Holistic Sustainability

Led by John Godden, Clearsphere

SUSTAINABLE HOUSING FOUNDATION

Date: February 17th 2021

WINTER 2021 - SUSTAINABLE HOUSING FOUNDATION WEBINAR SERIES

February 18th 2021

1. Holistic Sustainability: What does "sustainable" housing actually mean today and how has that definition changed over time? Is it energy efficiency? Is it resilient buildings? Is it water efficiency? Or, is it all of these things and more? How do you measure and evaluate sustainability? Why is it important to be looking at these issues today and what does the future hold for the home building industry? **Led by John Godden, Clearsphere.**

March 18th 2021

2. Embodied Carbon: This webinar will help explain the difference between embodied carbon and operational carbon and why the difference is significant when talking about building sustainable housing. How does embodied carbon relate to energy efficiency? How do you measure embodied carbon? How does this tie into our governments' approach to a carbon tax? **Led by Christian Rinomato, Country Homes**

April 22nd 2021

3. Cost Effective Durability: The topic of resiliency in housing has become a hot button issue for many municipalities who are struggling to address climate change, natural disasters, water shortages and other issues- not to mention energy. This webinar will look at this issue from the view point of building science, and engineering principles. **Led by Structural Engineer Travis Schiller**

May 20th 2021

4. Cross Border Challenge Awards:

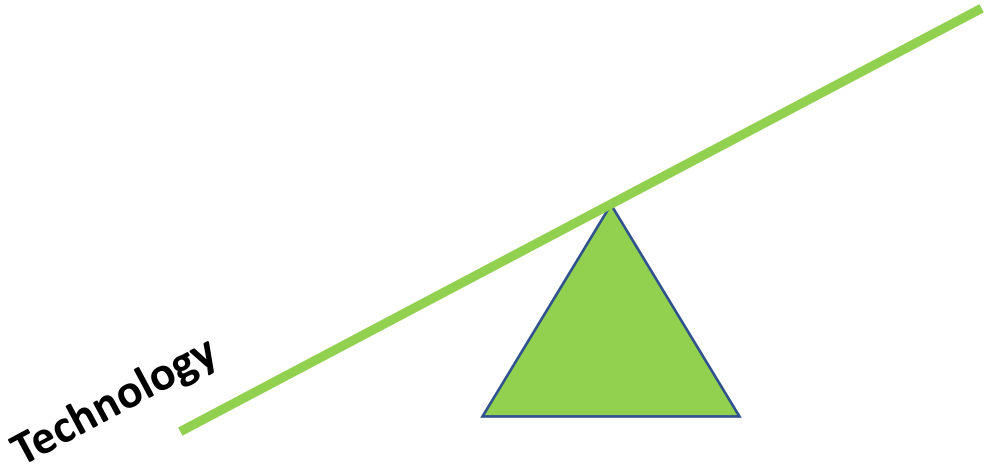
Holistic Sustainability Helpful Terms

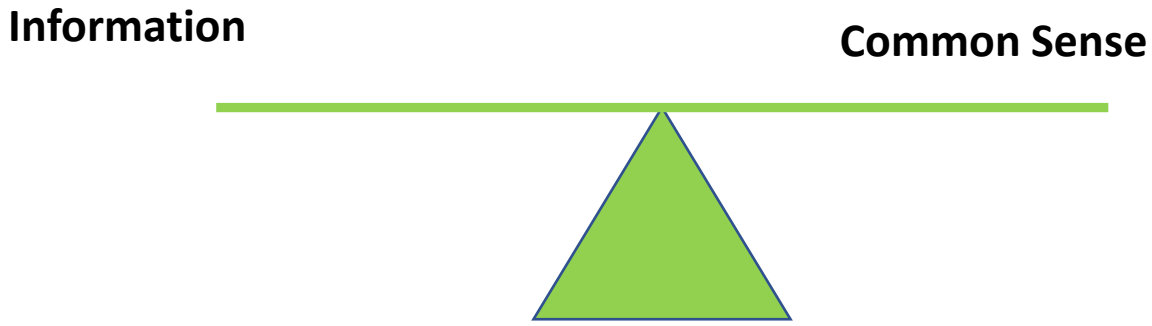
- **Primary Energy:** Energy that exists as a result of natural processes, i.e fossil fuels.
- **Secondary Energy:** Energy made from primary sources.
- **Common Sense:** good sense and sound judgment in practical matters.
  "Common sense is anything but common"
- **Low Hanging Fruit:** a thing or person that can be won, obtained, or persuaded with little effort.

There are no panaceas!

KNOWLEDGE VS UNDERSTANDING

(INFORMATION) (EXPERIENCE)





Futureproofing - The Third Wave

Alvin Toffler Best seller describes three historic stages for the development of civilization.

- First wave: The agricultural transition from a hunter gatherer structure
- Second wave: The industrial age, largely driven by the burning of cheap fossil fuels like coal and oil
- Third wave: The information age where we connect to the internet using our computers and smartphones.

Are we in the Third Wave and what is Bill Gates up to?

Sustainability is more than the process-it is about relationships between people and things. It is about how we value our connection with resources to achieve less waste and better outcomes for the future.

Simply put, sustainability involves saving energy, saving water, saving materials while constructing Low Carbon durable homes.

SUSTAINABILITY IS DOING MORE WITH LESS

What is Holistic Sustainability?

- Holy comes from the Greek root “HOLOS” which means WHOLE.
- A Holistic approach is concerned with the complete system rather than the dissection into its parts.
- Holistic Sustainability is making choices based on the understanding of how all the parts come together to form the whole and the impact of those choices over time.

How do we measure sustainability with regards to housing?

The Good Builder Score

Proposing a New Approach to Rating Home Builders

COMPARISON CHART FOR HOME LABELLING

building on sustainable opportunities

	ENERGY PATHS	ENERGY RATING SOFTWARE	RENEW-ABLES	WATER	THIRD PARTY TESTED	IDP	EASE OF USE	LABEL AT CLOSING	COSTS
BETTER THAN CODE®	Performance	RemRate (HERS)	Y	HERS H2O	Y	Y	Y	Y	No Reg Rate = 400-500
ENERGUIDE	Performance	Hot2000 (EnerGuide)	Y	N	Y	N	Y	Y	Reg = 125 Rate = 300 Total = 425
	Prescriptive performance	Hot2000 (EnerGuide)	N	N	Y	N	Y	Y	Reg = 125 Rate = 500 Total = 625
	Prescriptive performance	Hot2000 (EnerGuide) RemRate (HERS)	Y	Y	Y	Y	N	N	Version 41 reduces fees
BuiltGreen	Performance	Hot2000 (EnerGuide)	Y (not verified)	Y (not verified)	N	N	N	N	Reg = 250 Rate = 300 Total = 550
R-2000	Performance	Hot2000 (EnerGuide)	N	N	Y	Y	N	N	Reg = 225 Rate = 750 Total = 925
2017 OBC	**Prescriptive performance**	**Approved software (A.3.1.2.1)**	—	—	**Required for some compliance options**	**Y**	—	—	**Labelling is NOT required**

Project Profile – Lot 25 – Model 40-1

LEED® for Homes in Canada
PROGRAM PARTICIPANT
Canada Green Building Council
LEED® for Homes Case Study Program Participant

Rodeo Fine Homes

43 HERS Rating

68% Yearly reduction in natural gas consumption over provincial code

34 LEED Platinum Homes – Canada's Greenest Community

Roof locations for solar panels may vary

LEED Facts

Rodeo Fine Homes – Lot 25

Newmarket, ON

LEED for Homes Case Study Participant	Points
Target: Platinum	**95.5**
Sustainable Sites	12/21
Water Efficiency	11/15
Energy & Atmosphere	25/38
Materials & Resources	11.5/14
Indoor Environmental Quality	19/20
Innovation & Design	8/9
Awareness & Education	2/3
Locations and Linkages	7/10

Elev

Builder's Sustainability Checklist

	Section 1: HIGH PERFORMANCE ENVELOPE	INCLUDED	QUESTIONS	COMMENTS/REFERENCES
1.1	Third party performance based energy rating and testing with 20% Better Than Code (HERS 46)	☑	☐	
1.2	Tested air leakage @ 50Pa < 2.0 ACH detached (Aerobarrier required)	☑	☐	
1.3	R5 XP Building Products of Canada sheathing and air barrier with all penetrations sealed, including window flashing. Cavity insulation R22 Rockwool. (New addition above grade walls)	☑	☐	
1.4	Existing above grade walls Comfortboard 80 2x4 stand off wall w/R22 Rockwool batts	☑	☐	
1.5	Air seal all HVAC boots, bath exhaust fan housings, pot lights and penetrations	☑	☐	
1.6	Upgraded "better basement" R4 comfortboard 80 + R14 Rockwool for moisture management in new and existing	☑	☐	
1.7	High performance windows with low U-Value=1.4 and low Solar Heat Gain Coefficient (SHGC)<0.30	☑	☐	
	Section 2: HIGH PERFORMANCE HVAC	**INCLUDED**	**QUESTIONS**	**COMMENTS/REFERENCES**
2.1	Right sized 96% AFUE heating plant min. 2 Stage burner w/ECM	☐	☐	
2.2	Condensing combination heating system with existing boiler @95% AFUE and 3 zoned hi-velocity air distribution system	☑	☐	
2.3	Programmable web-based thermostat (3 zones)	☑	☐	
2.4	Indirect hot water storage tank (EF=0.9) for use with radiant floor	☑	☐	
2.5	Drain water heat recovery on two shower drains, R3-42 (R3-60 on one drain)	☑	☐	
2.6	Hybrid Heat with heat pump Air conditioner	☐	☐	
	Section 3: INDOOR AIR QUALITY	**INCLUDED**	**QUESTIONS**	**COMMENTS/REFERENCES**
3.1	Min. efficiency HRV 75% SRE	☐	☐	
3.1(b)	Best ventilation: Energy recovery ventilation (ERV) SRE of 75% c/w ECM, exhaust ducted to 2-peice bath and basement bath	☑	☐	
3.2	Flow rate verified by third party	☑	☐	
3.3	2 High Static Bathroom fans verified at OBC capacities c/w best soffit vents	☑	☐	
3.4	MERV 8 air filtration	☐	☐	
3.4(b)	Best filter: 4 inches pleated MERV 12 for maximum air filtration	☐	☐	
3.5	Better air conditioner: Right sized, 16 SEER, two-stage air conditioner	☐	☐	
3.6	Containment control during construction	☑	☐	
3.7	Pre-occupancy flush (48hrs before)	☑	☐	
	Section 4: REDUCE WATER USAGE	**INCLUDED**	**QUESTIONS**	**COMMENTS/REFERENCES**
4.1	Toilets 4.00 LPF	☐	☐	
4.2	Kitchen and Private faucets 5.7 LPM	☐	☐	
4.3	Greywater recycling system (Total Water Solution)	☑	☐	
4.4	Showerheads 5.7 LPM	☐	☐	
4.5	Hot Water Circulation Pump w/ HERS H2O label	☑	☐	
	Section 5: EFFICIENT ELECTRICAL AND MATERIAL MANAGEMENT	**INCLUDED**	**QUESTIONS**	**COMMENTS/REFERENCES**
5.1	100% LED lighting	☑	☐	
5.2	Attic Insulation low CFC blown foam	☑	☐	
5.3	Thermal insulated sheathing 90% recycled content	☑	☐	
5.4	Rockwool Stonewool insulation throughout house, Greenguard Gold + certified	☑	☐	
5.5	ENERGY STAR appliances (clothes washer, dishwasher and refridgerator)	☐	☐	
5.6	Sustainable Forestry Initiative (SFI) approved engineered hardwood floor	☐	☐	
5.7	Battery storage with critical circuits for backup	☑	☐	

How we make our economic choices?

- The old way is economic only – the least expensive is the best.
- The new way of making choices is including externalities.

Examples of externalities

- Carbon emissions – Global Warming Potentials (GWP) of different products. The production of concrete (7%) and steel (8%) make up 15% of total Global Emissions.
- Waste – Post Industrial and Post Consumer recycled content.
- Transportation – Is a product locally made or does it come from overseas.
- Chemical Pollution – impact on the environment and human health.

Holistic Sustainability requires us looking at how we live and what we drive

Federal Carbon Tax for Various Fuels

Date	Natural Gas (Cents/m3)	Gasoline (Cents/L)	Annual Impact Natural Gas	Annual Impact Car (4 cyl)(20000km)
Apr-19	3.91	4.4	$70.38	97.77
Apr-20	5.87	6.6	$105.66	$146.67
Apr-21	7.83	8.8	$140.94	$195.55
Apr-22	9.79	11.05	$176.22	$245.55

In April 2022, those of us who live in ENERGYSTAR houses and drive a 4 cylinder car will be paying $421.77 in carbon taxes

*sources: https://www.ontario.ca/page/motor-fuel-prices
https://www.canada.ca/en/revenue-agency/services/forms-publications/publications/fcrates/fuel-charge-rates.html

Low Carbon Net Zero Cost

A Brookfield Home has a similar annual CO2 footprint as a small 4 cylinder car!

clearsphere
training & educating | sustainability consulting | energy rating
building on sustainable opportunities

The Hybrid Approach - Futureproofing

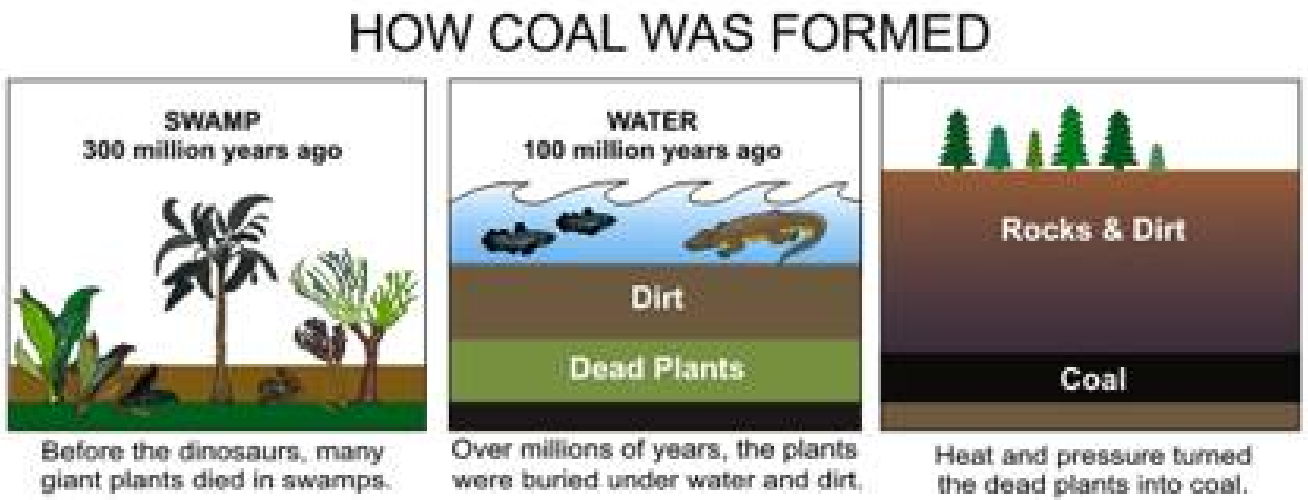
Plug-in Hybrid car can run 4 different ways.

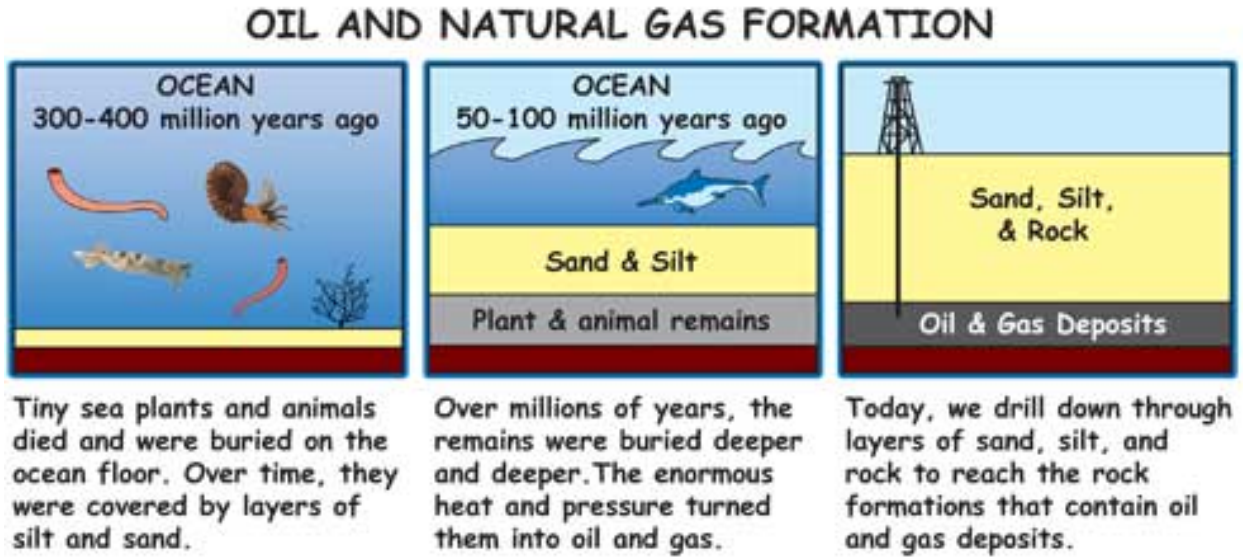
1. 1.4 litre turbo engine which runs on gasoline
2. 1.4 litre turbo engine can charge battery
3. Hybrid mode where braking stores energy
4. Straight electric mode with 8kWh battery which has 40km range

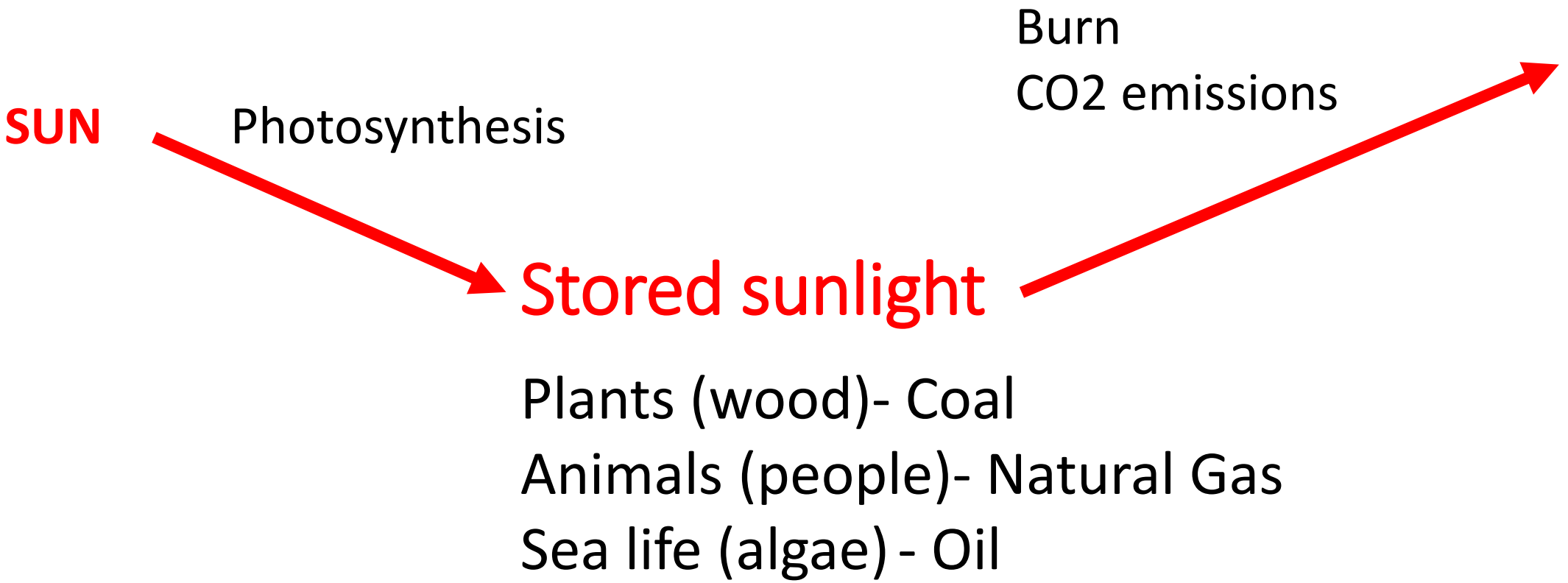
An Audi Etron plug-in hybrid gets charged by an eCamion transportable level 3 charging station.

The Primary Energy Blues – School House Rock Earth

Coal, Oil and Natural Gas Formation

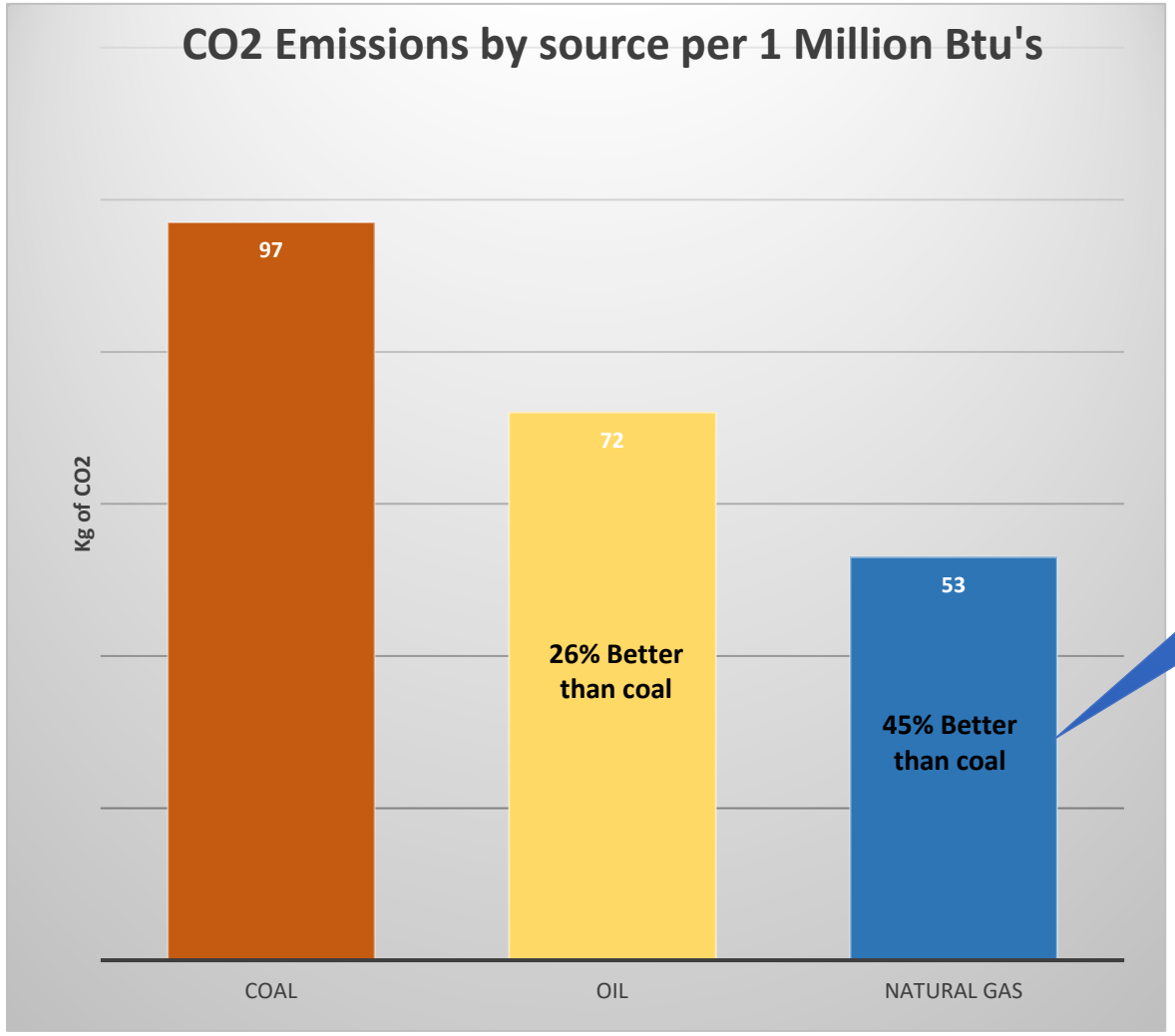






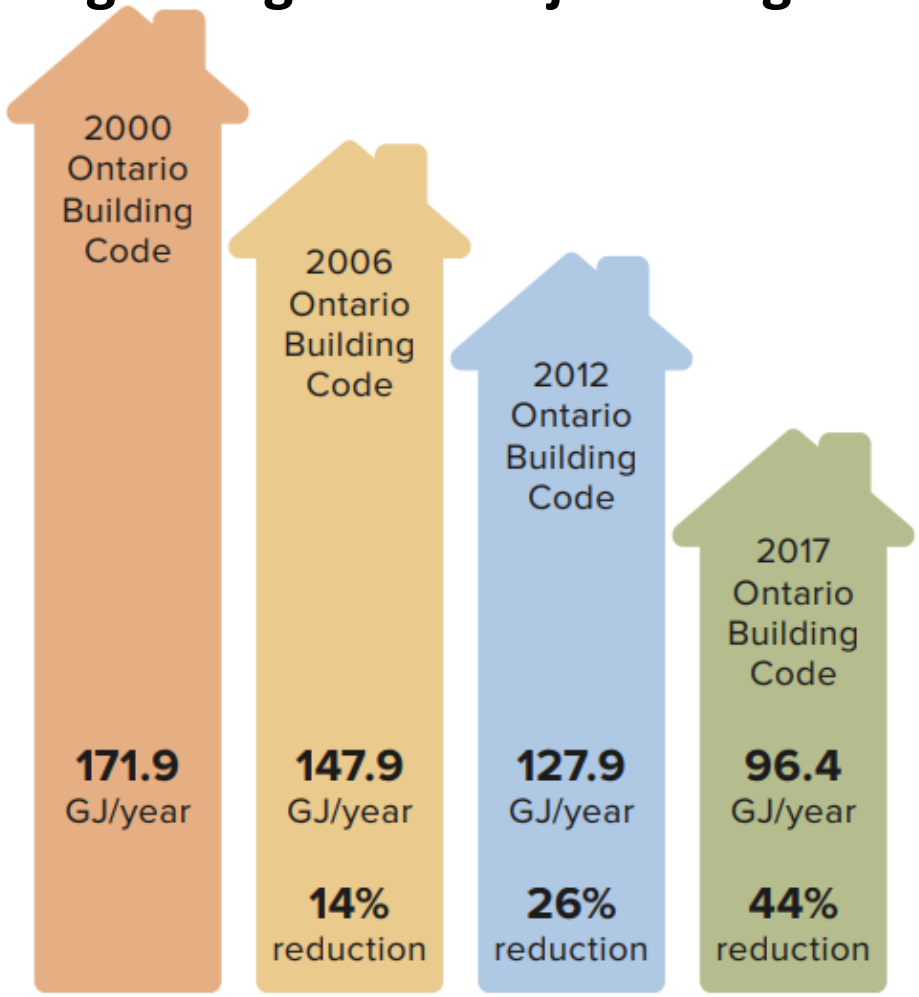
Plants are very important because they create oxygen and absorb CO2

Natural Gas still part of a long-term strategy for Emissions Reductions



Natural Gas part of strategy for emissions reductions

OBC 2017 Package A1 surpasses PARIS ACCORD Targets …
But …. signalling more major changes

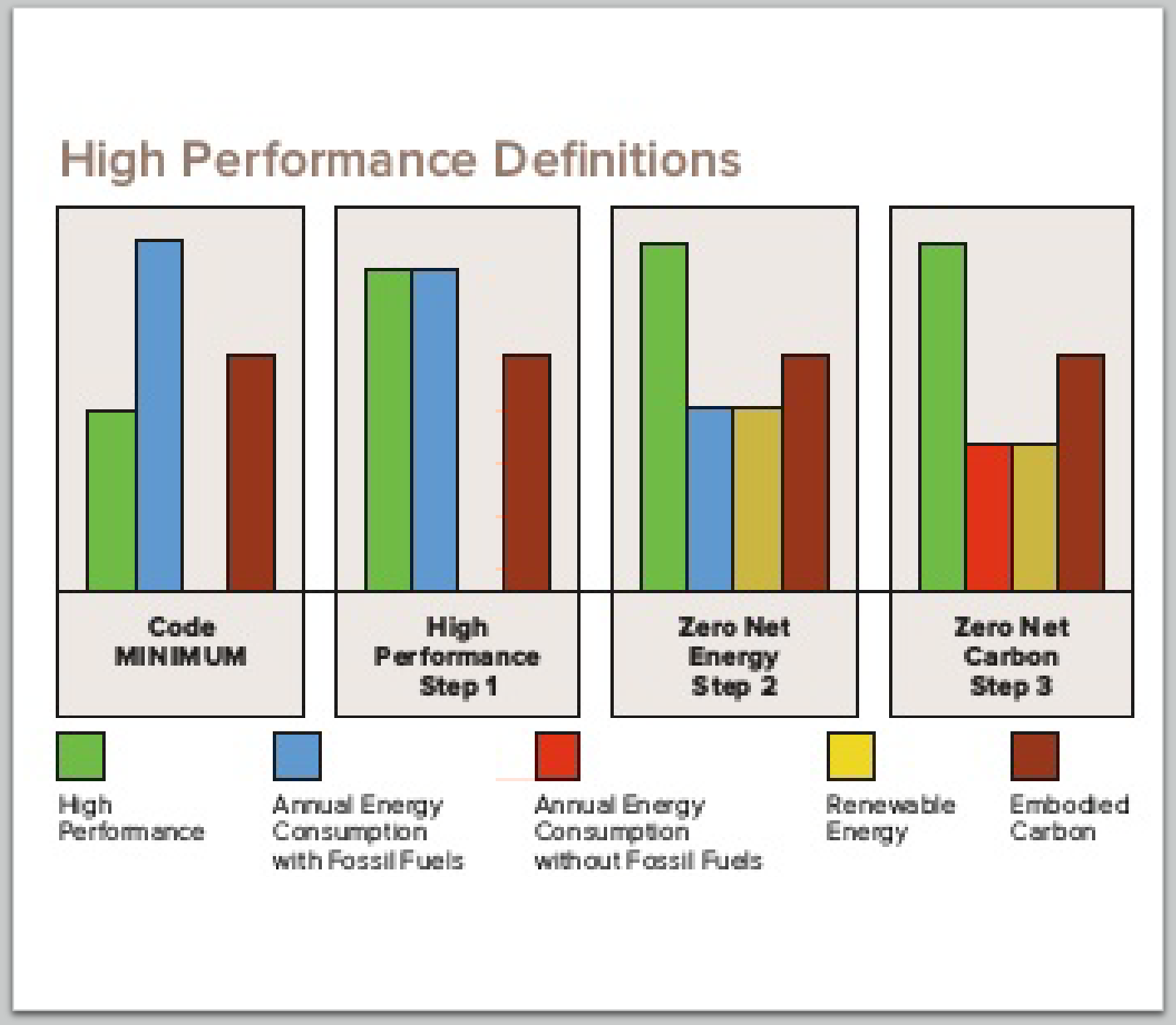


Total Household Energy Usage by Year of Construction

Step 1: Reducing operational carbon (i.e. natural gas)

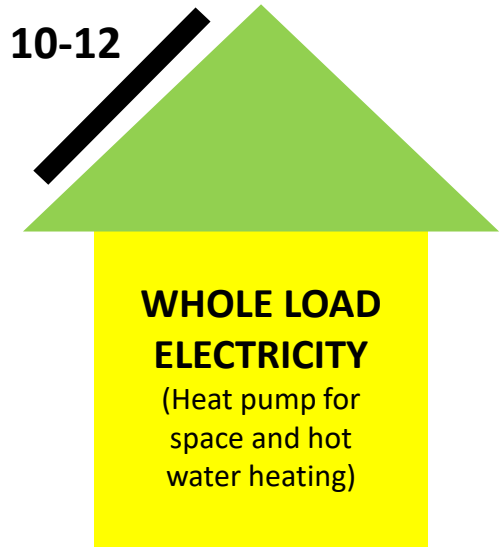
Step 2: Reducing operational carbon and producing onsite energy

Step 3: Reducing embodied carbon



Net Zero in Ontario

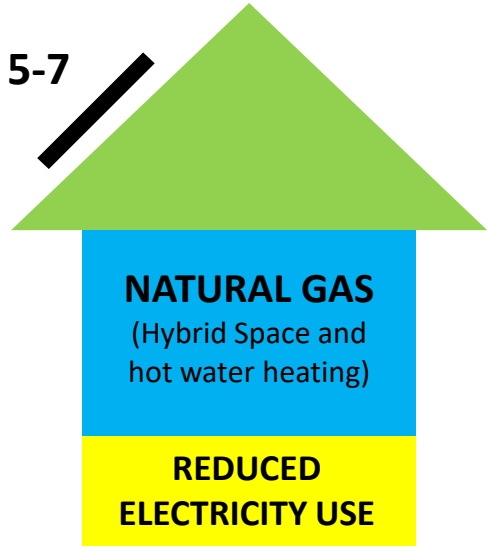
Modeled balanced energy – PV offsets other loads
Problem: surplus electricity can not be sold to the grid and requires battery storage for use electricity in the house



NET ZERO

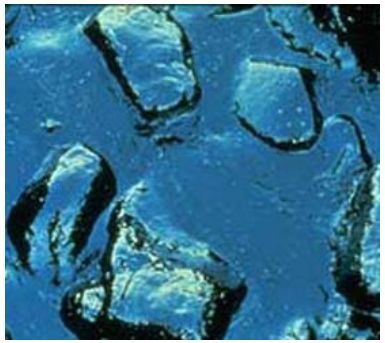
Low Carbon (Operational and Embodied)

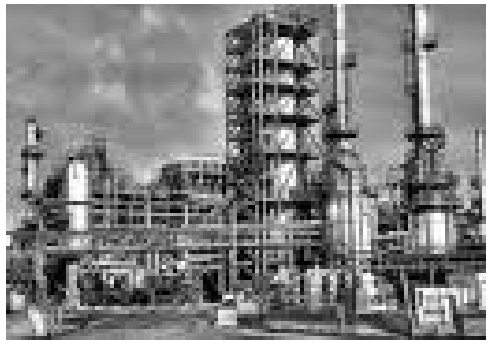
Modest solar array charges battery with critical circuits for use in the house. Less insulation in the envelope because not trying to reach balanced energy or Net-Zero. Careful choice of materials with low embodied carbon.



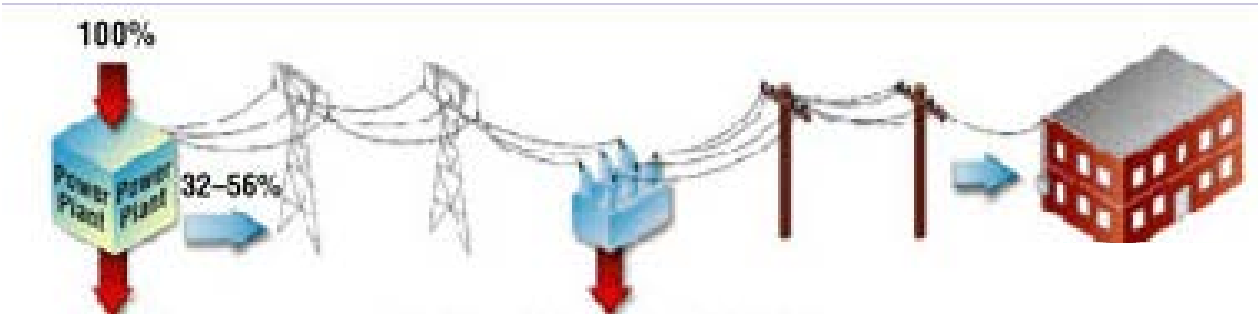
LOW CARBON
NET ZERO COST

Generation Losses and Primary Energy





Source
100%
Fuel Energy



57% - 70%
Generation Losses

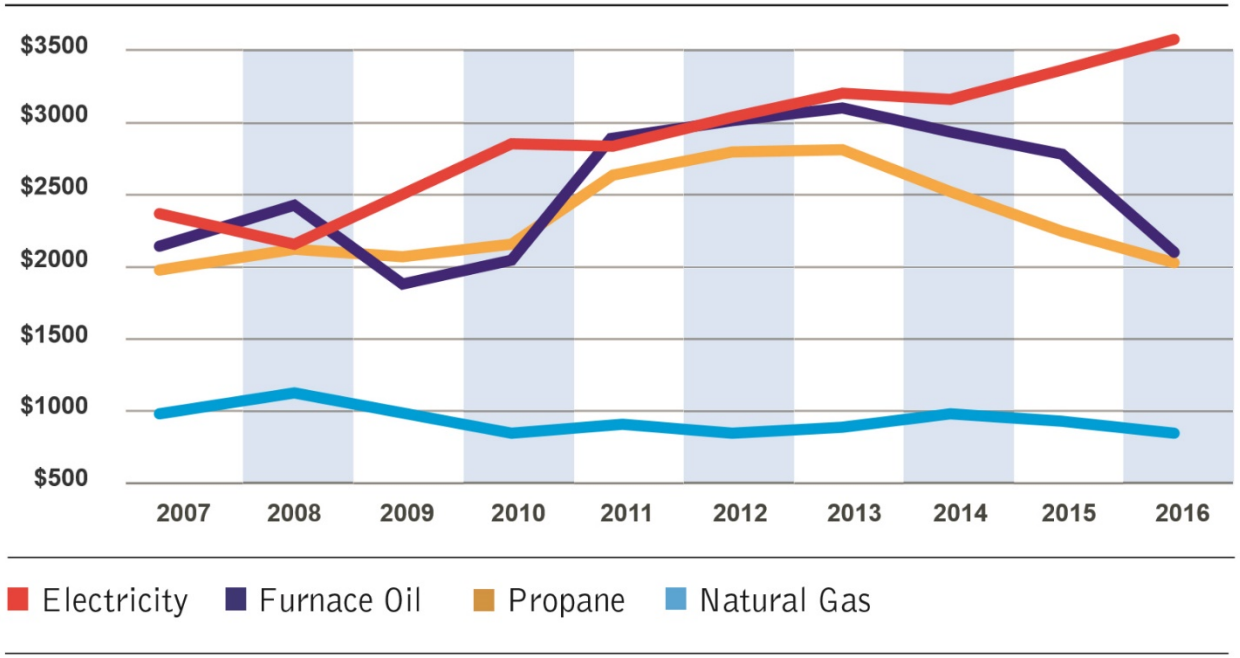
8% - 16%
Transmission and Distribution Losses

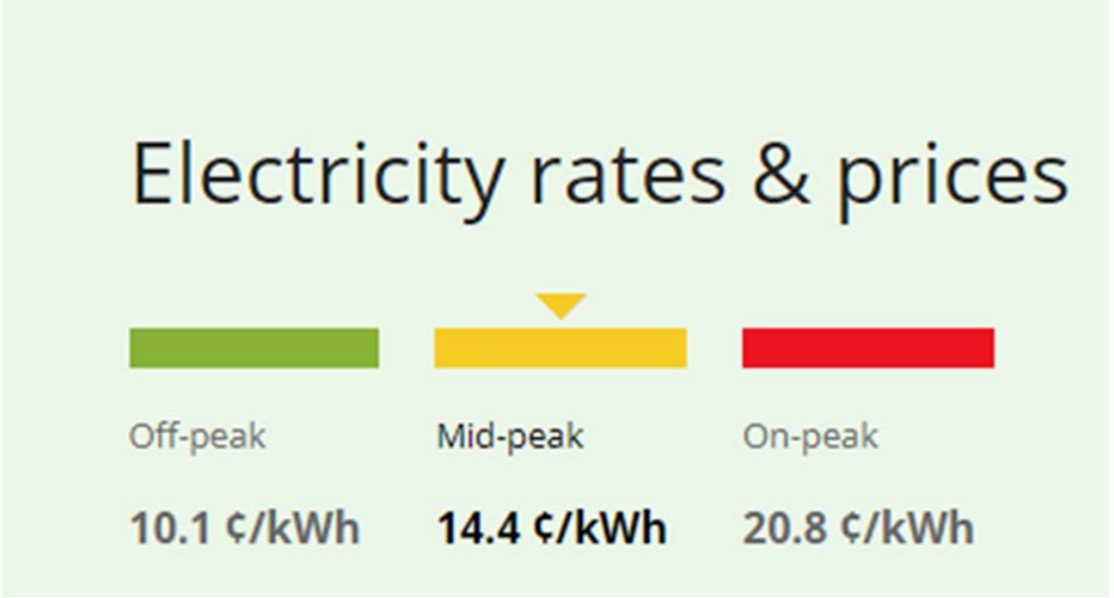
25% - 35%
Electricity reaching your home

Only 1/3 of fuel source energy reaches your home as electricity.

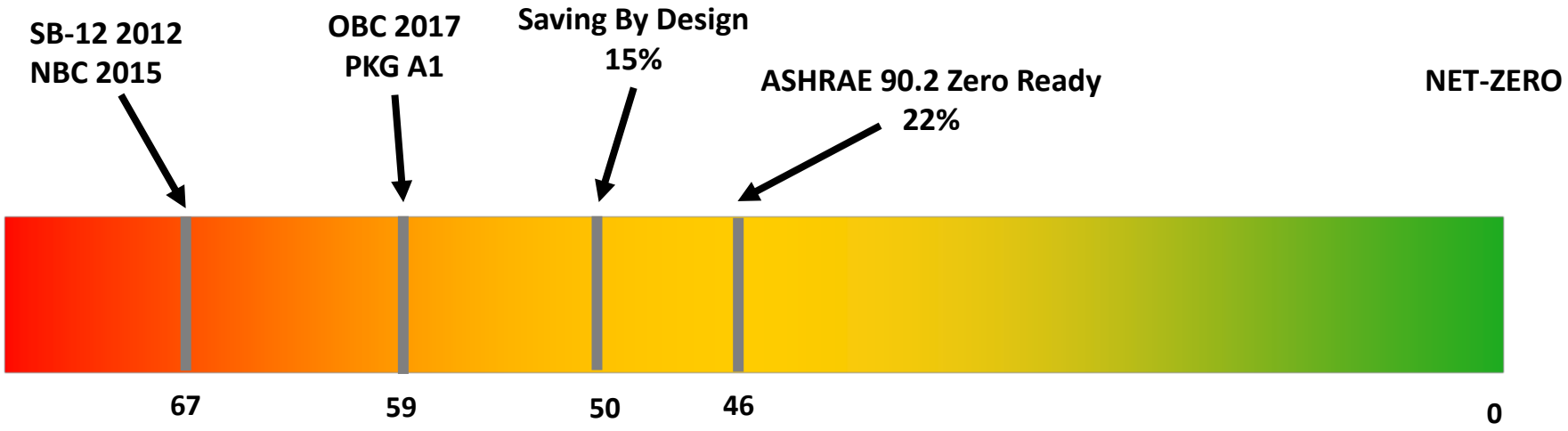
Apples to Apples

Energy





HERS THRESHOLDS FOR ONTARIO FOR HOUSE



SBD-15%: (59-50) / 59 = 15%

ASHRAE 90.2

90.2 COMPLIANCE ERI SCORES BY CLIMATE ZONE	
CLIMATE	ERI SCORE
ZONE 1	43
ZONE 2	45
ZONE 3	47
ZONE 4	47
ZONE 5	47
ZONE 6	46
ZONE 7	46
ZONE 8	45
IN ONTARIO, LOW CARBON HOMES ARE ERI/HERS 46	

Zero Ready Home in USA (North America)

Sustainability: 5 examples of doing more with less

Example 1: The Enbridge Savings by Design program, which introduces builders to the integrated design process (IDP).

The IDP results in market transformation which shows builders how to save energy, save water, save materials while constructing Low Carbon durable homes.

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BETTER Builder

the builder's source

Simply the Best

WINNERS OF THE CROSS BORDER CHALLENGE

INSIDE

PUBLICATION NUMBER 42408014

The 2020 Cross Border Builder Challenge

RESNET cresnet

Canadian Builders Up for the Challenge

Once again, Canadian builders represented the nation brilliantly at this year's 7th Annual RESNET/CRESNET Cross Border Builder Challenge, a competition celebrating excellence in energy-efficient home building while promoting the Home Energy Rating System (HERS) Index.

John Godden (left) and Paul Duffy, CRESNET; Jim Neto and Silvana Ramirez, Brookfield Residential; Tim Campanale, Campanale Homes; and Rod Buchalter, RenewABILITY Energy Inc. at the RESNET annual Cross Border Builder Challenge Awards in Scottsdale, Arizona

Jim Couperthwaite (left), Geranium Homes – Innovation Award presented by Paul Lowes, Building Products of Canada

Lisa Grimshaw (left) and Nadia Winters, Tribute Communities – Lowest Score Custom

Frank Mauro (left) and Vince Naccarato, Rodeo Fine Homes – Honourable Mention

Tim Campanale, Campanale Homes – Lowest Score Mid-Production

Erminio Labriola (left) and Silvana Ramirez, Brookfield Residential – Lowest Score Production (over 100 homes)

MANY THANKS TO THE SPONSORS OF THIS YEAR'S CHALLENGE

BP BUILDING PRODUCTS OF CANADA CORP. ENBRIDGE Life Takes Energy RenewABILITY ENERGY ROCKWOOL

Example 2

The use of structural insulated sheathing with wood fibre that has 100% recycled content and a high vapour permeance which allows for drying potential in the wall cavity to the outside. In addition, the product is locally produced and uses foam with non CFC blowing agents

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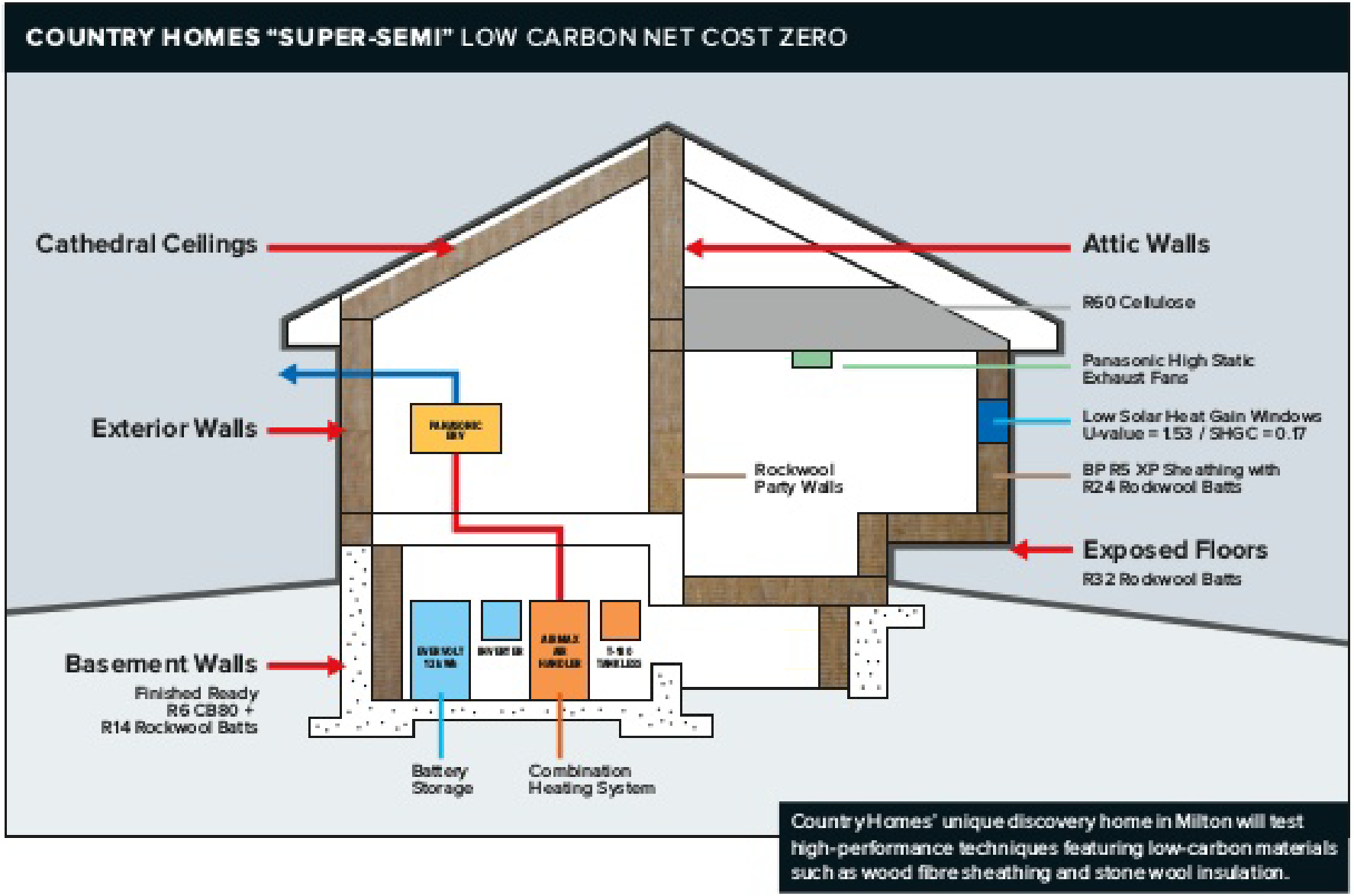
Monthly Newsletter



The super-semi scores a HERS 43 well below the threshold for zero-ready in zone 6

Nominal R-Value Versus Effective R-Value

Package A1
Thermal Bridging

Nominal R- Value = 22.0

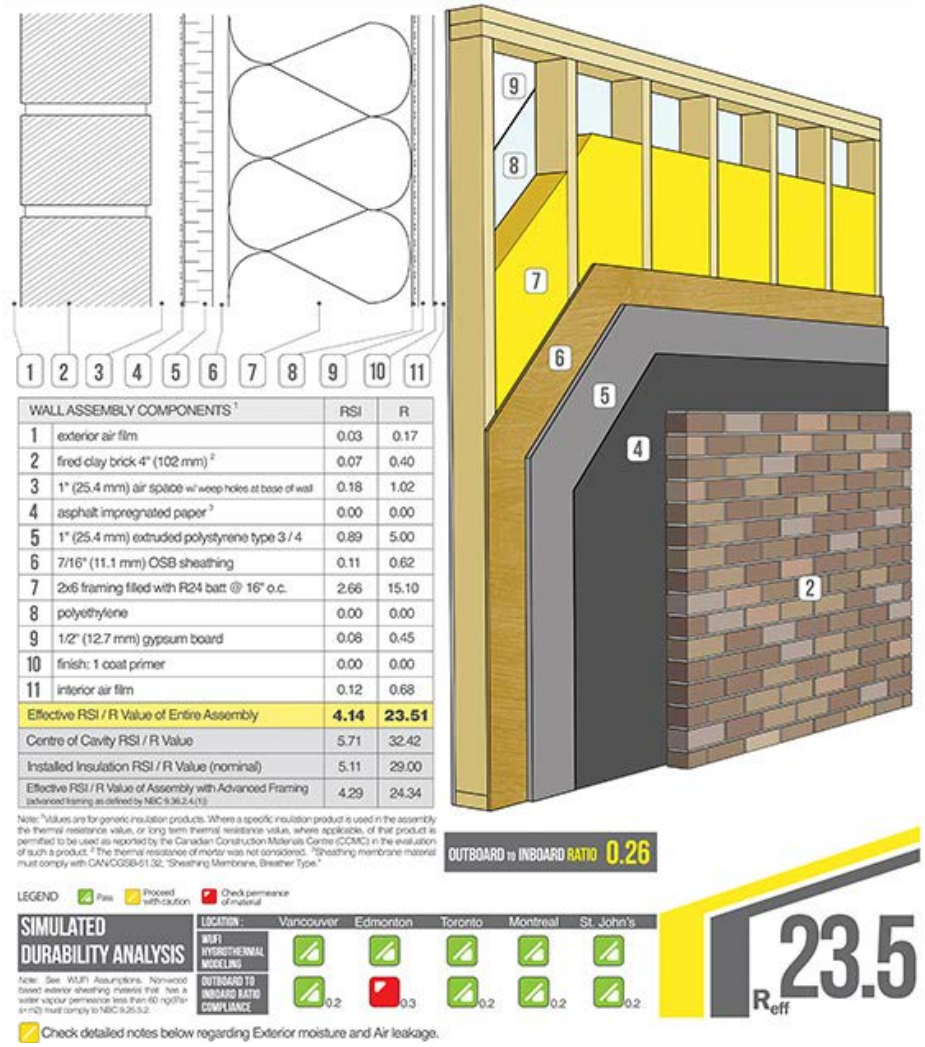
Effective R- Value = 17.1

Package A2
Continuous Insulation

Nominal R-Value = 24.0

Effective R-Value = 20.32

The additional R1 makes a huge difference with sheathing



WALL ASSEMBLY COMPONENTS [1]		RSI	R
1	exterior air film	0.03	0.17
2	fired clay brick 4" (102 mm) [2]	0.07	0.40
3	1" (25.4 mm) air space w/ weep holes at base of wall	0.18	1.02
4	asphalt impregnated paper [3]	0.00	0.00
5	1" (25.4 mm) extruded polystyrene type 3 / 4	0.89	5.00
6	7/16" (11.1 mm) OSB sheathing	0.11	0.62
7	2x6 framing filled with R24 batt @ 16" o.c.	2.66	15.10
8	polyethylene	0.00	0.00
9	1/2" (12.7 mm) gypsum board	0.08	0.45
10	finish: 1 coat primer	0.00	0.00
11	interior air film	0.12	0.68
Effective RSI / R Value of Entire Assembly		**4.14**	**23.51**
Centre of Cavity RSI / R Value		5.71	32.42
Installed Insulation RSI / R Value (nominal)		5.11	29.00
Effective RSI / R Value of Assembly with Advanced Framing (advanced framing as defined by NBC 9.36.2.4.(1))		4.29	24.34

Note: [1] Values are for generic insulation products. Where a specific insulation product is used in the assembly the thermal resistance value, or long term thermal resistance value, where applicable, of that product is permitted to be used as reported by the Canadian Construction Materials Centre (CCMC) in the evaluation of such a product. [2] The thermal resistance of mortar was not considered. [3] Sheathing membrane material must comply with CAN/CGSB-51.32, "Sheathing Membrane, Breather Type."

OUTBOARD to INBOARD RATIO 0.26

LEGEND Pass Proceed with caution Check permeance of material

SIMULATED DURABILITY ANALYSIS

LOCATION:	Vancouver	Edmonton	Toronto	Montreal	St. John's
WUFI HYGROTHERMAL MODELLING					
OUTBOARD TO INBOARD RATIO COMPLIANCE	0.2	0.3	0.2	0.2	0.2

Note: See WUFI Assumptions. Non-wood based exterior sheathing material that has a water vapour permeance less than 60 ng/(Pa·s·m2) must comply to NBC 9.25.5.2.

Check detailed notes below regarding Exterior moisture and Air leakage.

R_{eff} 23.5

WALL THERMAL DESIGN CALCULATOR

www.cwc.ca

Effective R Value of SB-12 Walls

Wall Construction	Framing Centers	Effective R-Value
2x6 Stud R-22 Batt	16" O.C.	17.03
2x6 Stud R19+R5	16" O.C.	20.32
2x4 Stud R14+7.5	16" O.C.	18.62
2x6 Stud R22+R5	16" O.C.	21.4
2x6 Stud R24 Batt	24" O.C.	19.24

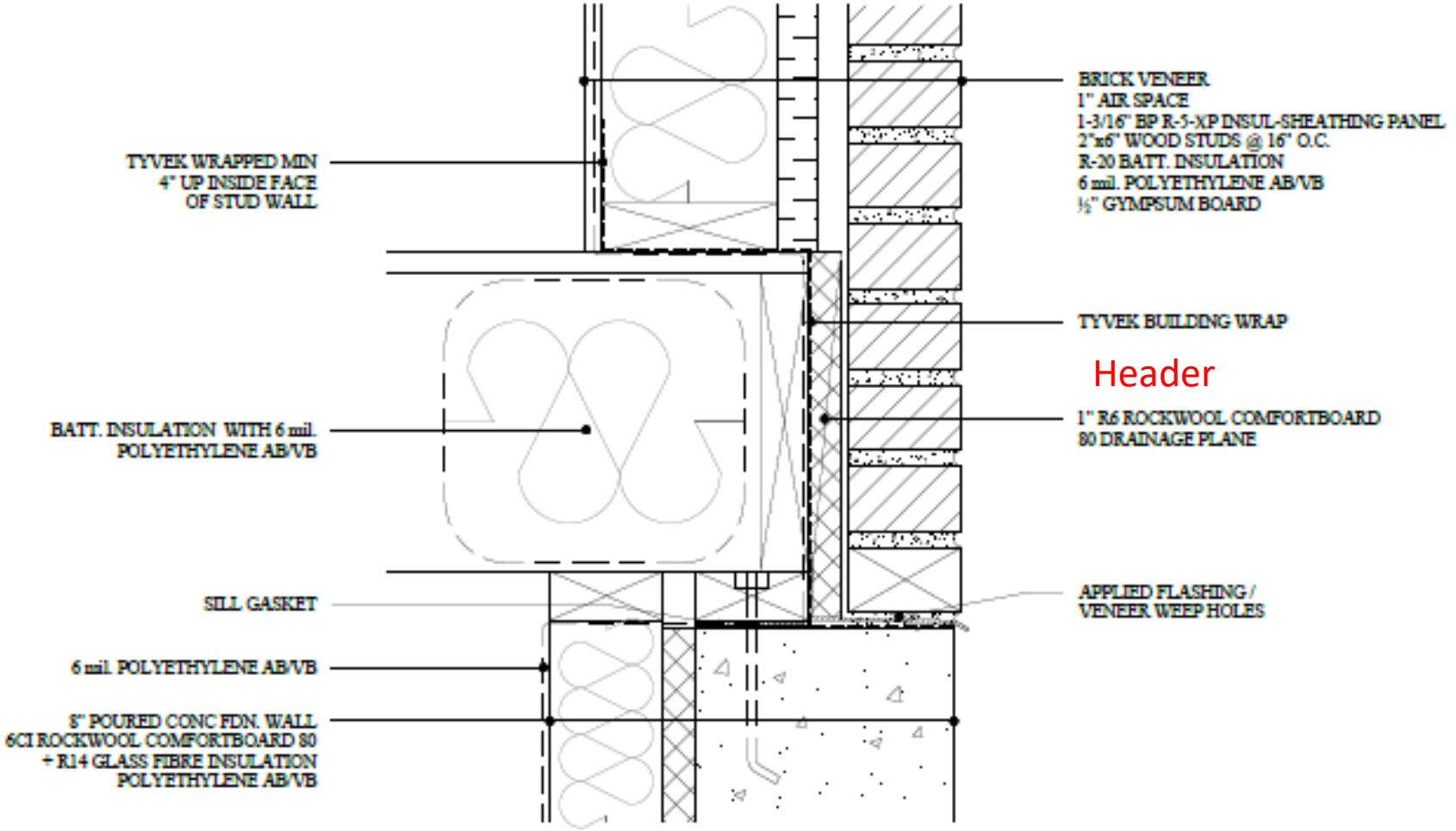
10% less lumber with 2x6 studs on 24’ centers.

OSB is non-permeable and causes condensation and ……?

Example 3

Lower embodied carbon by using an 8 inch foundation rather than 10 inch foundation used in most Net-Zero houses. This results in 25% less concrete which is the highest source of embodied carbon in a house.

Low Carbon foundation wall detail



8" FOUNDATION WALL SECTION
AT FIRST FLOOR WITH BRICK VENEER

1
A1.1

3" = 1'-0"

Hell or High Water

With water conservation being the next frontier, RESNET's new $HERS_{H2O}$ scale has come to Canada, providing builders with a valuable tool.

The impact of seeing baby kangaroos and koala bears being rescued is sure to be a lasting memory from the devastating fires in Australia that began last summer. But the disaster also underscored an important issue that faces all of humankind: climate change has exacerbated the growing scarcity of water and heightened our need to improve our efficiency with this vital resource.

With this in mind, RESNET's recently developed $HERS_{H2O}$ scale is coming to Canada, courtesy of John Godden, the person who first brought the HERS scale north of the border in 2005. $HERS_{H2O}$ is a rating system designed to determine how water efficient a home is. The system is based on a candidate-ANSI standard.

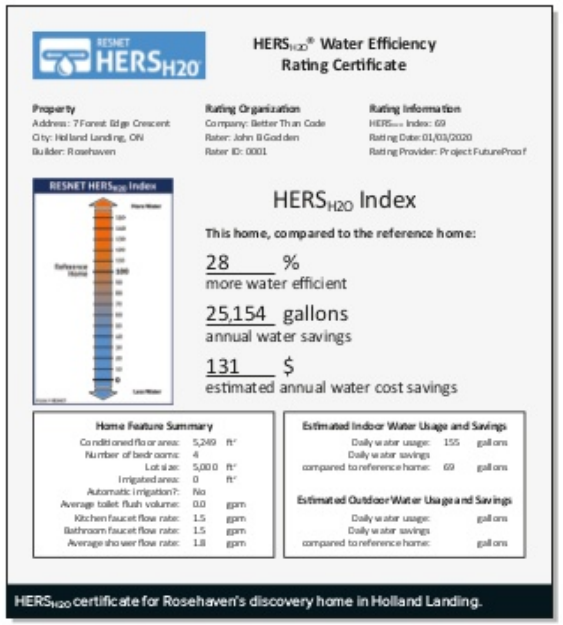
Godden says one of his goals was to determine what the Canadian reference was. While the standard American home is 100, the Canadian baseline is 97 – slightly better because plumbing standards call for more efficient toilets and Canada has provincial requirements for drain water heat recovery, he says.

Similar to HERS, $HERS_{H2O}$ allows builders to meet local standards while getting a third-party rating, rather than having the municipality force builders to do things they might not want to do. "If a municipality is having constraints on water and sewage, this is a way of giving builders a choice on the different water-saving features they can put in a house," Godden says.

It's a situation we saw played out in East Gwillimbury a couple of years ago (see "Leading Edge" in Better Builder Magazine issue 28), when Rosehaven Homes wanted to use the HERS scale as opposed to locally prescribed ENERGY STAR. In the end, after allowing Rosehaven to build a test home, East Gwillimbury was convinced enough to alter the prescriptive language of its Sustainable Development Incentive Program, thereby allowing builders more options. Rosehaven's discovery home – the first in Canada to receive a rating on the $HERS_{H2O}$ scale – scored a 69, meaning it's 31% better than the reference house that's being used as a baseline.

That very same Rosehaven home is part of a $HERS_{H2O}$ pilot program that Godden is performing as per a 2019 Memorandum of Understanding (MOU) he signed with CRESNET. The pilot consists of Godden applying this new standard and ultimately providing labels for specific homes.

Phase B of the pilot – which is being done in conjunction with a discovery home program in Enbridge's Savings by Design program – involves several


RESNET HERS H2O

HERS H2O® Water Efficiency Rating Certificate

Property
Address: 7 Forest Edge Crescent
City: Holland Landing, ON
Builder: Rosehaven

Rating Organization
Company: Better Than Code
Rater: John B Godden
Rater ID: 0001

Rating Information
HERS H2O Index: 69
Rating Date: 01/03/2020
Rating Provider: Project FutureProof

RESNET HERS H2O Index

HERS H2O Index

This home, compared to the reference home:

28 % more water efficient

25,154 gallons annual water savings

131 $ estimated annual water cost savings

Home Feature Summary

Conditioned floor area:	5,249	ft²
Number of bedrooms:	4	
Lot size:	5,000	ft²
Irrigated area:	0	ft²
Automatic irrigation?:	No	
Average toilet flush volume:	0.0	gpm
Kitchen faucet flow rate:	1.5	gpm
Bathroom faucet flow rate:	1.5	gpm
Average shower flow rate:	1.8	gpm

Estimated Indoor Water Usage and Savings

Daily water usage:	155	gallons
Daily water savings compared to reference home:	69	gallons

Estimated Outdoor Water Usage and Savings

Daily water usage:	gallons
Daily water savings compared to reference home:	gallons

$HERS_{H2O}$ certificate for Rosehaven's discovery home in Holland Landing.

Municipal requirement for ENERGYSTAR or equivalent and Water Conservation checklist

Water Conservation Measures	
Indoor Measures	
WaterSense labeled toilets installed (maximum 4.0 LPF single flush or 3/6 LPF siphonic dual flush toilets)	☑
WaterSense labeled lavatory faucets installed (B.A.V)	☑
WaterSense labeled shower faucets installed	☑
Energy Star dishwasher (≤20 litres per cycle) installed	☐
Energy Star clothes washer (water factor of ≤6) installed	☐
On-demand hot water recirculation system installed to one 2nd storey full bathroom or main floor bathroom in a bungalow.	☑
Installation of approved furnace-mounted whole-home water-efficient humidifier	☑
Outdoor Measures	
No irrigation system has been provided (B.A.V)	☑
A minimum of 6 inches of topsoil has been provided throughout development (B.A.V)	☑
Native or drought-tolerant landscaping has been provided throughout the development (B.A.V)	☑

B.A.V-Builder Applicant Verification

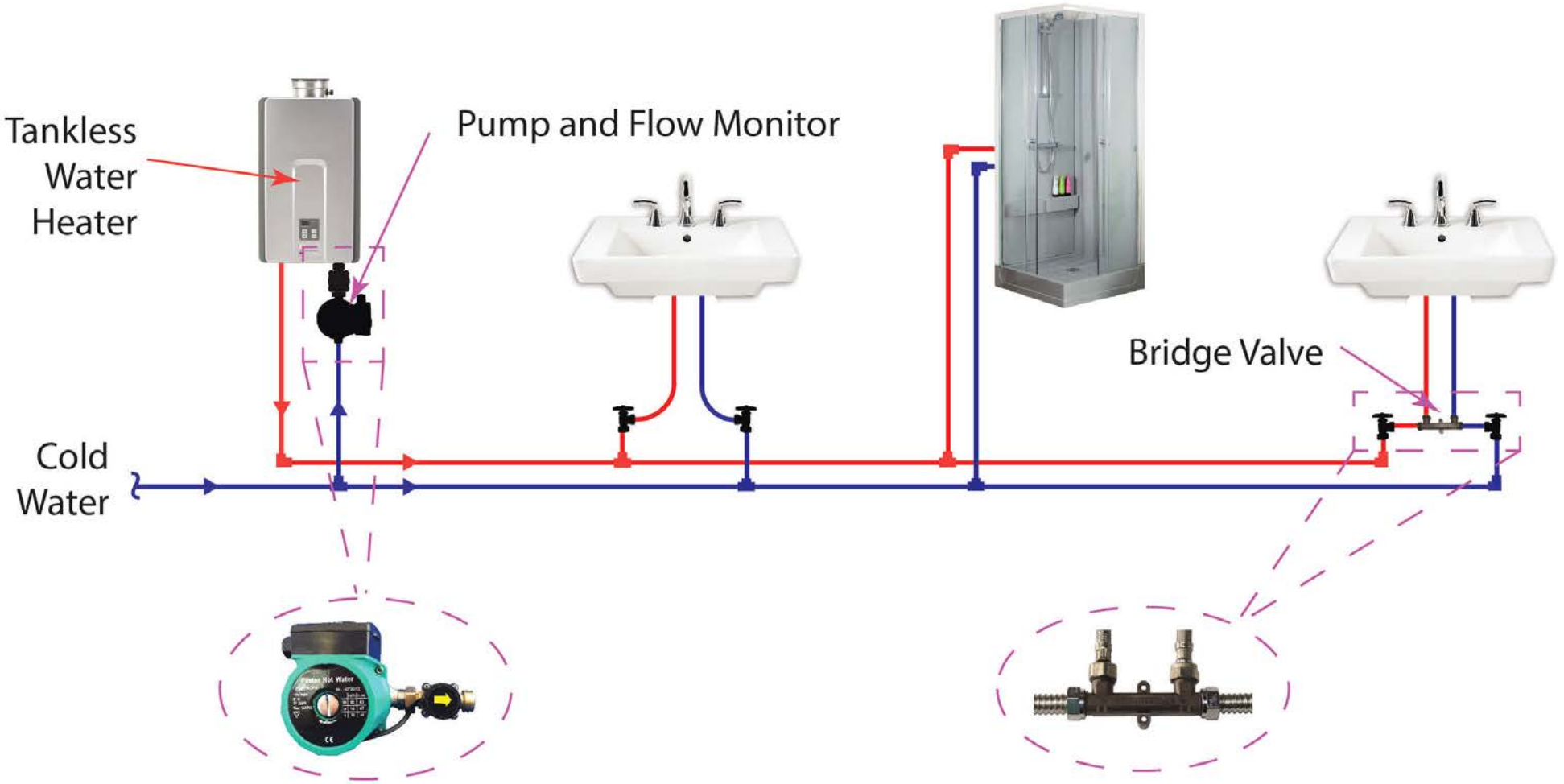
Example 4

Water use reduction using the HERS H2O index. Water is liquid energy. The city of Toronto spends more money on electricity for water pumping stations then they do on running the TTC annually.

Greywater recycling saves water from 2 showers per day for 30 toilet flushes per day. (family of 4)

This means 25% less water use per house and 25% less sanitary outflow to waste treatment plants.

Recirc on Hot Water Lines reduces usage by 10%



Clothes Washer – Single most important appliance

Of the 200 Energy Star certified washers available in Canada – 91 are top load

For electricity - Front Loads range from 60 kWh – 159 kWh

- Top Loads range from 92 kwh – 311 kWh

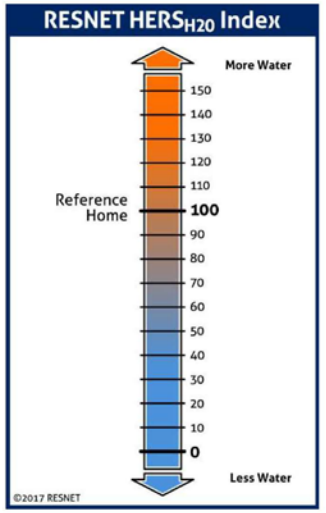
For water - Front loads range from 1728 gallons/yr to 4909 gal/yr (Canadian)

- Top Loads range from 4624 gal/yr to 7827 gal/yr

HERS$_{H2O}$® Water Efficiency Rating Certificate

Property
Address:
City/Pr./PC: Mount Albert, ON
Builder: Averton

Rating Information
HERS$_{H2O}$ Index: 78
Rating Date: 11/20/2020
Rating Provider: Better Than Code



HERS$_{H2O}$ Index: 78

This home, compared to the reference home:

22 %
more water efficient

59,552
Litres, annual water savings

Notes:

- Low Flush toilets@ 4litres
- Lo flow fixtures and faucets
- Hot water circulation system
- Front loading ENERGYSTAR clothes washer and dishwasher

- **INSTALL GREYTER greywater recycling system and HERS H2O is 69 or 31% better.**

BETTER THAN CODE

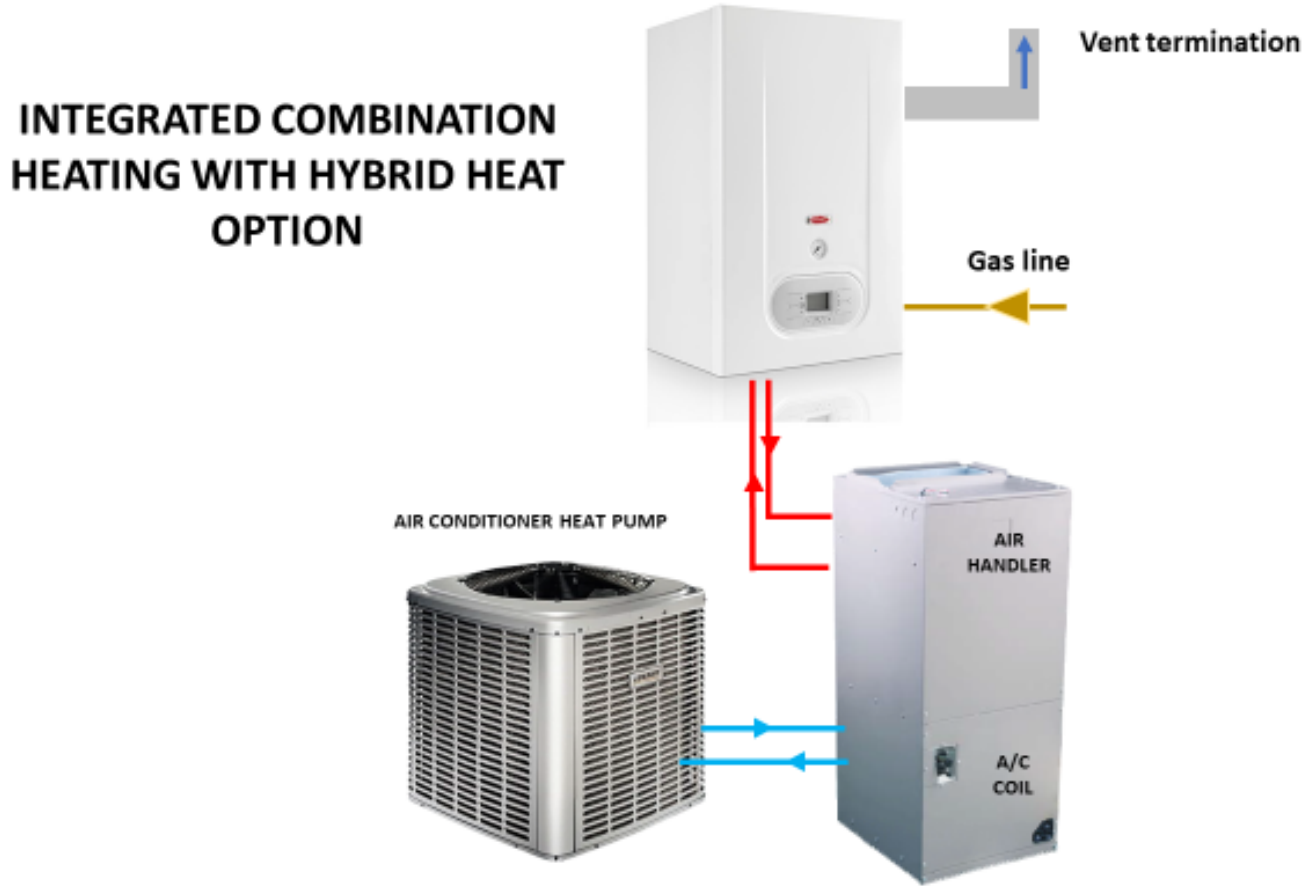
CANADIAN PILOT

cresnet
CANADIAN RESIDENTIAL ENERGY SERVICES NETWORK

Averton
design is everything

Example 5

Integrated combination heating system reduces gas consumption by up to 20%.



Integrated combination heating uses 20% less gas than separate furnace and hot water tank

CHANGING YOUR PROCESS

Where does actual change begin?

QUESTIONS?