

Affordable, Replicable and Marketable Net Zero Ready Multi-Unit Residential Buildings

Marie Hanchet



Existing CHBA Net Zero program



400+

**NET
ZERO**
LABELLED HOMES

AS OF **SEPTEMBER 2020**



NETZEROHOME.COM

Photo: Heirloom Shores, Net Zero home by Bercum Builders Inc., Kelowna, BC.

Coming Soon –
customized Net
Zero labelling
for MURBs!





NZ MURB Team

5 Project Consultants
6 Builders
5 Energy Advisors
13 Product Solution Providers
4 Funding Partners

Photo: Sept 2019 Kick-off





List of Net Zero MURB Project Stakeholders

Builders:

Zirnhelt Timber Frames
Avalon MasterBuilder
Landmark
Big Block Construction on behalf of Innovative Residential
Doug Tarry Homes
Sean.ca

Consultants:

Building Knowledge Canada – Facilitation, Lead Consultant
Bluewater Energy – Renewables
S2e Technologies – Performance monitoring
Efficiency One Services – Incentive program design
Priority One Solutions – Net & Sub Metering analysis

Partners:

Natural Resources Canada
BC Housing
BC Hydro
Enbridge/Union Gas

Product Solution Providers:

Aerobarrier
AirMax Technologies
All Weather Windows
BASF
Dettson
Eco Vision Sales
IBC Technologies
iFLOW
Jeld-Wen
Minotair
Mitsubishi
NTI Boilers
Owens Corning
Venmar



Project Objective

To **validate the use of panelized/modular construction** and **integrated mechanical system** technologies, design and construction practices on **Net Zero or Net Zero Ready MURBs** to optimize energy efficient performance, reduce costs, increase construction productivity and reduce construction schedules.

Build Team Goals:

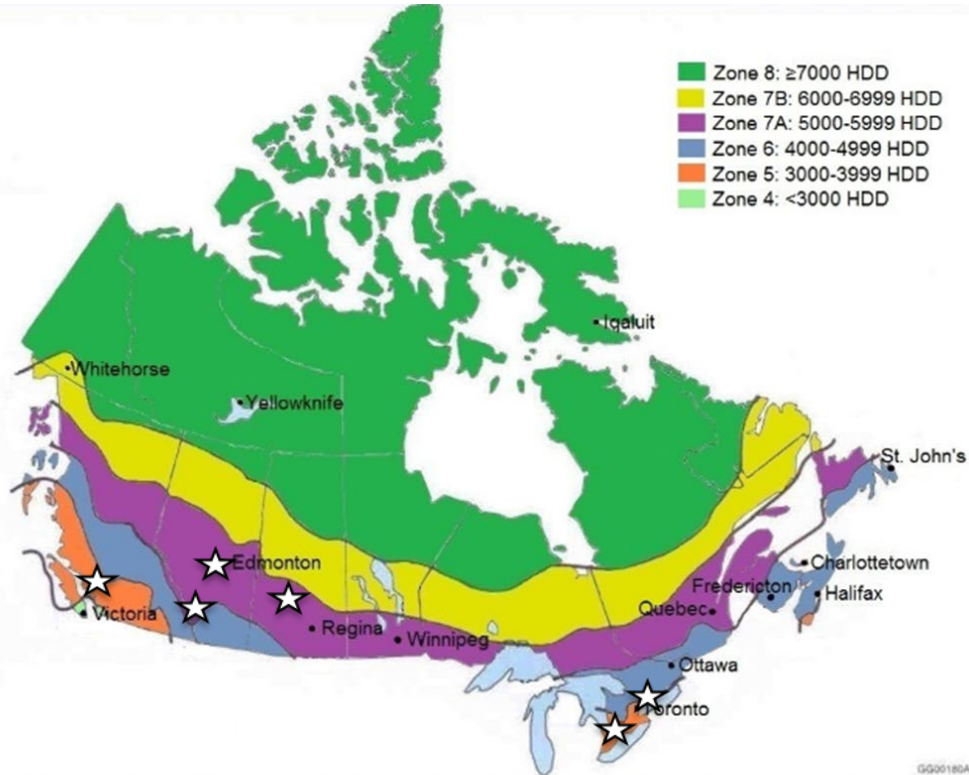
1. More prefabrication (all the way to modular)
2. Higher performance - Net Zero / Net Zero Ready
3. Multi-Unit Residential Buildings
**while keeping homes beautiful, affordable and systems simple*

Industry add-on:

Occupant use vs
building use.

...Data!

NZ MURB Build Projects

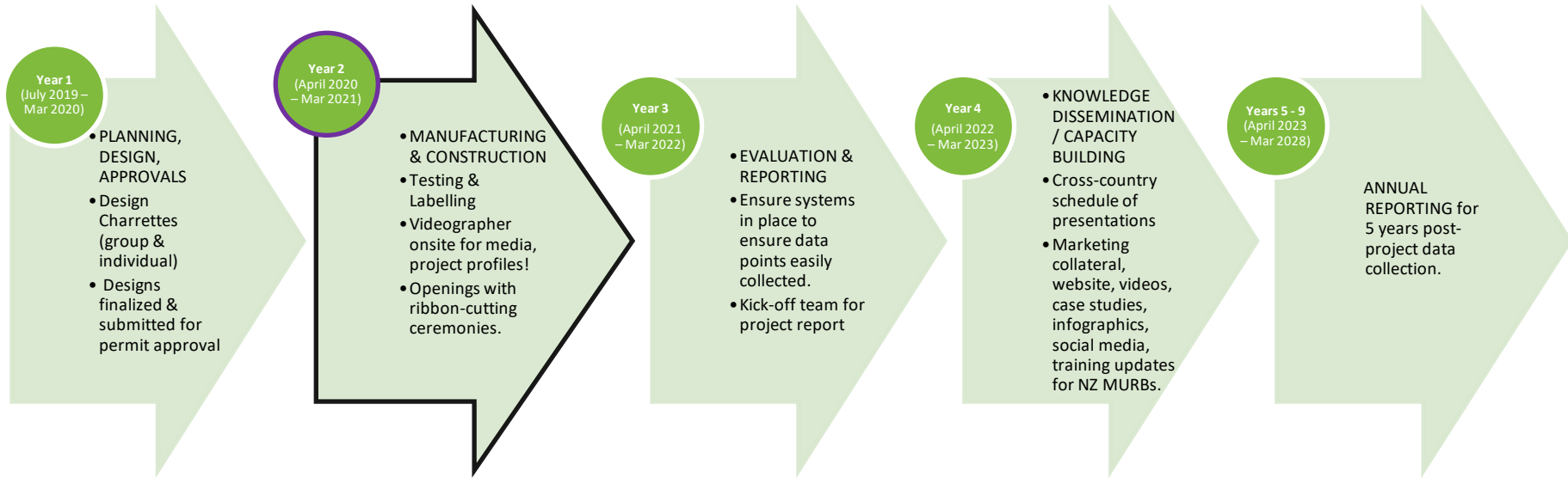


Builder	Province	Build Location	Climate Zone	Residential Units	Rent / Own
Zirnhelt Timber Frames	BC	Kamloops	5	7	Rent
Landmark	AB	Edmonton	7A	9	Both
Avalon MasterBuilder	AB	Calgary	7A	16	Own
Innovative Residential	SK	Saskatoon	7A	12	Rent
Doug Tarry Homes	ON	St Thomas	5	15	Rent
Sean.ca	ON	Barrie	6	12	Own

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Project Timeline – 5 – 9 years!





What we've done

- **NZ/NZr designs** for build projects
- **NZ MURB Label** for these builders with **Air tightness testing protocols**, recognizing attached units air leakage concerns
- **Monitoring equipment & plan**– will have data for 6 NZ MURBs & sister buildings by piece of equipment! 100 residential units of NZ & code-built
- **Net-Metering & Sub-metering** policy & cost analysis review
- NZ Marketing MURBs – is it the same? **\$13/month more for NZ MURB unit**
- Cost & time benefits of modular/pre-fab templates... including PV installation
- 5/6 builders have designs & permits. 1 has tenants moving in in a month!



Thank you

More information being shared regularly:

- [Net Zero MURB public webpage](#)
- CHBA National & Net Zero Social media
- CHBA Net Zero News

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Canadian Home Builders' Association

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Net Zero Modular: Single Family Home CONSTRUCTION TOUR & PROJECT HIGHLIGHTS

‘Net Zero Modular: Case Study Project’
Re-cap & Links to CanmetENERGY Ottawa Research

Presenters:

Cory Warms of Grandeur Homes

Clarice Kramer, Jeremie Leger & Lucas Coletta: from the NRCan LEEP Team



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Project Re-Cap

Net Zero Modular: Case Study Project

- ‘NZ Modular: Case Study Project’ was launched last year at the 2019 CHBA Fall Meetings: Modular Construction Council
- 4 modular builders offered to participate from 4 regions across Canada; West Coast/ Prairies/ Eastern/ Maritimes
- 10 Case Studies were defined -all Single Family Modular Homes
- Study included every Canadian Climate Zone: zone 4 to zone 8
- Analyzed energy performance of a current model home
-  Identify best options to make it Net Zero

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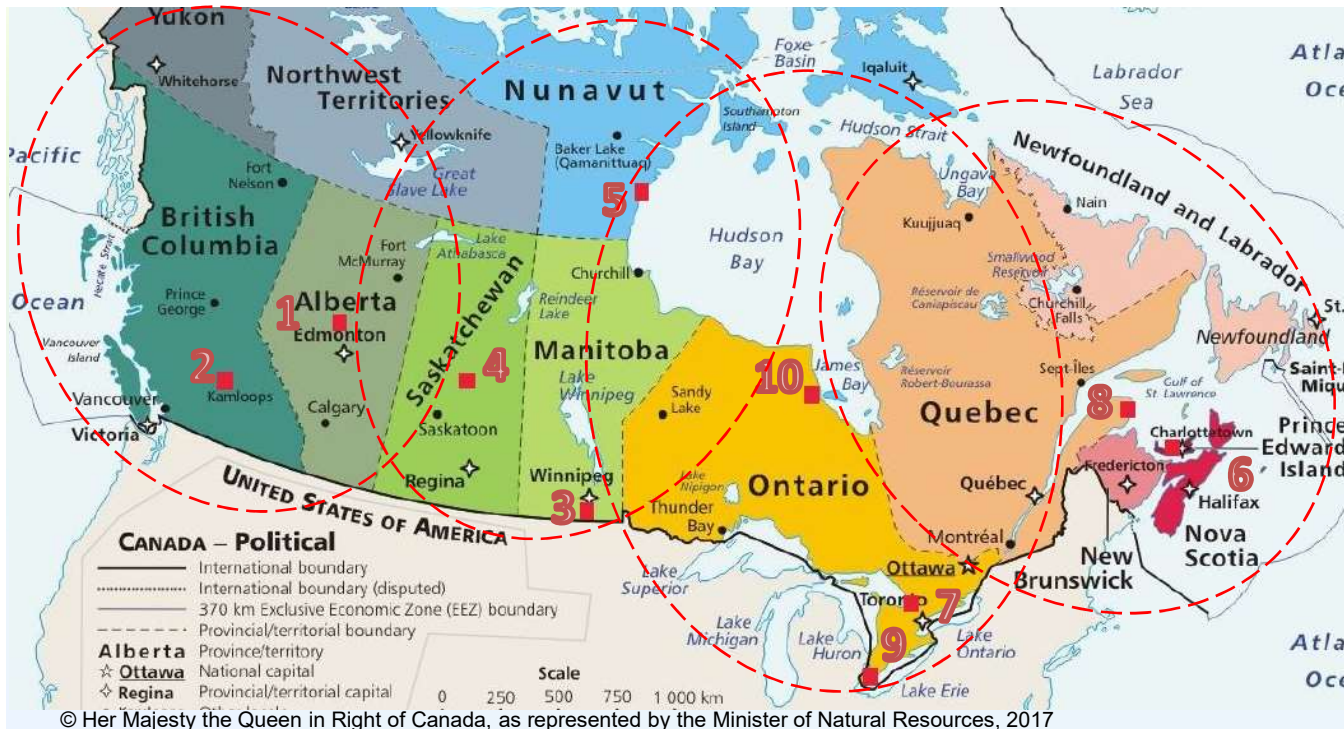
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NZ Modular: Case Study Project

4 Participating Builders

10 Case Study Locations

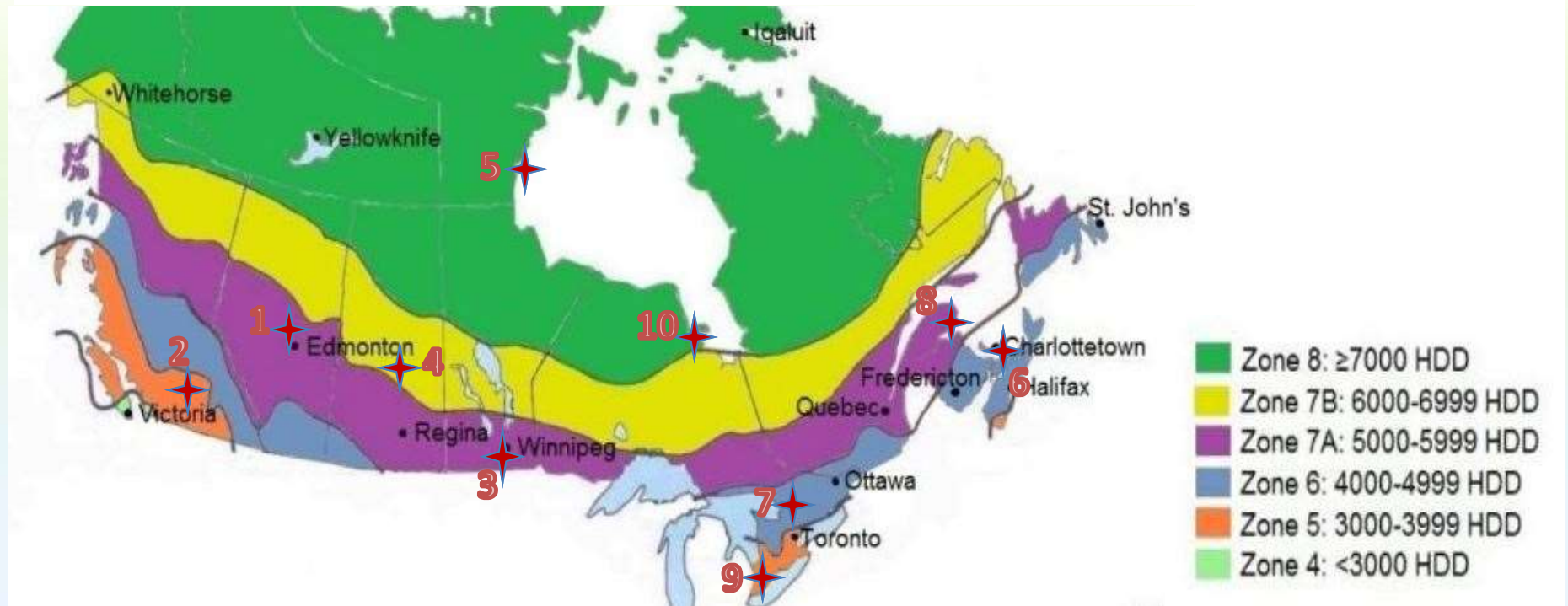


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Canadian Climate Zones & 10 Net Zero Case Study Locations



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Net Zero Modular: Case Study HOMES



**10 Single Detached
Modular Homes**
1085 SF - 1693 SF
above grade finished area



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Net Zero Modular: Case Study Focus Story

#3

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Builder: Grandeur Homes

Location: Winkler, MB

Climate Zone: 7A

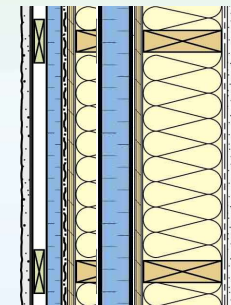
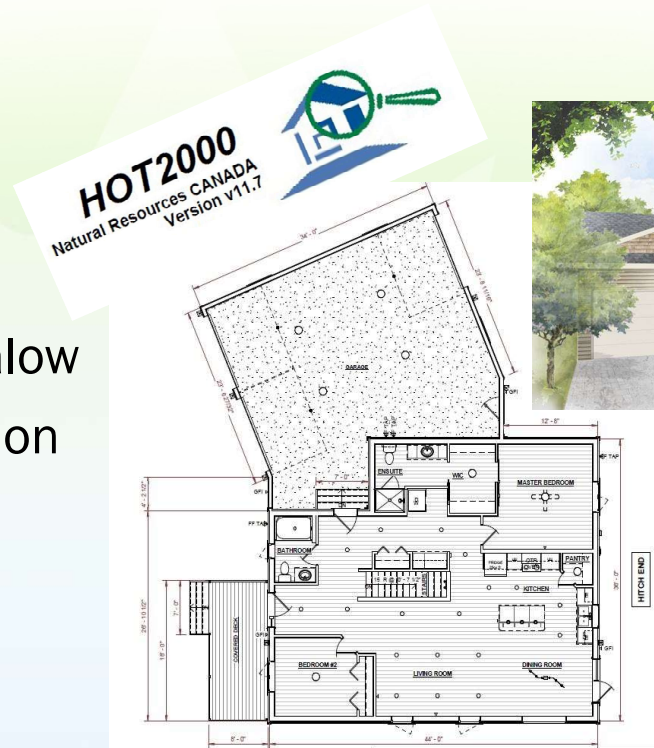
2 Bed/2 Bath 1475 SF Bungalow

One-Piece Modular Construction

Site-Built Entry Porch &

Attached Double Garage

Insulated 8 Ft Basement



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Summary of Energy Performance Analysis

Case Study #3	Grandeur Standard build	NetZero Standards
Airtightness ACH@50Pa	2.5	0.6
Wall R-Value	35.8	35.8
Foundation Wall R-Value	27	27
Underslab R-Value	0	5
Ceiling / Roof R-Value	61.6	61.6
Window SHGC	0.4	0.4
Window U-Value	1.6	1.36
DHW System	Induced Draft	Heat pump COP 2.3
Drainwater Heat Recovery	Not installed	Optional
Space Heating	95% AFUE	Cold climate heat pump COP 3
Heat Recovery Ventilator %	75%/65%	75%/65
Heat system cost	\$4,100	\$14,000
AC cost	\$2,600	Included in heat pump
Hot water tank cost	\$1,300	\$2,700
Panel Cost	\$48,800	\$25,900

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Case Study #3 Summary Results

#3

1. Envelope energy performance was excellent, no change needed. Discussed air-vapour barriers and insulation strategies. Shared *LEEP Wall Systems Packages*.
2. Upgraded Mechanicals to significantly reduce loads (typical 80,000 Btu furnace was oversized)
3. Energy Star appliances will reduce electrical and hot water energy loads
4. Solar PV will meet annual load requirements using only half the available roof area. PV integration could be considered during factory construction

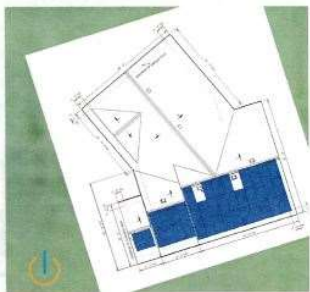
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Case Study #3

Winkler, MB

Solar PV Assessment

Monthly Utility Bills, Post-Solar



Month	Monthly Consumption	Production	Net Credits
April	903 kWh	1369 kWh	742 kWh
May	1023 kWh	1549 kWh	1268 kWh
June	1204 kWh	1550 kWh	1613 kWh
July	1204 kWh	1617 kWh	2026 kWh
August	1023 kWh	1387 kWh	2390 kWh
September	903 kWh	1071 kWh	2559 kWh
October	843 kWh	680 kWh	2396 kWh
November	963 kWh	434 kWh	1867 kWh
December	1083 kWh	325 kWh	1109 kWh
January	1083 kWh	432 kWh	458 kWh
February	963 kWh	648 kWh	143 kWh
March	843 kWh	1119 kWh	419 kWh
Totals	12038 kWh	12181 kWh	

Solar Power System Cost	\$23,555.47
Estimated LDC connection fee *	TBD
Total Cost**:	\$23,555.47
HST (13%)	\$3,062.21
Grand Total To Make The Switch:	\$26,617.68

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Builder Requirements

1. CHBA Membership – through your local HBA
2. Complete Net Zero Building Science Training
3. Become Licensed as an EnerGuide (NRCan) Registered Builder (through a qualified NZ Service Organization)
4. Work with Energy Advisor and NZ Service Organization to complete NZ Home Labeling Requirements
5. Register with CHBA as “Net Zero Qualified Builder/Renovator” to receive marketing materials and be added to online lists.

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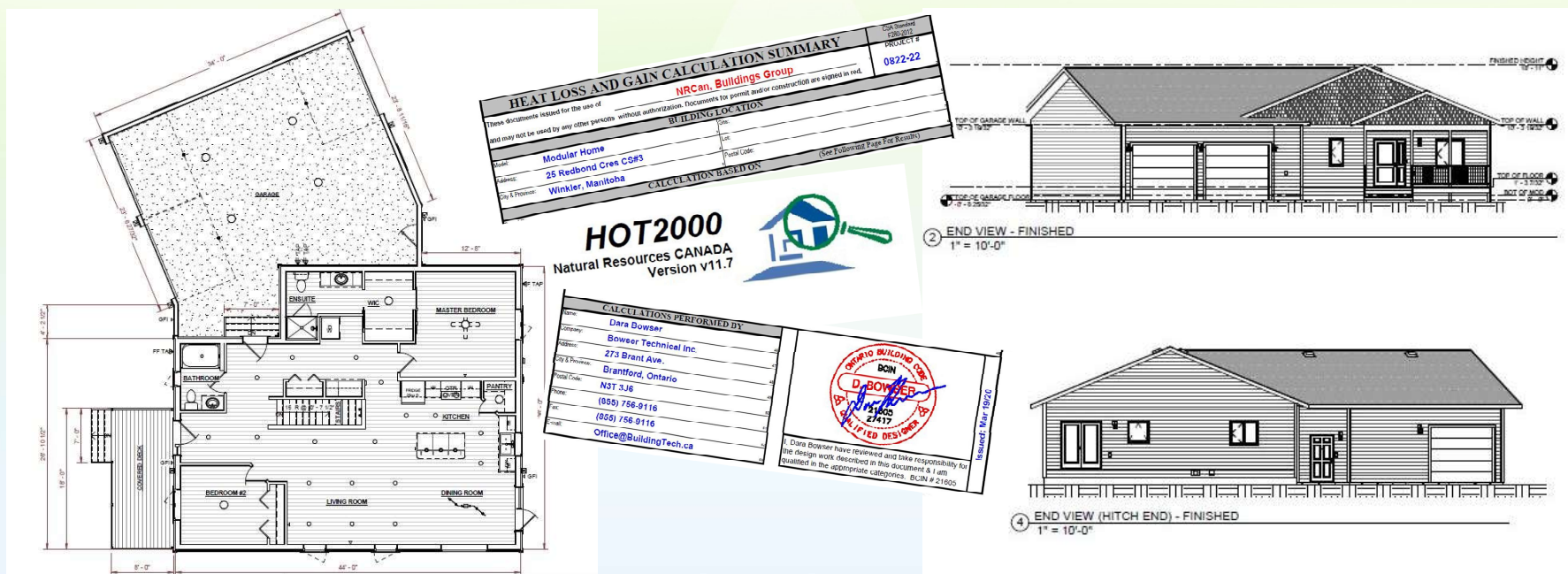
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GRANDEUR HOMES

Net Zero Home – Construction Tour



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Floor Plate Framing



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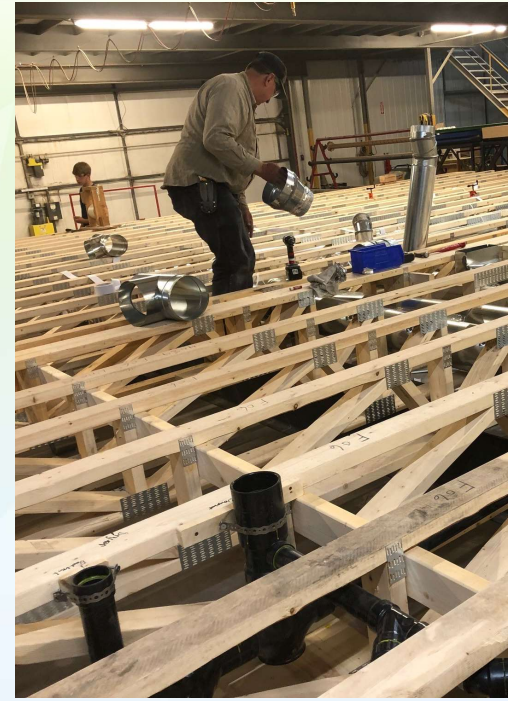


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Plumbing & Floor Ducts



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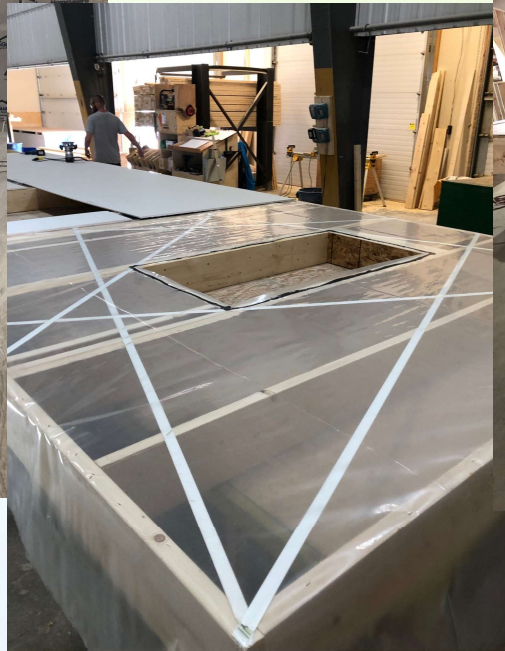


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Flooring & Wall Fabrication



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Wall Framing



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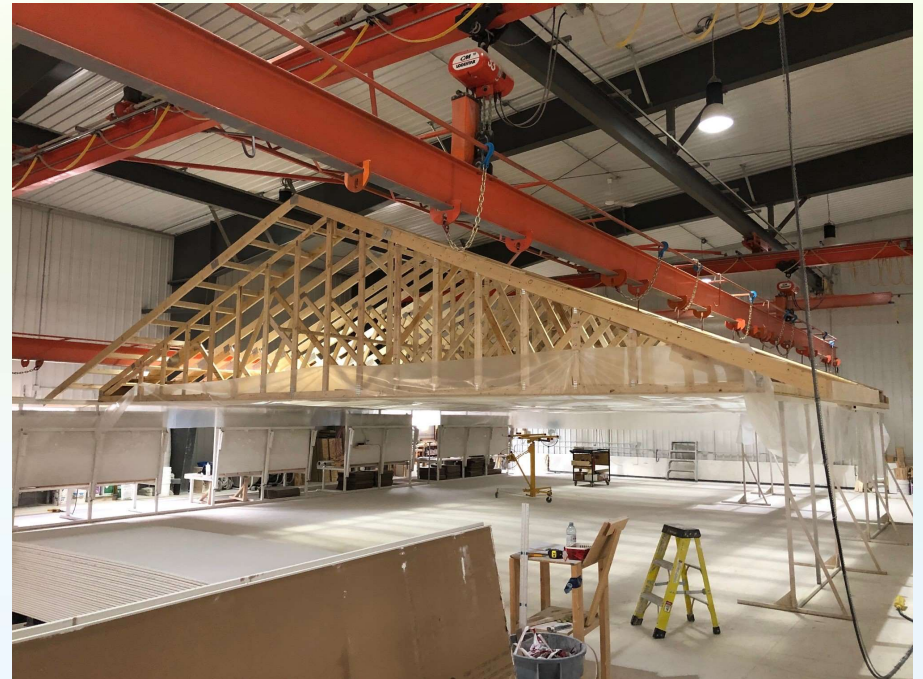
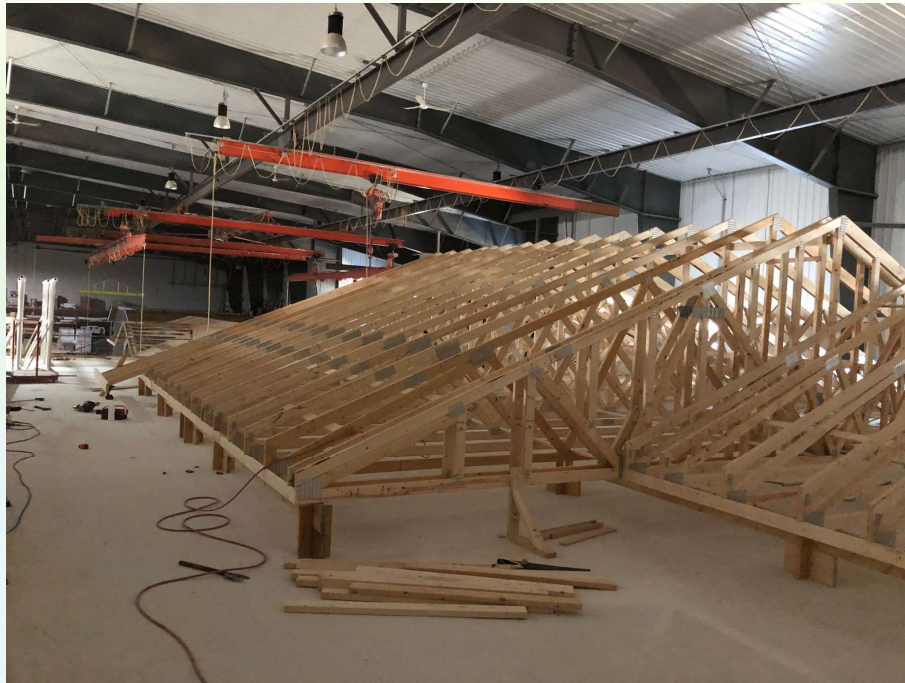


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Roof Framing



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Roof Installation



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Wiring and Vapour Barrier



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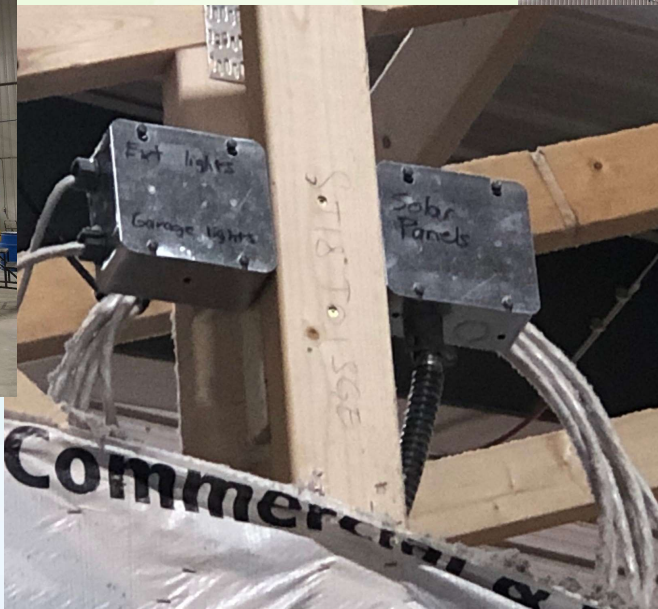


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Insulation



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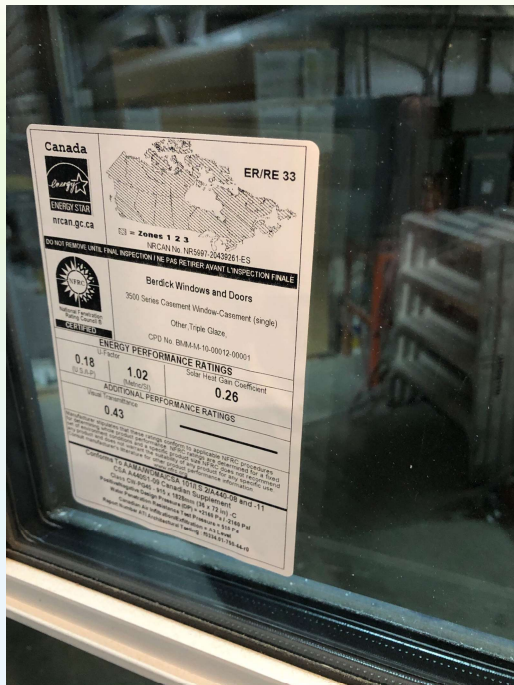


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Window Specs



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Window Sealing



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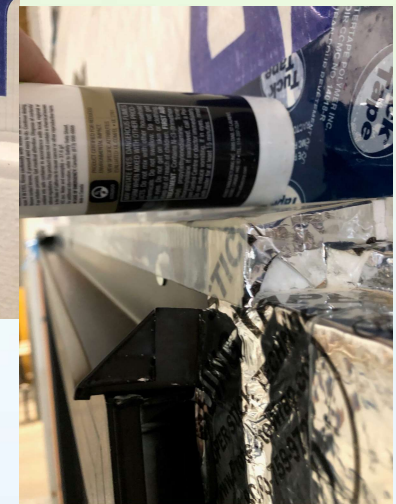


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Window Flashing



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Out of Factory



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Basement Site Work



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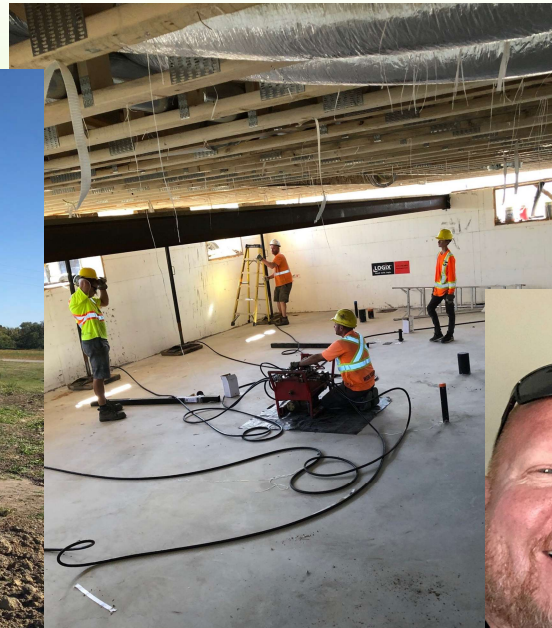


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Moving Day! House on Foundation



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Front Deck



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Basement Windows



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Garage Foundation



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Garage



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Mechanicals & Solar PV



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Interior & Finishes



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Links & Next Steps: HVAC Monitoring

How this house can help other Canadian Builders



JEREMIE LEGER, NRCan – will discuss the monitoring of CS#3

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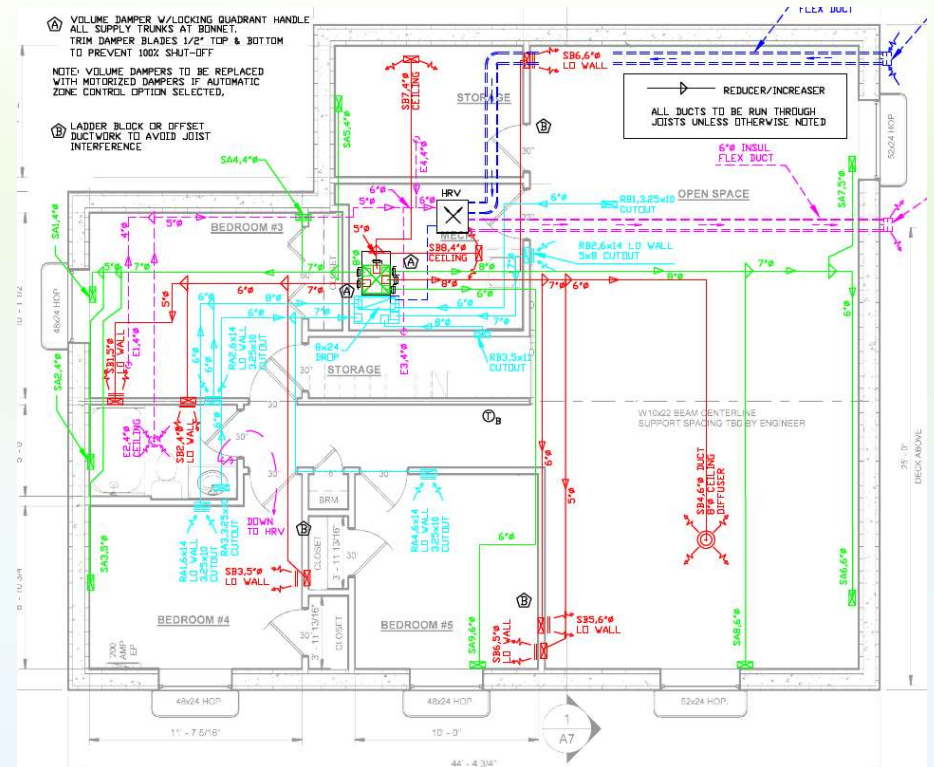
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The mechanical system

- Include a mechanical designer on the team
- Low load home (F280-12 results)
 - Heating: 23,753 BTU/h at -27°C
 - Cooling: 1.5 Ton
- Heat pump (3 stage) with electric backup
- Zoned duct design for better comfort



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Testing and monitoring the system

- Airflow measurement
 - Room by room flow measurement to confirm design airflows
 - Testing the duct system under different zone calls
- Monitoring the heat pump
 - Characterization of the blower power consumption for each zone call
 - Power consumption measurements for the heat pump, blower and backup
 - Temperature measurements (indoor, outdoor, in ducts)

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Links & Next Steps: CBAT Optimization

How this house will help other
Canadian Builders

Cost Benefit Analysis Tool Cost-optimizing energy efficiency

LUCAS COLETTA, NRCan LEEP Team



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AVAILABLE ARCHETYPES	
Small 2-Storey Courtesy of Cresco Homes  Approx 2,500 ft² of livable space, with walk-out basement	Rowhouse Courtesy of Brody Developments  Approx 1500 ft² of livable space, with crawlspace, no basement
Large 2-Storey Courtesy of Odessa Group  Approx 3700 ft² of livable space, with walk-out basement	Modular Home Courtesy of Grandeur Housing  Approx 2700 ft² on 2 floors, with basement

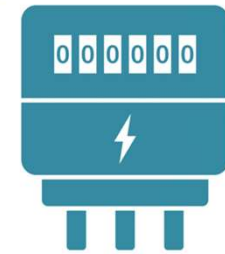
CS#3



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?
- How much does energy efficiency cost **me**, using **my prices**?
- How can I be sure my energy efficient design house cost-effective?
 - For the Builder
 - For the Homeowner
- What energy efficiency programs can I target with a fixed budget?
- What is the cost-optimal design for building NZ in my climate?



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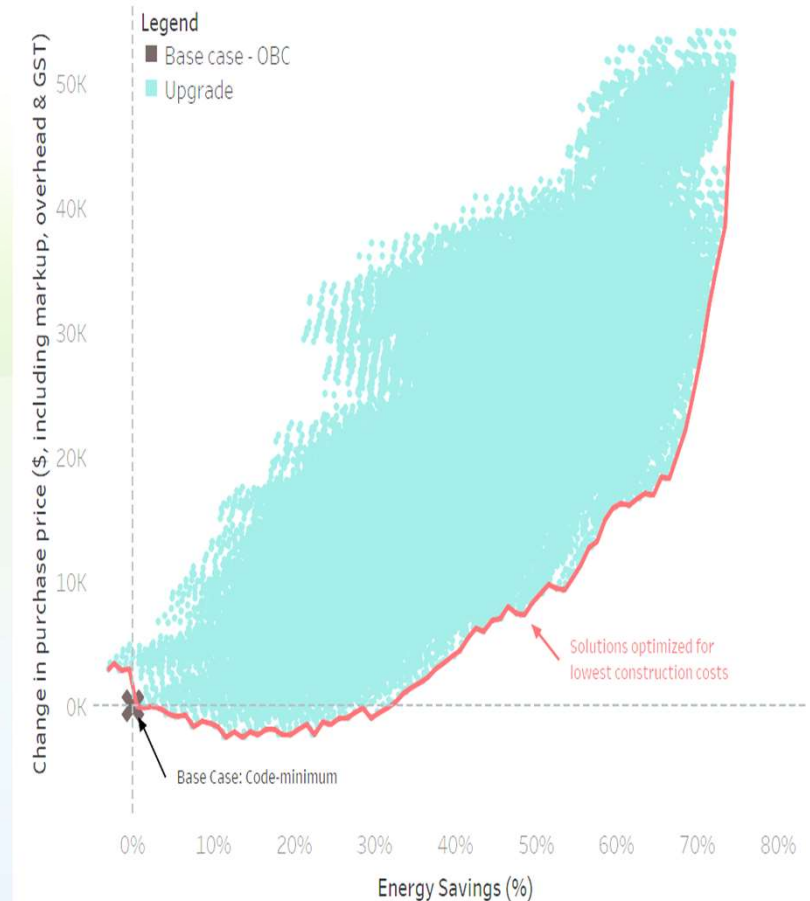
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CBAT + Grandeur

Builders can now access a modular archetype to use for cost-optimization and additional analysis.

- Grandeur modular archetype in CBAT, 10 cities, all climate zones
- 90,000 HOT2000 runs, 10 major cities, all 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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Thank You

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Clarice Kramer, Architect, Housing Design Advisor, NRCan LEEP Team

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