W02 – A Primer on High Performance – Passive House Buildings

Wednesday, November 8 8:30-10:00
QUARTER HORSE A/B

Speakers:
Rob Bernhardt, CEO, Passive House Canada
Doug Owens, Senior Director of Operations, Housing, Brookfield Residential
PASSIVEHOUSE CANADA
Build better. Feel better.

PASSIVEHOUSE CANADA
High Performance Buildings

- **Why?**
- **Characteristics of high performance buildings**
- **A foundation for net zero, zero carbon, etc.**
- **Project delivery**
Conventional buildings:

- Consume up to 40% of global energy use
- Contribute up to 30% of annual global GHG emissions
CARBON EMISSION - LIFE QUALITY IN BUILDING INDEX
DATA TO BE AGGREGATED AT CITY LEVEL

- REPRESENTS A LARGE COMMUNITY OR CITY

PROJECTED GOAL
BUILDINGS OF THE FUTURE
HIGH LIFE QUALITY/
NEGATIVE CARBON BUILDINGS

CURRENT TRAJECTORY
MID-HIGH LIFE QUALITY/
HIGH CARBON BUILDINGS
Policy Context
Why Passive House?

Better buildings

• UNECE
• Build Smart – Canada’s Building Strategy
• BC Step Code
• Energy Efficiency AB
• Vancouver & Toronto Zero Emissions Buildings
• Regional & municipal policies & initiatives.
Market Transformation

- **Innovators**: 2.5%
- **Early Adopters**: 13.5%
- **Early Majority**: 34%
- **Late Majority**: 34%
- **Laggards**: 16%

(Sources: Everett Rogers Diffusion of Innovations revised)
Energy Use Intensity (kWh Per m² Per Year) For Residential Buildings In Canada

- **Space Heating**: 146 kWh/m²/yr
- **Water Heating**: 15 kWh/m²/yr
- **Appliances**: 38 kWh/m²/yr
- **Lighting**: 31 kWh/m²/yr
- **Space Cooling**: 9 kWh/m²/yr
- **Passive House**: 2 kWh/m²/yr

From Pioneer...

Darmstadt, 1991
...to Whole Communities...

- 700 apartments
- 560 student apartments
- 7,000 workplaces
- 21,000 m² Laboratory
- Kindergarten
- Supermarket
- Cinema

To be completed in 2020
...to deep energy retrofits...
What is a Passive House

- EU research project
- Specific performance targets
- Energy model
- Not prescriptive
- Comfort, air quality & hygiene requirements
- Quality assurance
- Eliminates performance gap
26-story Residential Building

for

Cornell University

now completed on Roosevelt Island in New York City
**Predicted vs Actual Performance**

Bank of America Tower, NY
- LEED Platinum
- uses more kWh/m² than any other office tower its size in Manhattan

The reason?
- LEED assesses relative improvement over baseline design....
- But baseline could be an energy hog (as in this case)
What is a Passive House?

- Foundation for other standards
- Materials
- Renewables/Net Zero
- Resiliency – design for 2080
- Embodied & operational carbon
What is a Passive House?

- A tool, not a brand
- An application of building science
- Fabric first approach
- Constructed according to design
- Details matter
- Simpler, more robust buildings
- Care facilities, first nations, social housing
Walls

• Thermal bridge free
• Window/door installation
• Thermally broken couplers, structural and thermal properties
• Simple form, envelope décor is external
Windows

- Different requirements in different climates
- Operable windows required occupied spaces
- No condensation/drafts.
- External shading
- Installation details
- psi values calculated
Sub-grade

- Heated basement – thermal bridge free insulation
- Parkade thermal bridges
- Elevators, services
- Slab on grade vs crawl space
Mechanical

- High efficiency, entire system
- Silent
- No drafts
- Commissioned
- Balanced
- Simple consumer controls
- Ease of maintenance
Energy Model

- A design tool
- Detailed data entry
- Iterative design with scenarios
- Tracks CO2
- Several certification levels
- Incorporates renewables
TEDI & PER

- Heating/cooling demand vs load
- Generally not challenging with suitable AV ratio
- Primary Energy Renewable
- Equipment codes & standards
- Innovation in design & equipment required
Project Delivery

- An investment in design
- Front load design
- Better drawing details
- Attention to detail & QA
- Model informs design
- Simple, but not easy
Project Delivery

- Impacts design
- Local bylaws - wall thickness, cantilevers
- Solutions require creativity
- Takes time, energy, commitment
- Project leadership key
- Focus on desired outcome
Procurement

- Develop a strategy
- Develop trained and experienced project teams
- Avoid those who do not have training, but believe they know how
- Engage with others delivering similar projects
Thank you

For more information:
Visit    passivehousecanada.com
Email    info@passivehousecanada.com
Call     1-778-265-2744
A Game-Changing Concept Home

An Exhibition of Innovation and Efficiency
Symons Gate Passive House
Why ‘Passivhaus’ standard?

- Represents most stringent building energy standard in the world.
- Standard focuses on conservation and resiliency; Canadian roots.
- Design leverages one of Alberta’s most abundant resources.
- Elegantly simply design requirements; providing comfort, health & security.
- Allows for a great deal of flexibility in design, presents challenging targets.
- Relatively unknown building standard in Canada.
- Project - highlights building code and bylaw challenges to innovation.
- Introduces alternative building materials and mechanical systems.
- Provides educational opportunities, creates awareness.
- **It’s just plain fun.....**
• 2013 Passive House built by Bernhardt Passive Homes in Victoria was recently certified by the Passivhaus Institute.

• 1977 Conservation House built in Regina, Saskatchewan.
What makes a Passive House?

- 15 kWh/m²/a or 10 W/m² heating during worst case scenario
- 0.6 ACH @ +/- 50 Pa (8-10 m/s wind)
- 120 kWh/m²/a primary energy usage
- Excess temperature frequency <10%

Typical Heating Energy Intensity for Canadian Housing
Bic™ Lighters…

- A tea light gives 30W of heat
- You have a 30m² room
- How many tea lights to heat a passive house at 10W/m²?

\[ \frac{10W}{m^2} \times 30m^2 \times \frac{1 Tea Light}{30W} = 10 Tea Lights \]

- A Bic lighter produces 70-80 Watts. You would 3.75 – 4.3 Bic lighters.
Symons Gate
Passivhaus - Overview

- Calgary, AB – 274 Sage Bluff DR NW
- Single Family – 2,435 SQF
- Structure – Cross Laminated Timber
- Wall Assembly – Open Diffusion
- Insulation – Wood Fibre Board
- Walls (Effective) – R45
- Roof (Effective) – R51
- Basement (Effective) – R54
- Windows – Uw - 0.125 (R 8.0)
- HVAC - Earth-tube
- HVAC – HRV / Active By-pass
- Air Tightness – 0.6 ACH
Pure Blue
THE GREENEST GREEN IS BLUE
Symons Gate Passive House - Challenges

- ~200 – SQF Differential
- Front Attached House - Glazing
- Alternative Solutions (Engineering)
- Lot Availability / Orientation
- Glazing Restrictions / Sprinkler
- Architectural Requirements
- Product / Material Availability
- Consumer Acceptance – Gas
- Skills & Capabilities
- Experience / Case Studies
- Perception – Air Quality
- Additional Upfront Costs
- How much will I save?
Symons Gate - Passive House

Doug Owens – Senior Director Strategic Development and Regulatory Affairs
Marcello Garcea – Project Manager
Jordan Revak – Site Superintendent
Dean Guidolin – Lead, Architectural Designer

Brookfield Residential Properties
4906 Richard Rd. SW
Calgary, AB, T3E 6L1
403.231.8900
info@brookfieldrp.com