

# Passive House Affordable Housing

**Lisa Ker**

Executive Director

Vaughan, November 8<sup>th</sup>, 2016

2082.2 m<sup>2</sup>

14 kWh/(m<sup>2</sup>a)

11 W/m<sup>2</sup>

1 kWh/(m<sup>2</sup>a)

4 W/m<sup>2</sup>

%

117.69 kWh/(m<sup>2</sup>a)

55 kWh/(m<sup>2</sup>a)

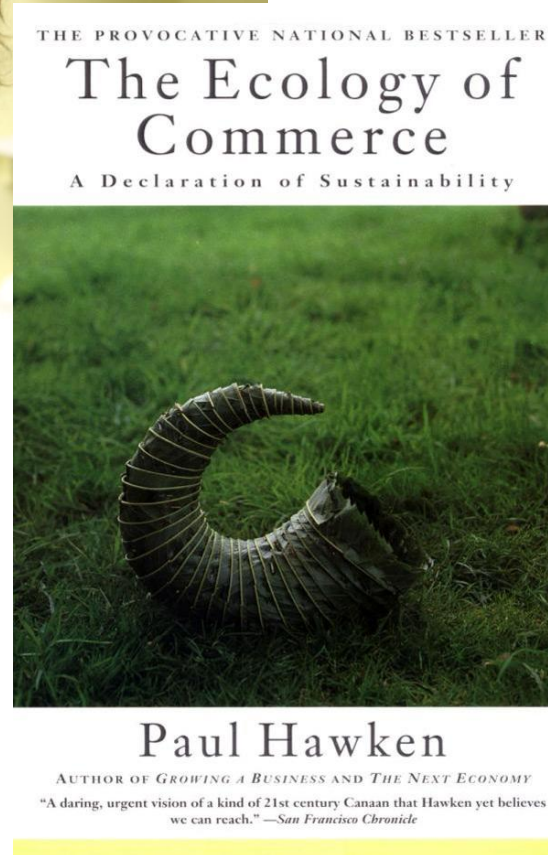
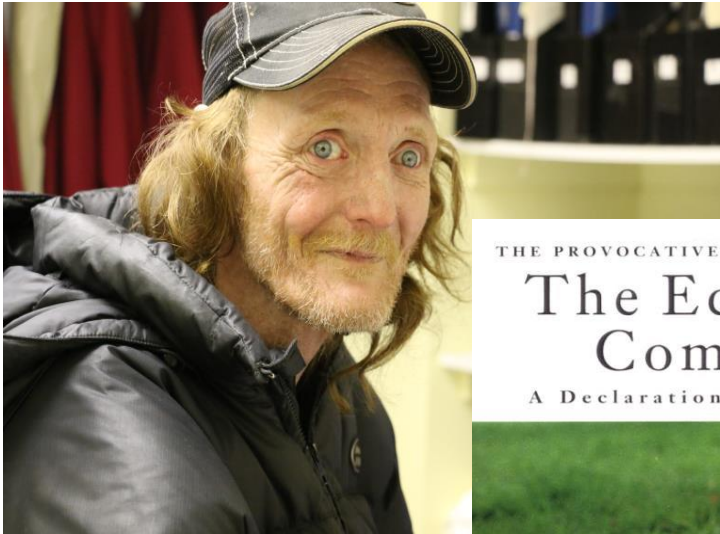
kWh/(m<sup>2</sup>a)

0.3 1/h



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Là où l'avenir trouve un chez-soi.





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*"A Passive House is a building, for which thermal comfort can be achieved **solely by post-heating or post-cooling of the fresh air mass** which is required to achieve sufficient indoor air quality conditions – **without the need for additional recirculation of air.**"* Dr Wolfgang Feist, PHI

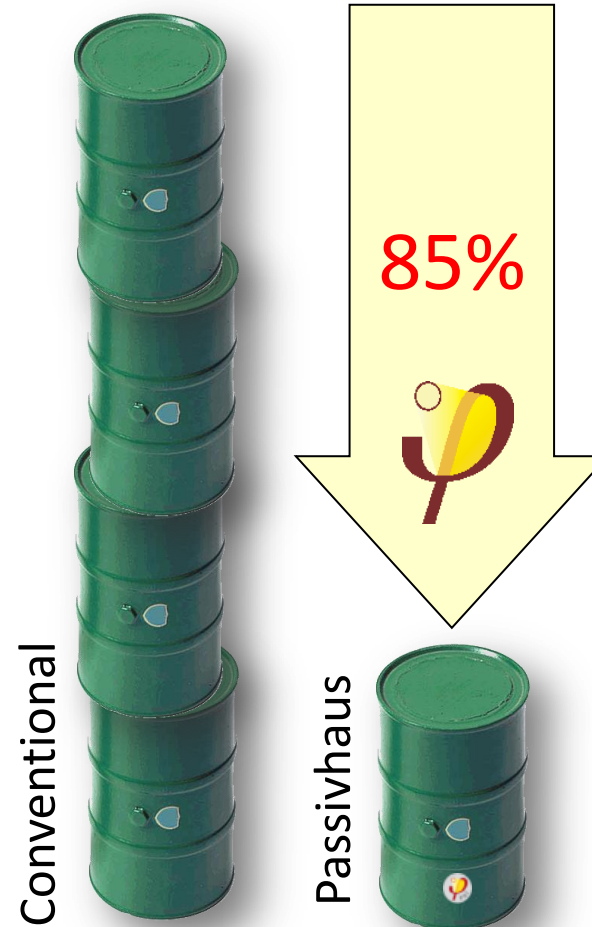
*Insulation*

*Airtightness*

*Thermal bridge free const.*

*High efficiency win.*

*Mech.ventilation  
with heat recovery*



## Passive House Metrics

1. **10 W/m<sup>2</sup>** Heating /Cooling Load based on 20°C (or 15 kWh/(m<sup>2</sup>a) )  
Space Heating/ Cooling Demand
2. **0.6 ACH@50Pa**  
Building Airtightness w/ Mech Ventilation
3. **120 kWh/(m<sup>2</sup>a)**  
Primary Energy Demand
4.  **$\Psi < 0.01$  W/mK**  
Thermal-Bridge Free Construction
5. **< 10%**  
Overheating Frequency based on 25°C

PassivHaus



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**Do we have the right site?**  
 infill site, south façade fully shaded.



**Costs : analysis showed that it was cheaper to save energy than to produce energy**

**Do we have enough roof space for PV?**



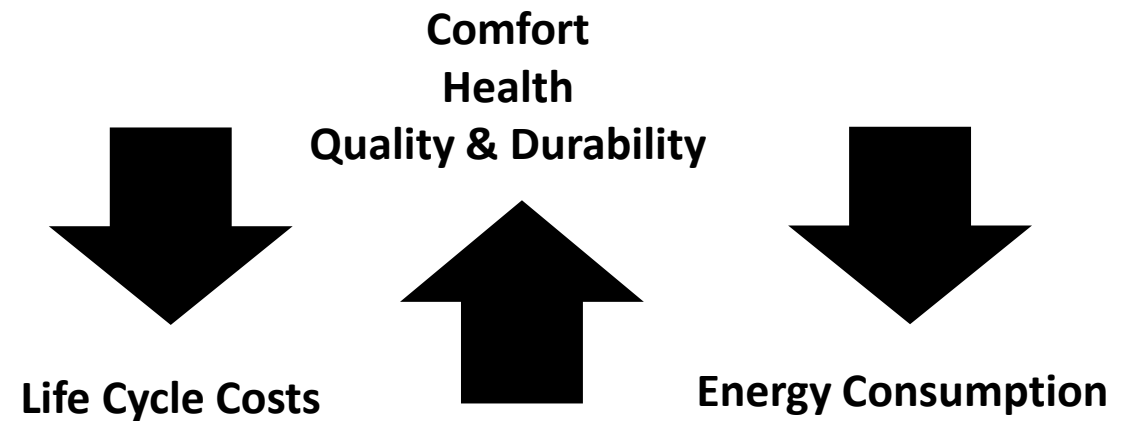
Areas m²	Final energy demand (PH)	80% roof cover with PV	Net-Zero
TFA =265 m² footprint =141 m²	12 MWh/a	~13 MWh/a (115% *)	✓
TFA =2118 m² footprint =629 m²	95 MWh/a	~60 MWh/a (63% *)	☹️

Credit: Jessica Grove Smith, PHI

**Is it the right scale for maintenance?**  
 High risk of underperformance due to operator error and poor maintenance



- *Radical Energy **Efficiency***
- *Reliable **quality** assurance*
- ***Performance** that lasts*
- *Exemplary **comfort** all year round*



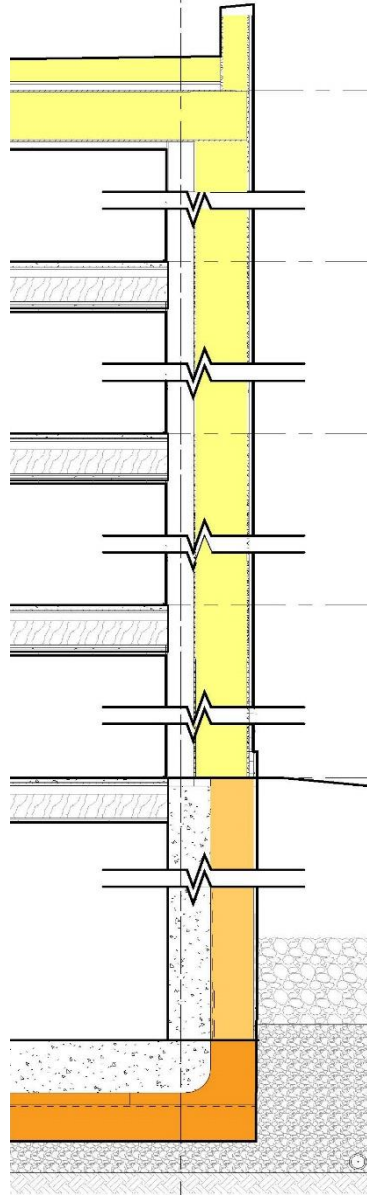
Efficiency, affordability, reliability first. Renewables...someday



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1-Insulation  
2- Thermal bridge Free  
3- Airtightness  
4- High Efficiency  
Windows and Doors  
5- MVHR

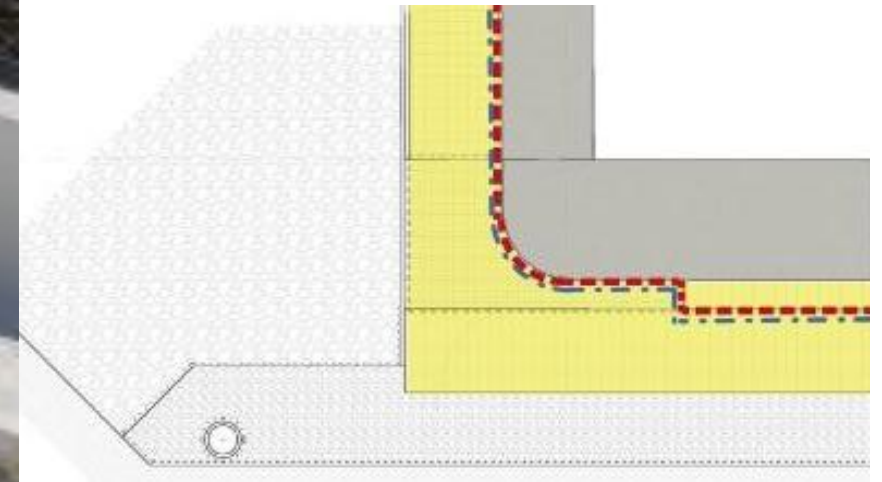


## Slab on Grade: R54

13" Concrete

13" Insulation w/ vapour barrier

Granular



## Tray Slab Foundation



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SIPs



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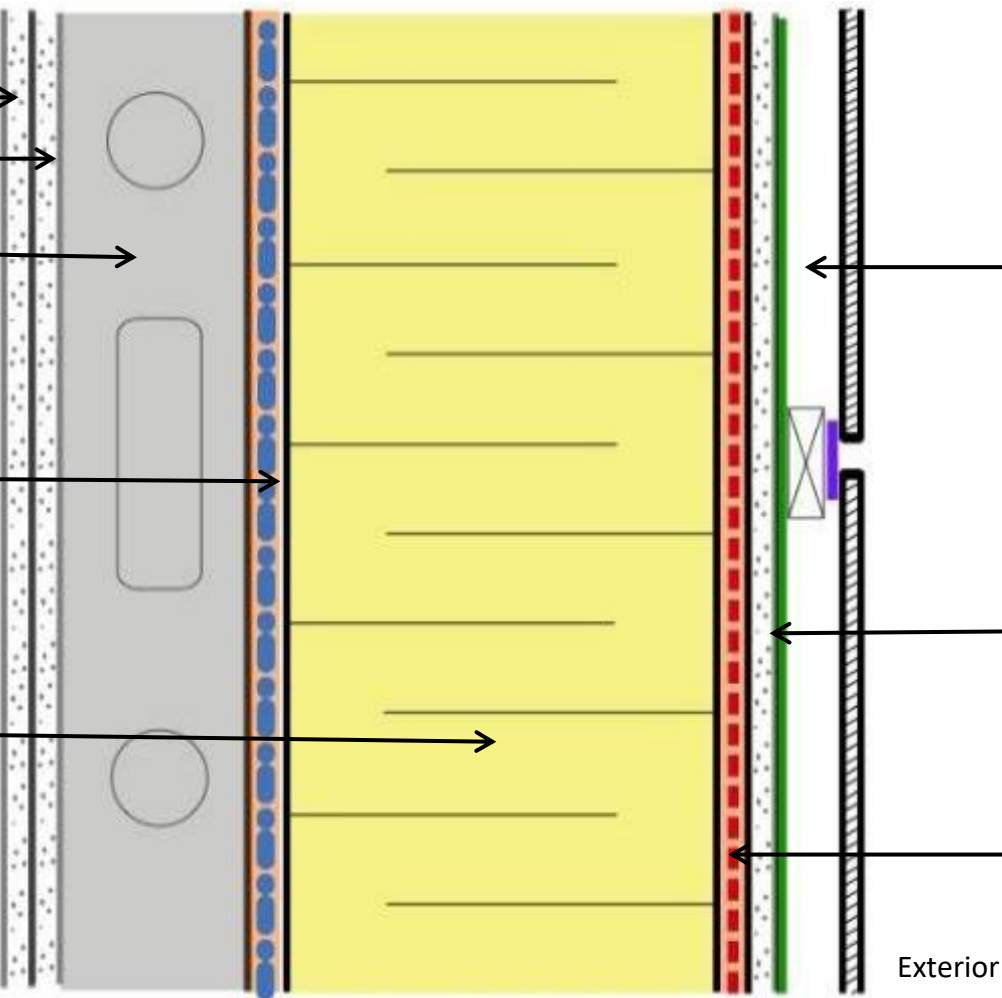
Interior Finish  
Fire Protection

3in 1 : - Structure  
- Seismic Protection  
- Service Cavity

Vapour Control:  
Interior SIP OSB

Thermal Control Layer

Interior



Vent Space –  
Rainscreen System

Weather Protection:  
Siga Majcoat

Airtightness Layer:  
Outboard SIP OSB

Exterior

U-Value: **0.106** W/(m²K)

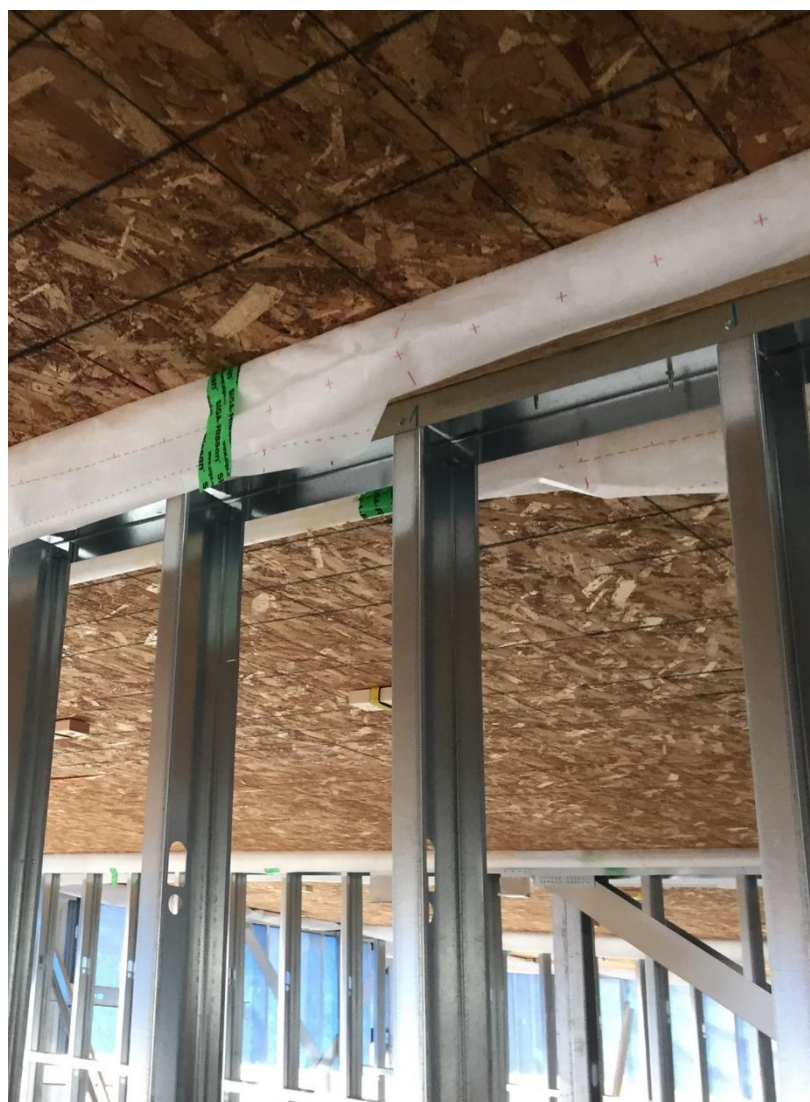
**R54**

Exterior Wall Assembly

1-Insulation  
2- Thermal bridge Free  
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Windows and Doors  
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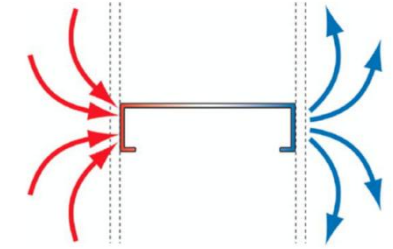
- 1- Insulation
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## Roof SIPs + 6" tapered insulation



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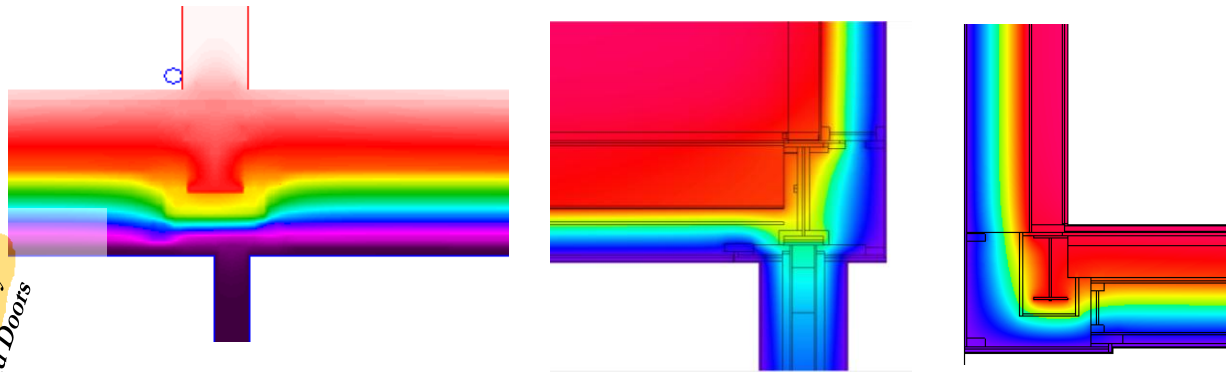
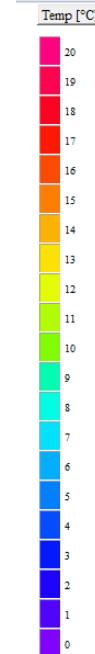
## Thermal conductivities:

Neopor Insulation: 0.032 W/mK

Wood: 0.13 W/mK

Concrete: 2.3 W/mK

Steel: 50 W/mK



Thermal bridge description	User determined length [m]	$\psi$ W/(mK)	Fraction of transmission heat losses
Det 4/A825 Beam along K @ parking	4.73	0.082	0.1%
PH825.1R2 Garbage/ West wall	3.68	0.082	0.1%
PH825.2R2 G1 Beam above Parking	8.66	0.016	0.0%
3/A825 Column & Beam connection at G	1.00	0.024	0%

**98 kWh/year - \$5.00/ year**

Thermal conductivity



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All service penetrations are meticulously taped for state of the art airtightness



air tight installation at the Steel brackets with Siga Nail Seal Tape



### Final Blower Door Test Results:

Depressurization: 0.30 n50

Pressurization 0.34 n50

Average: **0.32 n50**



Dryer exhaust damper



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## Air Barrier



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### Certificate

**Certified Passive House Component**  
for cool, temperate climates; valid until 31.12.2015

Category: **Window Frame**  
Manufacturer: **aluplast GmbH**  
76227 Karlsruhe, GERMANY  
Product name: **Energeto 8000 I passiv**

This certificate was awarded based on the following criteria:

Given a  $U_g$  value of 0.70 W/(m²K) and a window size of 1.23 m by 1.48 m,

$$U_w = 0.80 \text{ W/(m}^2\text{K)} \leq 0.80 \text{ W/(m}^2\text{K)}$$

Taking into account the installation based thermal bridges and provided that the installation is, with regard to the thermal bridges, equal or better than shown in the data sheet, the window meets the following criterion.

$$U_{w, \text{installed}} \leq 0.85 \text{ W/(m}^2\text{K)}$$

**Thermal data**

	$U_r$ -value [W/(m²K)]	Width [mm]	$\Psi_g$ [W/(mK)]	$f_{Rsi=0.25}$ [-]
Spacer			SWISSP, Ultimate*	
Bottom	0.92	148.9	0.024	0.76
Side/top	0.79	119	0.024	

\*Spacers of lower thermal quality, especially those made of aluminium, lead to significantly higher thermal losses and lower temperature factors.

For further information, please see the data sheet

www.passivehouse.com 0638wi03

Passive House Institute  
Dr. Wolfgang Feist  
64283 Darmstadt  
GERMANY

Passive House Efficiency Class

phA advanced component  
phB basic component  
phC certifiable component  
not suitable for Passive Houses

PHI CERTIFIED COMPONENT  
Passive House Institute

### Certificate

**Certified Passive House component**  
for cool, temperate climate, valid until 31.12.2015

Category: **Curtain Wall**  
Manufacturer: **Raico Bautechnik GmbH**  
87772 Pfaffenhausen, GERMANY  
Product name: **THERM+ 56 H-I**

The following comfort criteria were used in awarding this certificate:

Given a  $U_g$  value of 0.7 W/(m²K) and an element size of 1.20 m by 2.50 m,

$$U_{cw} = 0.80 \text{ W/(m}^2\text{K)} \leq 0.80 \text{ W/(m}^2\text{K)}$$

Taking into account the installation based thermal bridges, and provided that the installation is, with regard to the thermal bridges, equal or better than shown in the data sheet, the facade meets the following criterion.

$$U_{cw, \text{eingebaut}} \leq 0.85 \text{ W/(m}^2\text{K)}$$

**Thermal data of the construction**

	$U_r$ -value [W/(m²K)]	Width [mm]	$\Psi_g$ [W/(mK)]	$f_{Rsi=0.2}$ [-]
Spacer			Swisspacer V*	
Transom (t)	0.91	56	0.034	0.79
Mullion (m)	0.91	56	0.034	
Thermal glass carrier bridge $\chi_{GT}$ [W/K]:				0.004

\*Spacers of lower thermal quality, especially those made of aluminium, lead to significantly higher thermal losses and lower temperature factors.

Further information see data sheet

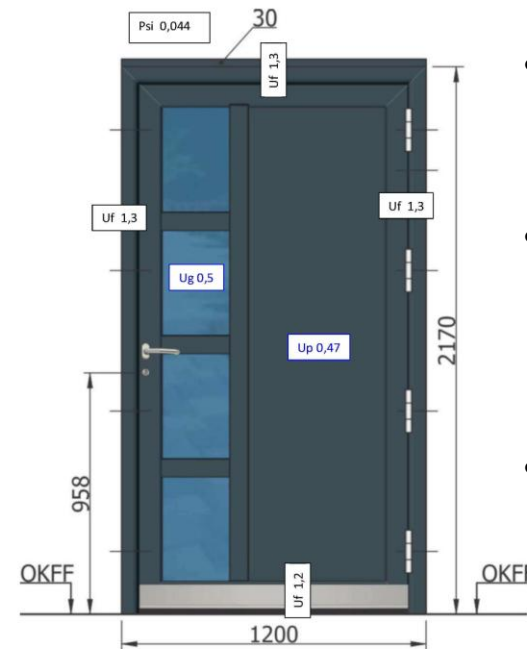
www.passivehouse.com 0167cw03

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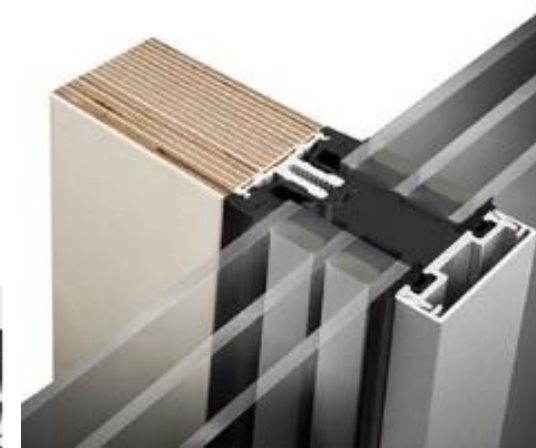
Passive House Efficiency Class

phA advanced component  
phB basic component  
phC certifiable component  
not suitable for Passive Houses

PHI CERTIFIED COMPONENT  
Passive House Institute



- Fenêtres:  
 $U = 0.80 \text{ W/(m}^2\text{K)}$
- Triple Vitrage:  
 $U = 0.57 \text{ W/(m}^2\text{K)}$   
SHGC: 0.5
- Portes Exterieures:  
 $U = 1.1 \text{ W/(m}^2\text{K)}$



$U=0.8\text{W/(m}^2\text{K)}$ ,  $R_7$

**Gaulhofer**

**RAICO**

**HERRMANN'S**  
Timber-Frame Homes

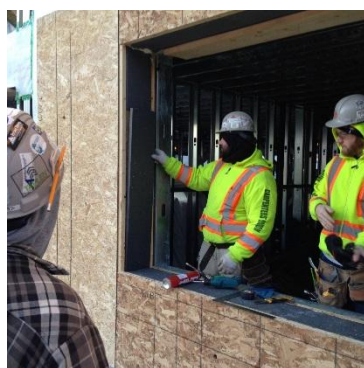
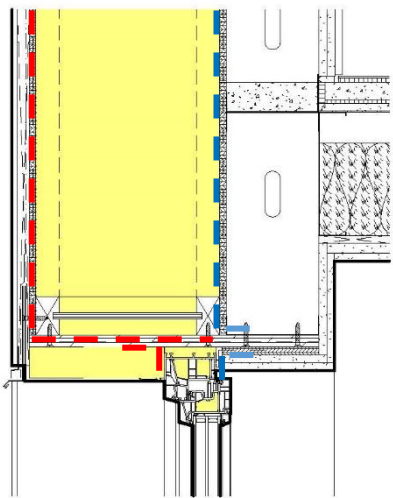
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**Windows and Doors**



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Windows and Doors



Fill the gaps of the I joists with neopor



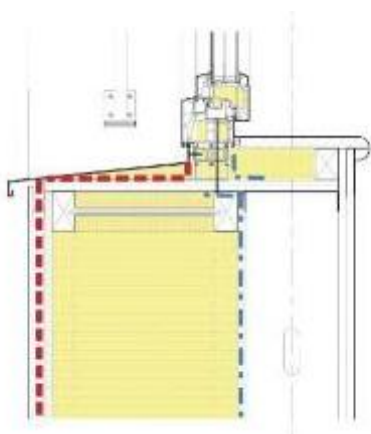
Plywood box install



Airtightness at window opening



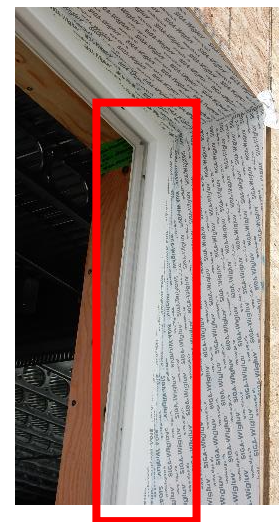
Lap to primary airtightness layer



Vapour control: Lap to primary vapour control layer



Window is set and screwed in place



More taping around the exterior perimeter of the frame for continuity of the airtightness and vapour control layers



Vapour Open Spray Foam on the inside



## PH Windows : Tilt, turn, sensors

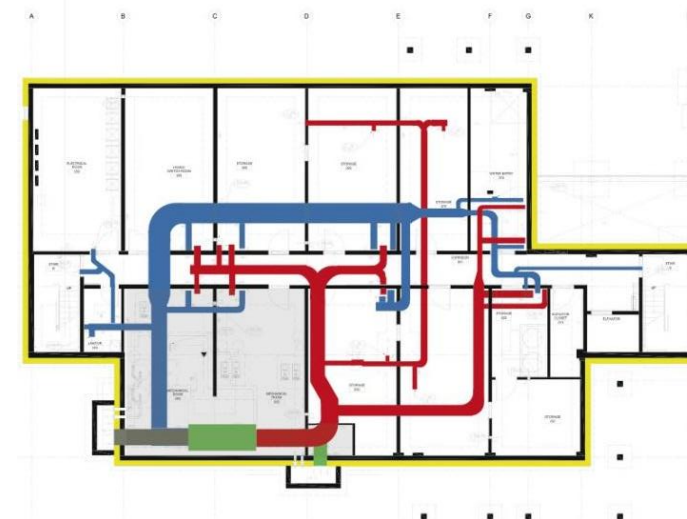
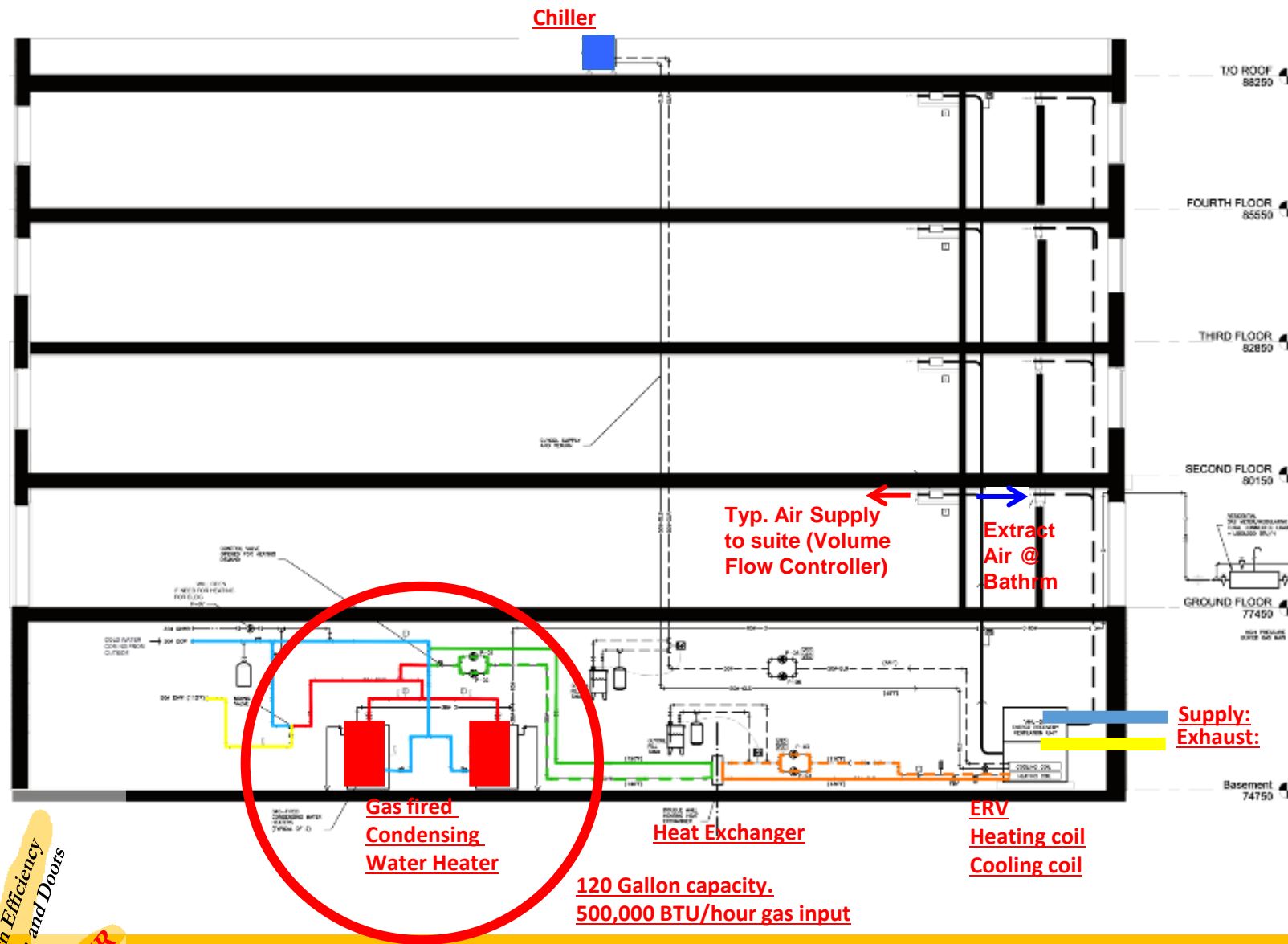


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# HVAC



## Legend

- DHW @ 60 °C
- Domestic Cold Water DCW
- DHW @ 44 °C
- DHW to heat exchanger
- Supply
- Return
- Space Heating Water (to heating coils)
- Supply
- Return



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# Why Gas, not Electricity?

## Electricity

Cost 14 cents/ kWh

Carbon emissions: 532g/ kWh at the source energy

## Gas

Cost: 5 cents/ kWh

Carbon emissions: 250g/kWh at the source energy



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300 W



Haiku  
K3127-S0-PB-04-02-C,  
K3127-S0-PW-04-02-C

Size (Diameter in Inches)	52	<b>Features:</b> Haiku® I Series ceiling fans come equipped with breakthrough SenseME™ Technology that allows users to automate their comfort and save energy year-round. These 60" fans are built from a durable, glass-infused matrix composite and go through a 13-step hand-balancing process to ensure that they won't wobble or rattle.  Featuring an ultra-efficient motor and an elegant design that's won awards the world over, I Series fans operate silently and bring a dash of sleek sophistication to any space. Every I Series fan can be conveniently controlled using the included remote or the Haiku Home app for iOS or Android.  To learn more, visit <a href="http://bigassfans.com">bigassfans.com</a> <a href="#">EXIT</a> or call 877-244-3267.
Airflow Efficiency by Speed (CFM/Watt)	Low	
	Medium	
	High	
Annual Energy Use (kWh)*	6.7452	
Annual Operation Cost	\$ .77	
Lifetime Operation Cost	\$7.75	
Motor Warranty (Years)	Lifetime	
Components Warranty (Years)	1	
MSRP	-	

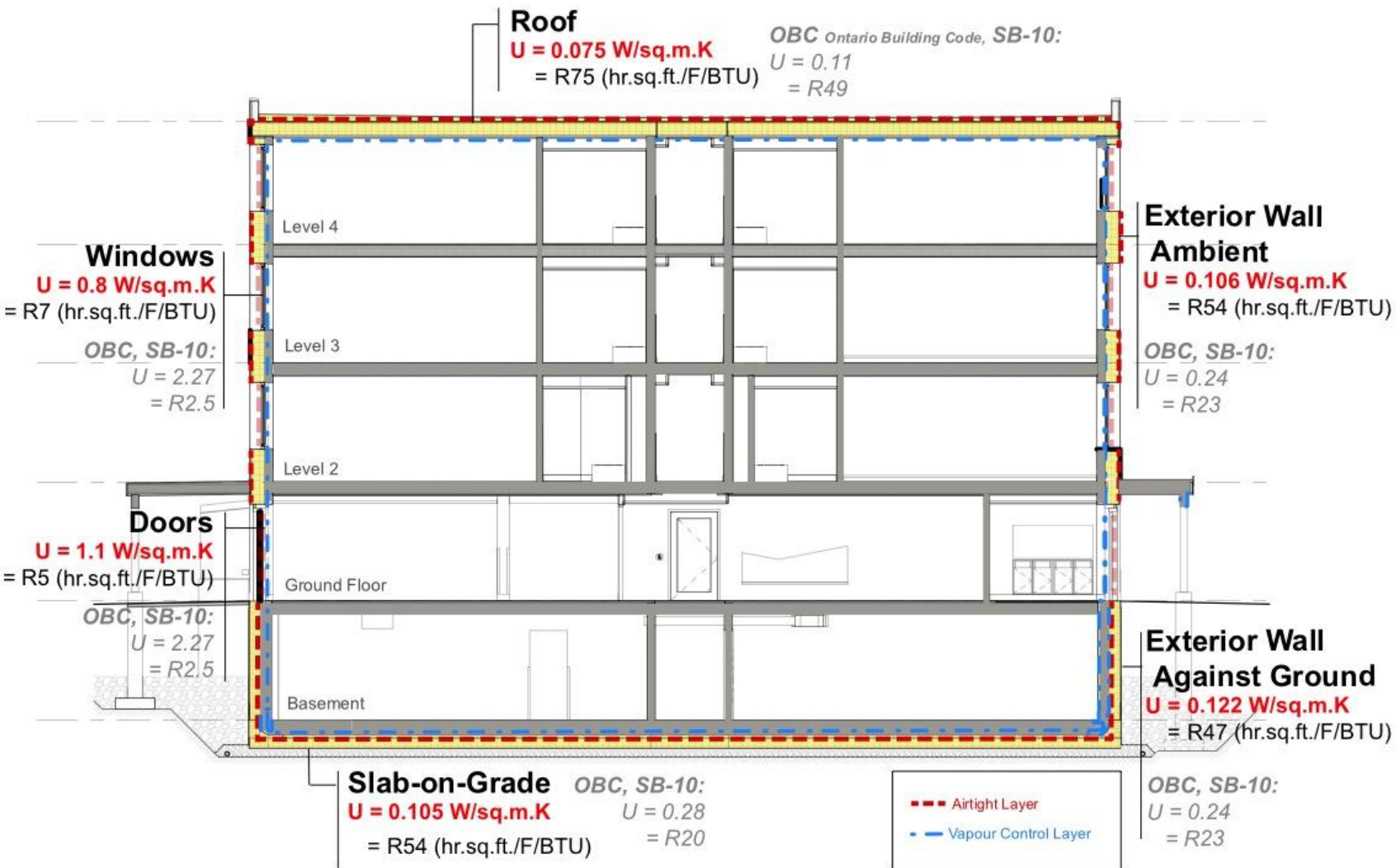


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## Auxiliary heating and cooling



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Roof 1.5  
 Exterior Walls 2.3  
 Below Ground Walls 2.3  
 Basement Slab 2.7  
 Windows 2.8  
 Doors 2

# Ontario Building Code factors



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Total eq. CO2 emissions including DHW, auxiliary electricity, lighting and appliances  
62,490kg/year

or

50% reduction compared to the OBC

Total eq. CO2 Emission from Heating excluding DHW

Heating demand : **14 kWh/m<sup>2</sup> year**

8,544 kg/year

or

85% reduction compared to the OBC

## CO2 Emission Recap



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# Subsoil Glycol Loop already in place



4 loops (Approx. 400mm )of geothermal horizontal pipes around the foundation wall min 5' below grade to harvest ground energy.

Salus Clementine Net Zero-Readiness



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# \$29



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# PASSIVHAUS

A BUILDING QUALITY REVOLUTION

**metr**

**CBCradio**

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**"A RENEWAL FOR OTTAWA" ...**  
BEACON SUSTAINABILITY PROJECTS...  
Insights on the Windmill Zibi Project, Salus Clementine

**disrupting  
DESIGN**

# 20th INTERNATIONAL PASSIVE HOUSE CONFERENCE 2016

the collaborative and innovative approach taken and various partnerships (Algonquin College etc.), elaborate on the district energy system approach

One Planet Living is an initiative of BioRegional and its partners to make truly sustainable living a reality. One Planet Living uses ecological footprinting and carbon footprinting as its headline indicators. It is based on ten guiding principles of sustainability as a

**PASSIVE HOUSE RESIDENTS WORLDWIDE OPEN THEIR HOMES:**

## International Passive House Days

13-15 November 2015

Renee Gratton, President of the Construction Resource Initiatives Council will lead and moderate the conversation on the common denominators between the CRI Council's own reform initiatives, One Living Planet Living project like Zibi, Salus Clementine and World Cities Projects. Why are these Beacon Projects for the City of Ottawa?

6:00pm Networking Dinner  
7:00pm Plenary Presentations  
8:00pm Audience Discussion, Q&A

To purchase tickets: <http://www.eventbrite.ca/eb-events-for-ottawa-beacon-sustainability-projects-insights-on-the-windmill-zibi-project-salus-clementine-1670037212>

**Efficient & Active Ventilation Systems for Residential Buildings**

**JUNE 17, 2015 5PM-8PM**  
Algonquin College  
150 University Ave.  
CA Building, Rm CA108 abc

**PRESENTATION OUTLINE:**  
In this presentation we will explain from the why's to the how's of residential ventilation.

- Why ventilate?
- The significance of moisture and air contaminants in homes
- Why are windows not the tool of choice?
- The necessity of a force for continuous air exchange and good air mixing
- Why is tightness first?
- Why heat recovery?

**How to design an efficient residential ventilation system:**

- An air handling unit and distribution system fit for a Passive House
- How not to lose the force;
- the dark side of filters and ducts;
- how to keep everyone healthy and comfortable at home and let the force be strong with you!

**SPEAKER: Dr Kara Rosemeier**

Kara Rosemeier PhD is the chair of the Passive House Institute New Zealand and director of the Passive House Academy New Zealand. She studies and works in the architecture classroom at the University of Auckland. Her PhD thesis looked at "Healthy and affordable housing in New Zealand: the role of ventilation".

Before moving to New Zealand she was the director of an engineering consultancy in Germany where she advised the federal and state governments on matters of energy efficiency in the building sector. Kara worked with various clients on the building projects of Passive Houses while supervising hundreds of retrofit projects. Additionally she managed an up-skill training initiative for building professionals.

Her book "Passive House Homes" co-authored with Dr. Rüdiger Birkelmeier, will be published by CIBO soon this year.

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**CSC CONNECTIONS CAFÉ...  
ECONOMICS OF SUSTAINABILITY**

**"An engaging evening of information sharing, networking and expert panel discussion to explore the Economics of Sustainability"**

We will explore with a panel of experts:

- The different dimensions of Sustainability from the Economic, the Social, Technological, Environmental and Political perspectives;
- Head of the Austria Passivhaus Network Gunter Lang, Award winning Architect Anthony Leaning, Sustainability leader Nadine Gudzy, Passive House expert and building performance passionate Malcolm Isaacs, Economist Rob Conboy and Builder Adam Cronk will look at the challenge of ensuring that the three pillars of Sustainability- Economics, Society and Environment- can be met;
- How creative energy solutions and innovative technology are contributing to a sustainable future.

**You are invited to join the conversations and get**

**SABMag**

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National Media Partner of the Canada Green Building Council

Official education provider for LEED professionals through the Green Building Certification Institute

INCLUDES THE SUPPLEMENT

**Canada Green Building Council**

**house**  
THE HIGH-PERFORMANCE HOUSING SUPPLEMENT

**SALUS CLEMENTINE**

Learn more about Passive House energy efficiency certification and the innovative Salus Clementine project that is seeking to be Canada's first multi-unit residential project to achieve this.

**KEYNOTE SPEAKERS:**

**Gunter Lang**  
CEO at Lang Consulting, Head of Passivhaus Austria

**Andrew Peel**  
Passive House Certified

**THE TYEE**  
NEWS, CULTURE, SOLUTIONS.

[March 12, 2015] [10:00am - 12:00pm] [464 Metcalfe Street]

**PASSIVHAUS MEETS NET ZERO**

**Webinar prepared by:**  
Passive House Ontario Group  
Ca. G.B.C.  
Greater Toronto Chapter

**Sponsored by:**  
Pinwheel Supplies

**Andrew Peel, Peel Passive house Consulting**  
He is Canada's only building certifier. He has a tremendous depth of knowledge and experience in building energy performance and technology assessment and modeling

**Jessica Grove-Smith, PHI**  
She is part of the research team at the PHI. Her responsibilities range from stationary and dynamic energy demand modeling, to the renewable primary energy assessment that is being introduced for the new Passive House classes.

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**naphn**  
16 North American Passive House Network  
CONFERENCE & EXPO

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JUNE 13-14  
NEW YORK CITY



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# OTTAWA CONSTRUCTION NEWS

**SALUS**

**Where Hope Finds a Home.  
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# Thank you...

# Questions Welcome

Lisa Ker

[lker@salusottawa.org](mailto:lker@salusottawa.org)

Sonia Zouari

[sonia@passivehouse.ca](mailto:sonia@passivehouse.ca)

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**@salusottawa**



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