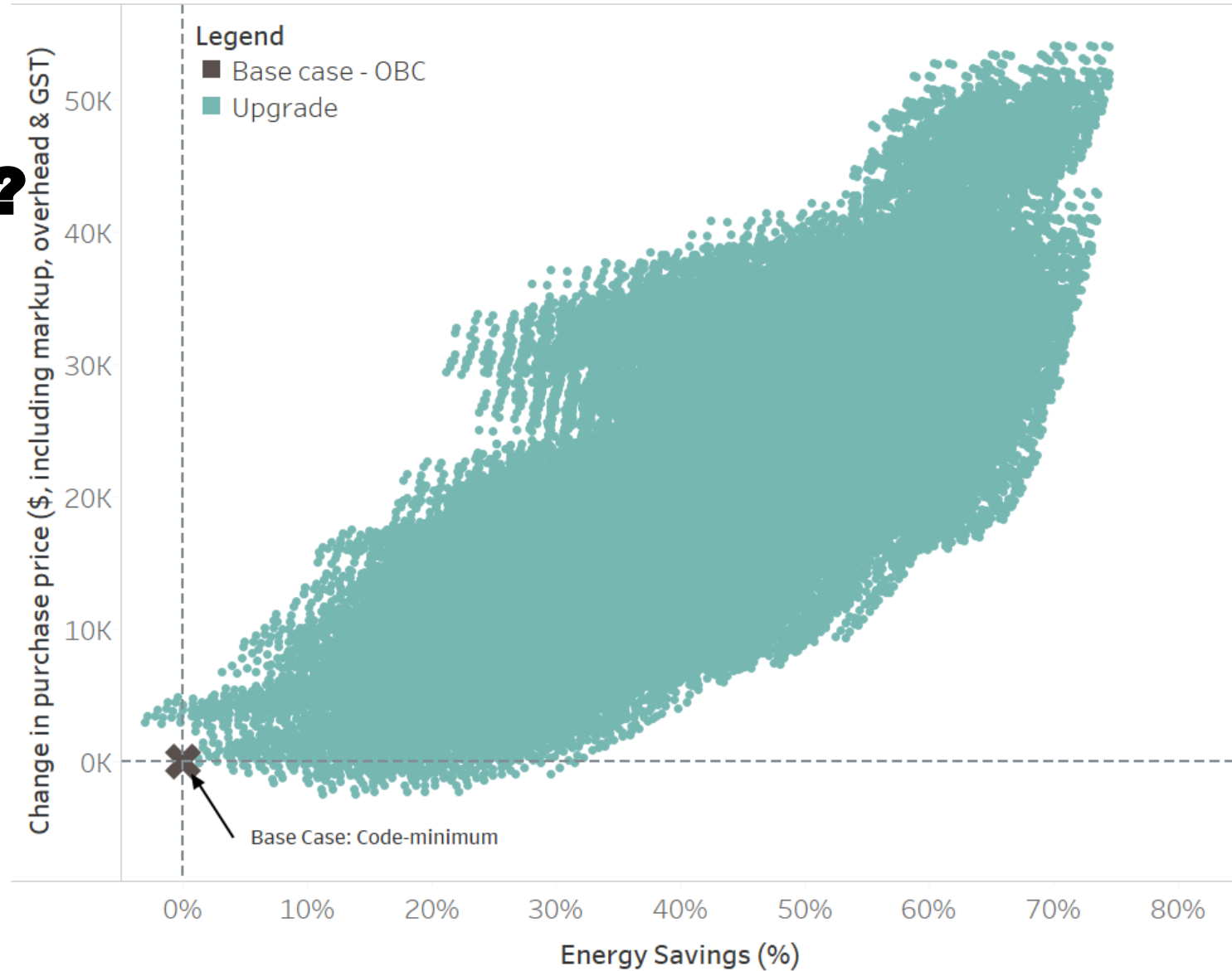
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What Kind of Data Does HTAP Generate?

This plot depicts 80,000 different HOT2000 simulations of an Ottawa-area home.



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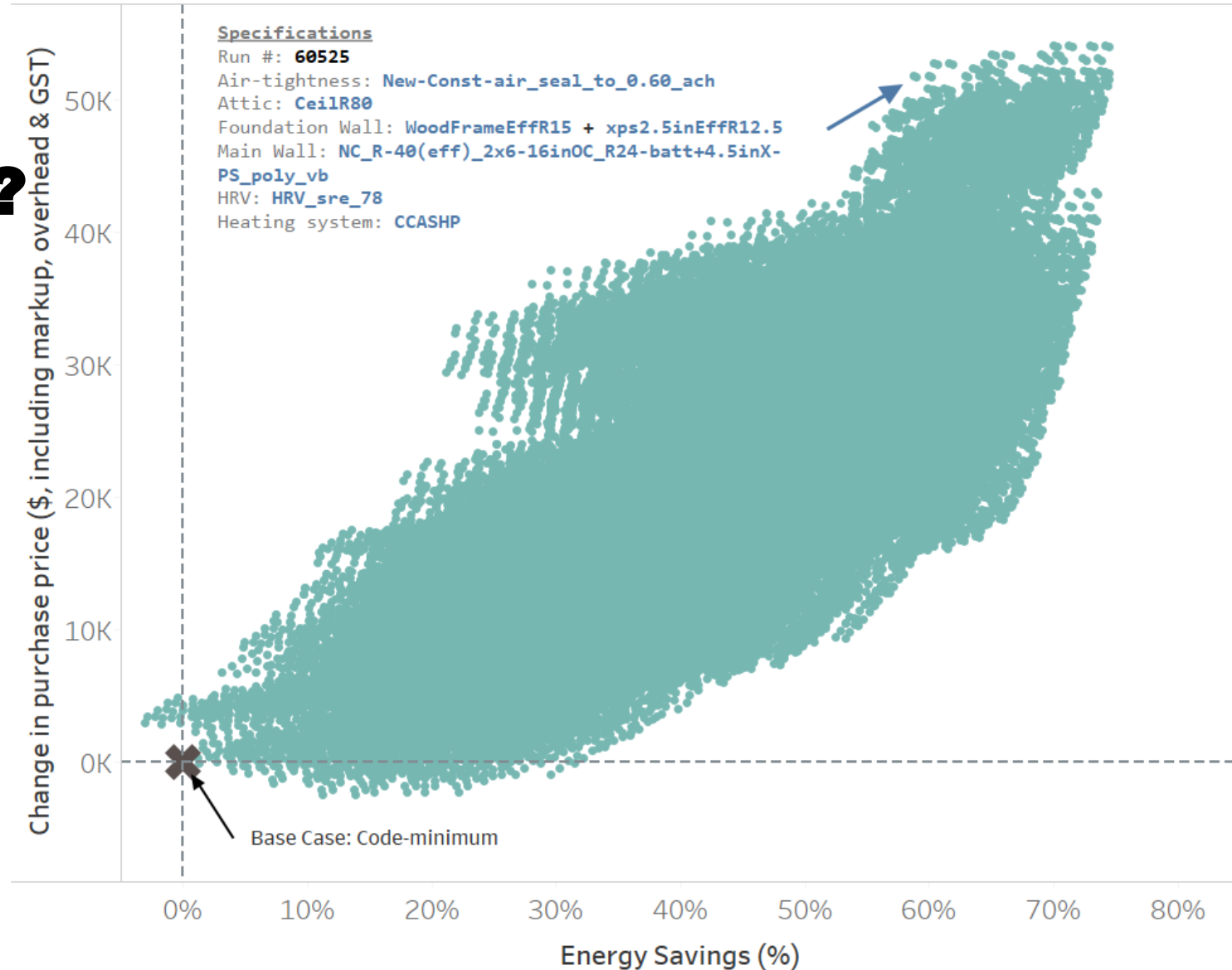
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What Kind of Data Does HTAP Generate?

Each dot depicts a complete home design, with specifications for insulation, air-tightness, heating and how water equipment.



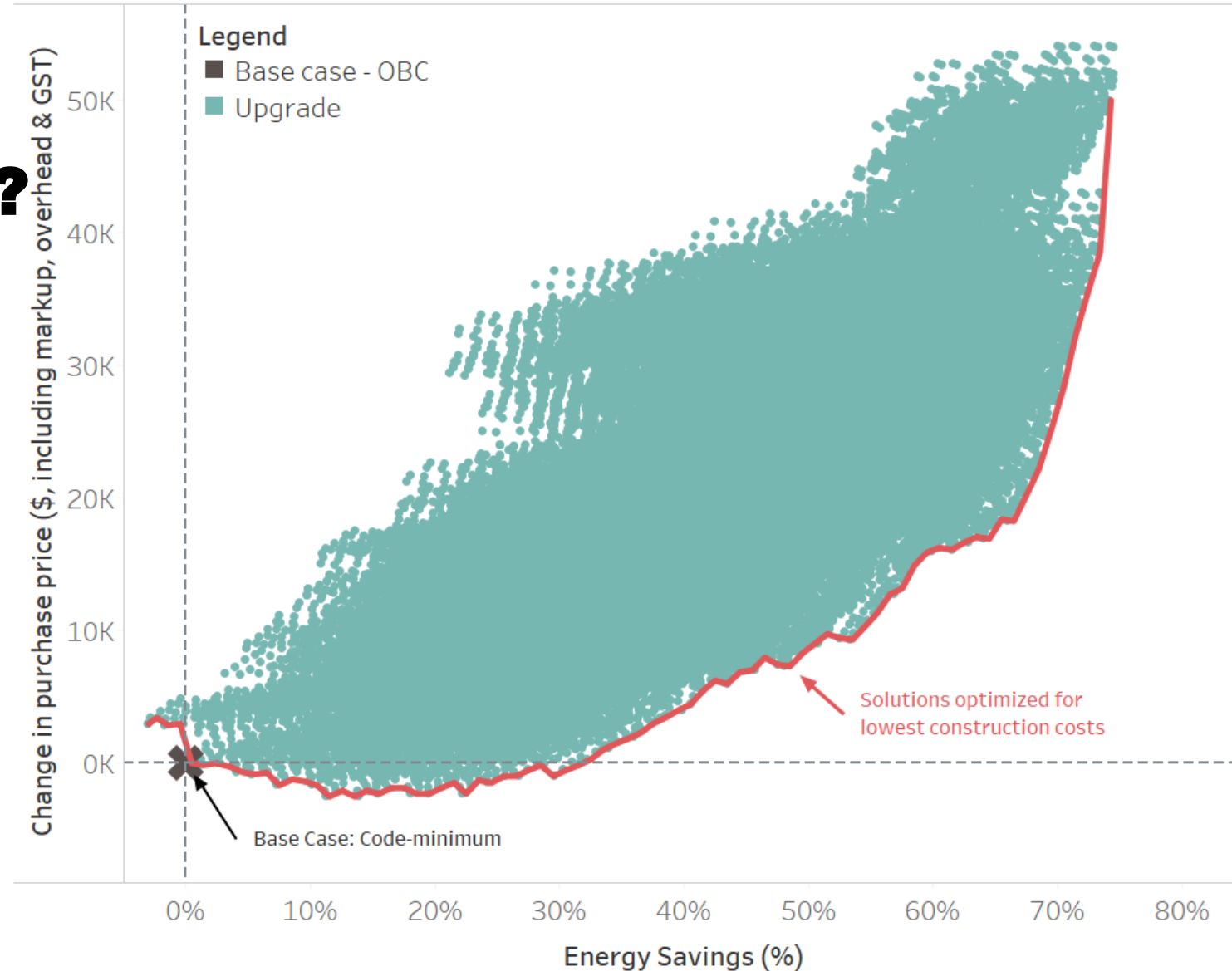
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What Kind of Data Does HTAP Generate?

The bottom fringe of this cloud depicts the optimal pathway from HTAP runs. Each point on the red curve represents the lowest cost solution to achieve a given energy savings.



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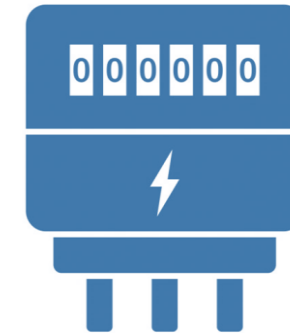


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What questions can CBAT answer?

Builders and Energy Advisors are making energy efficiency more affordable by using CBAT to answer questions such as:

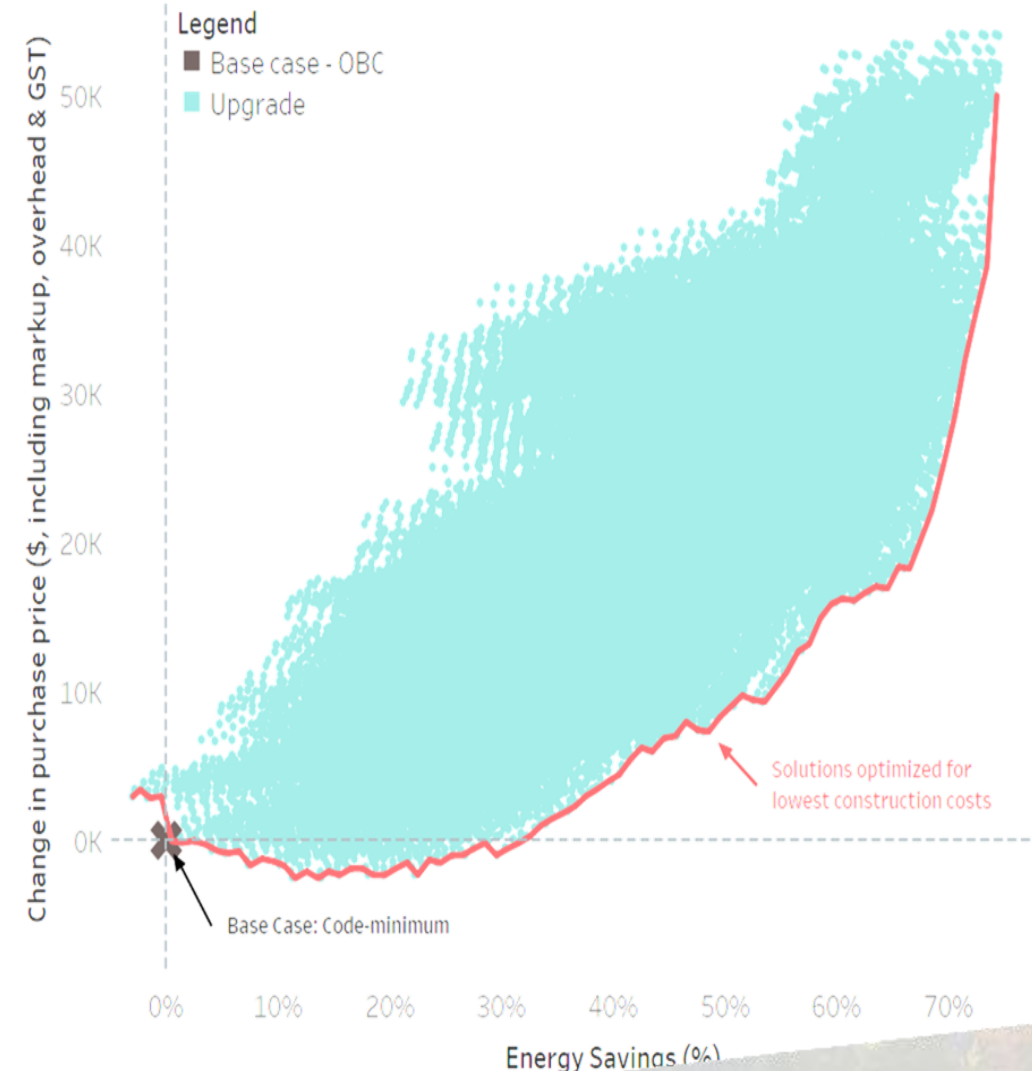
- What technologies can I use to build energy efficient homes?
- What is the cost of energy efficiency, using **my prices**?
- How can I be sure my energy efficient design is cost-effective?
 - For the Builder
 - For the Homeowner
- What is the cost-optimal design to build NZ in my climate?
- What energy efficiency programs can I target with a fixed budget?



Under the hood of CBAT

CBAT supplements the analytical capabilities of HOT2000 by leveraging parametric runs from HTAP, and allowing users to customize costing data.

- 4 archetypes, 16 cities, all climate zones
- 90,000 HOT2000 runs, per archetype, per climate zone
- Preloaded costing database
- Financial calculations and Energy reporting
 - Construction cost
 - Net cost to buyer
 - Net present value
 - Total cost of ownership
 - Lowest annual energy consumption
 - Lowest operating carbon



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03 How is Industry using CBAT?

CBAT is enabling Industry to better understand the requirements for targeting high-performance and energy efficient home designs.

CBAT is being used by:

- **Builders** – Reducing the cost of energy efficient homes
- **Municipalities** – Program design and roll-out
- **Utilities** – Savings by design charrettes
- **CACEA** – Training for members

CBAT Upcoming:

- **Colleges** – 4 colleges to integrate 3-hour lecture on CBAT
- **Renovators** – CBAT for renovations under development

Optimal Solution - 40% Savings above NBC	
1.0 ACH	
R-50 Fiberglass Blow-in	
R-22 Effective, Fiberglass Batt, Exterior Insulation, XPS	
Mid Gain, U=1.08	
R-22 Effective, Fiberglass Batt, Exterior Insulation, XPS	
Uninsulated Slab	
60% Efficiency HRV	
Electric Tank	
None	
96% Natural Gas Furnace, ECM Motor + AC	
Total Cost of (\$)	\$70,461
Incremental Cost (\$)	\$12,778
Electricity Cost Savings (\$/year)	-\$611
Natural Gas Cost Savings (\$/year)	\$703
Incremental Mortgage (\$/year)	\$947
Incremental Net Cost (\$/year)	\$855
Net Present Value (\$)	-\$7,297



CBAT and Industry



**CBAT Workshops delivered
in markets across Canada**

CBAT is seeing considerable uptake in industry:

- 80 BC trainers to deliver CBAT workshops in their communities
- Analysis for large developments of 500 to 12,000 homes
- Colleges integrating into curriculum
- High demand for CBAT/HTAP from Municipalities, Provinces, and Industry
- CHBA is integrating into NZE Labelling Program
- CACEA member training
- CBAT for Retrofit development underway (Spring release)

Durham Region CBAT Pilot

Objectives

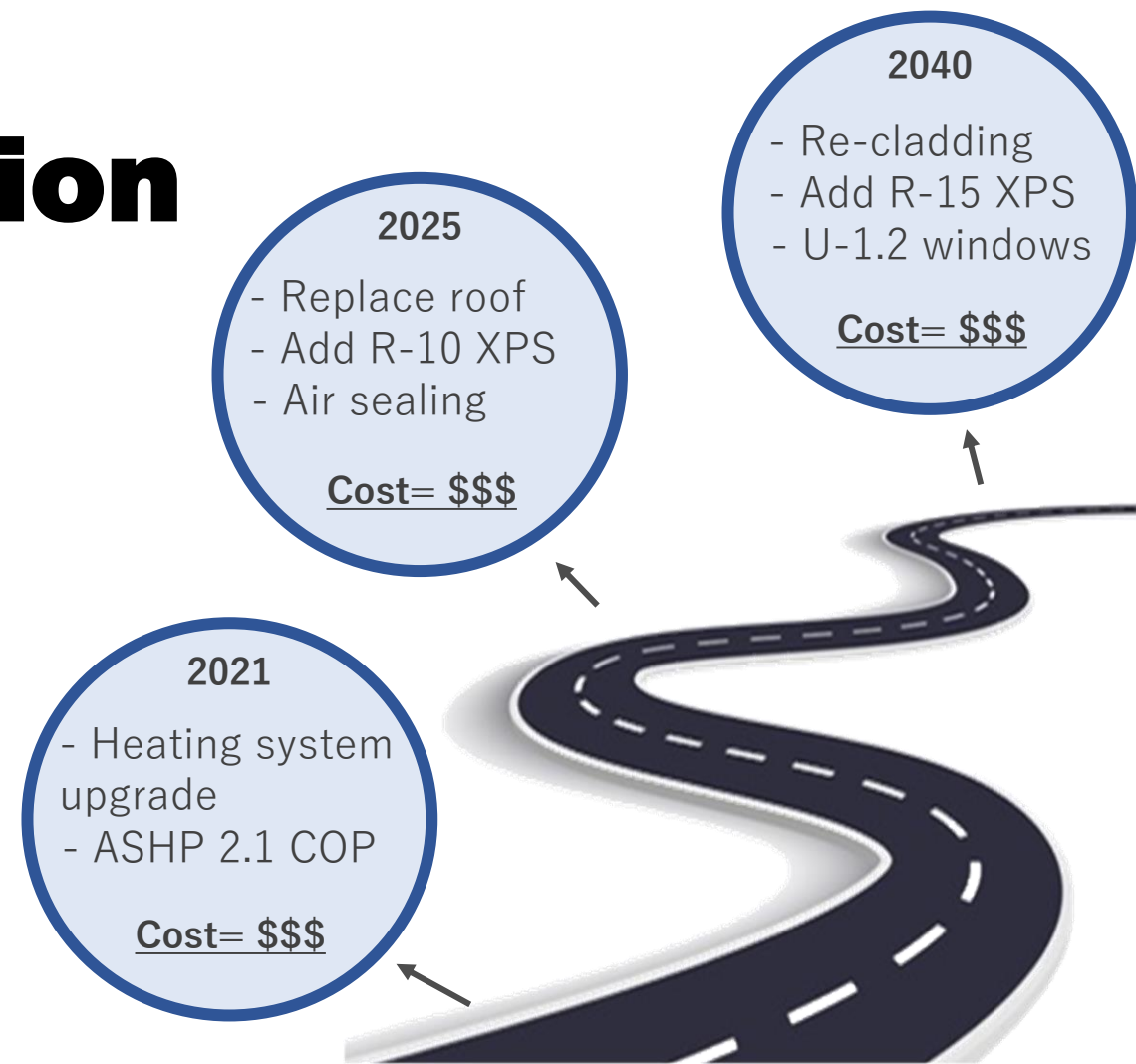
1. Collect new housing costing data for Southwestern Ontario, in partnership with Durham Region Home Builder's Association (DRHBA) and Regional Municipalities.
2. Pilot collaborative engagement strategy with DRHBA and Regional Municipalities (Whitby, Pickering, Durham).
3. Collaboratively explore barriers, gaps, and opportunities to high performance homes in the region.
4. Refine engagement strategy and consider next steps.



04 CBAT for Renovation

CBAT for Renovation will allow renovators and home-owners to identify cost-effective roadmaps for energy-efficiency.

1. Select your archetype
2. Confirm your starting point and your objective
3. Answer questions about your renovation
 - What is your budget?
 - What is your efficiency target? Carbon vs Energy
 - What is the age of component X?
4. Customize costing data or use defaults
5. View cost-optimal energy-efficiency roadmaps for your renovation project

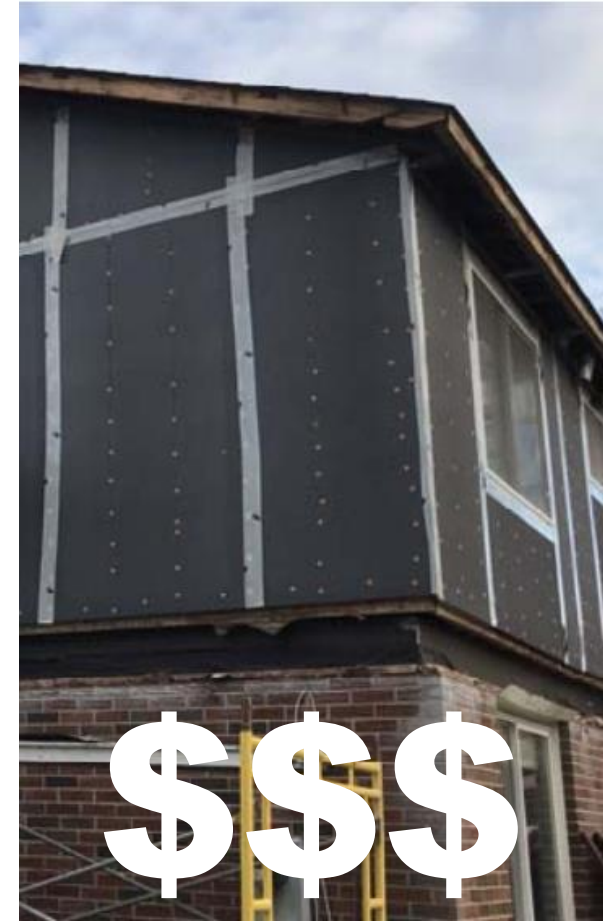


NRCan + CACEA: Pan-Canadian Retrofit Study

The Need:

Under PCF & NZC²⁰⁵⁰ objectives retrofit housing will be of prime importance

- 14M+ homes on the ground today, account for 12% of Canada's GHGs
- Canadians (industry and homeowners) need a starting point from which to make decisions
- Collecting renovation costing data helps to determine cost-effective pathways for Canadians
- CACEA is coordinating collection of data through the EA and Renovator network



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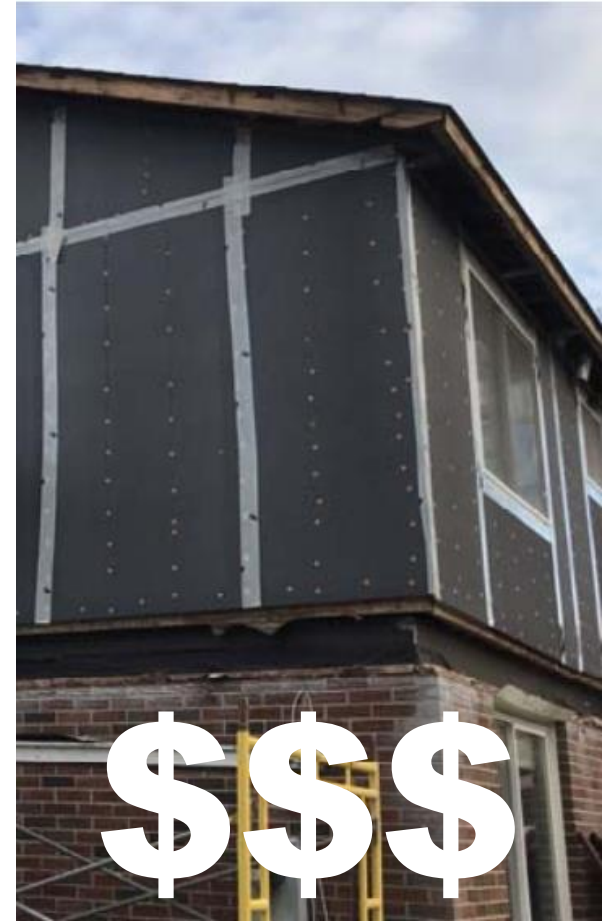
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NRCan + CACEA: Pan-Canadian Retrofit Study

- CanmetENERGY coordinated study
- Data collection for multiple regions
- Multi-stakeholder participation would be ideal

We are looking for partners!

Working out how to share genericized data and how to add value for participating municipalities.



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