



New Opportunities for Affordable Housing Include ‘Passive House’ Design

Cities large and small struggle with inadequate affordable housing that can be costly to operate. Could low-energy building practices be a part of the answer to more and better housing? For a growing number of developers, the answer is yes.

At one time, constructing as many homes or units as possible, as cheaply as possible, seemed to be the way to create affordable housing. Yet as with most things, you get what you pay for. History has shown that it’s better to look at costs over a building’s life cycle rather than just the cost to build.

Developers like Hamilton-based Indwell believe that spending money up front to create energy-efficient buildings will reduce maintenance and operating costs later. This makes low-energy design and construction the smart way to build affordable housing.

“It’s actually quite doable to reduce energy use and get a better building,” says Graham Cubitt, Indwell’s Director of Projects & Development.

Indwell’s goal is to build at about the same cost as conventional construction. That goal is critical for all parties. Money to build includes affordable housing grants from the three levels of government. In exchange, Indwell guarantees it will only charge tenants the shelter allowance set under the Ontario Disability Support Program for up to 40 years.

Over that time, an energy-efficient building ensures tenants are comfortable and can afford their utilities. The developer and property manager also face reasonable utility, repair and maintenance costs.

Indwell’s journey to energy efficiency

As a Christian charity, Indwell’s mission is to create affordable housing for people seeking health, wellness and belonging.

Indwell’s first major construction project was the **Perkins Centre in Hamilton** in 2011. Cubitt’s design team simply aimed to create a high-performing building with 46 studio apartments and a community space. For the **Harvey Woods Lofts in Woodstock**, in 2015, the team tried for both the least greenhouse gas (GHG) emissions and best performance. The project converted a former industrial building, which now has 80 one- and two-bedroom apartments, commercial offices and community meeting spaces. The build included a geothermal space heating and cooling system.



Figure 1 Harvey Woods in Woodstock.

Cubitt's design team is LEED-accredited, and used ideas from Leadership in Energy and Environmental Design (LEED) and other sources to improve energy efficiency with each project. However, they wanted actual energy performance to go further.

A friend who works in social housing introduced Cubitt to the concept of the "Passive House" in 2016. This high-performance model is an internationally recognized science-based construction standard. Passive House buildings consume up to 90% less heating and cooling energy than conventional buildings. According to Passive House Canada, the reduction in operating costs can quickly make up for any extra construction costs.¹

The Indwell team toured some Passive House projects. They liked that the standard provided a framework to design low-energy-consuming and –GHG emitting buildings, not just energy-efficient buildings. It also compared favourably to Net Zero Ready and other standards for low energy use.

Indwell first used "passive design" for a large renovation – **Parkdale Landing in Hamilton**. Passive design refers to specific technology, construction methods and strategies that increase energy efficiency, reduce operating costs and improve indoor environmental quality, but without complex mechanical or energy systems.² The project turned a former tavern and rooming house into a mixed-use commercial/residential building with 57 studio apartments, a pharmacy, convenience store and neighbourhood food hub.

The passive design approach

"The elements of passive design aren't radically different," Cubitt explains. "The process involves learning about new materials and deliberately designing for minimal thermal bridging and excellent air tightness."

Passive design methods often mean relatively simple and inexpensive improvements. Cubitt points to these five key areas:

1. **High levels of insulation** mean the building doesn't lose heat through its envelope – R55 walls, R60 roofs and R20 under slab, in Indwell's case.
2. **High-quality windows** are triple-glazed with thermally broken and insulated frames, high-quality glass and low emissivity coatings.
3. **Attention to solar orientation** places windows to maximize solar gains, daylight and occupant experience and reduce summer heat gains through exterior shading, if necessary.
4. **Eliminating or reducing thermal bridging** through the building envelope reduces heat loss at areas such as balconies, roof anchors and window supports.
5. **An airtight building envelope** minimizes heat and cooling loss by air leakage while indoor air quality is maintained with a high-performance ventilation system.

"Over time, we've become more focused on the building envelope and insulation levels," Cubitt adds.

The Passive House Institute's EnerPHit standards³ recognize that retrofitting is more complicated than a new build. For example, EnerPHit allows air tightness of 1.0 air changes per hour at 50 Pascals vs. the original standard of 0.6 air changes. Cubitt reports that recent tests show Parkdale Landing's air tightness at just 0.29 air changes per hour.

Indwell finds it is most efficient to put up three- to six-storey multi-unit residential buildings. A software program called the Passive House Planning Package⁴ helps model the buildings. So far, the floor plans haven't been repeatable – as no two buildings or sites have been alike enough to simply copy.

For the early projects, Indwell found it difficult to source cost-effective materials. Some equipment or materials weren't yet available in Canada. Yet even by the third project, more "Passive certified" products had come on the market. New sources mean the team can now specify supplies made in Canada that weren't available for the first.

¹ PassiveHouseCanada.com

² Housing Observer, Sept. 2017: Passive Approaches to Low-Energy Affordable Housing

³ EnerPHit: <https://passivehouseplus.ie/enerphit>

⁴ Passive House Planning Package available from https://passipedia.org/planning/calculating_energy_efficiency/phpp_-_the_passive_house_planning_package





Figure 2 Window detailing for airtightness.



Figure 3 Roofing airtightness well-sealed pipe.



Figure 4 External photo showing triple-glazed windows.



Besides Parkdale Landing, Indwell's current projects are new builds:

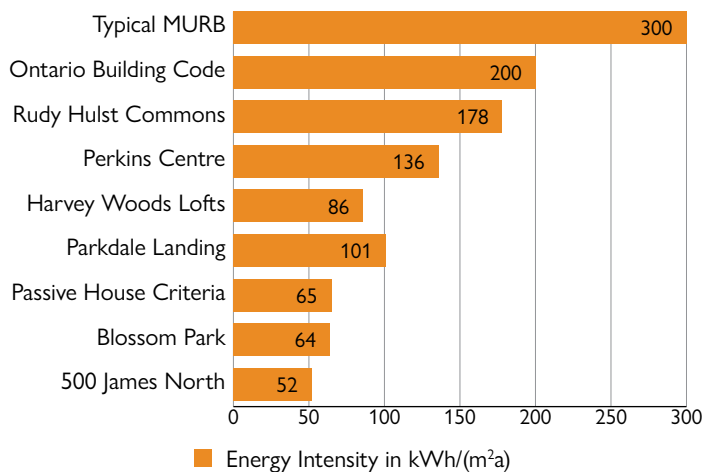
- Blossom Park Phase II, Woodstock, where 34 apartments will replace a former group home.
- Hughson Street Baptist Church, Hamilton, which includes a new church and 45 housing units.

Other earlier projects helped inform Indwell's approach to energy-efficient building development:

- Strathearne Suites, Hamilton, which is a former rooming house converted to 39 independent living apartments with a community kitchen. This involved a full upgrade of the building envelope and HVAC systems.
- Hambleton Hall, Simcoe, which converted a church's former Sunday school building into 40 one-bedroom and bachelor apartments. The team also added a community kitchen and multi-use room, and a community garden.
- Rudy Hulst Commons, Hamilton, which includes 47 one- and two-bedroom apartments as well as Indwell's head office.

"With each building, we get a better feel for what does and doesn't work," Cubitt says. "The new ones are very much inspired by recent ones, so the learning curve has really improved."

Figure 5 Total Energy Intensity in KWH/(M²/Year)



Source: Invizij Architects Inc.

Passive houses easier, cost-competitive, environmentally friendly

Achieving Passive House standards may seem like a stretch. Cubitt says, "If you are conscientious about construction, it's both easier than you think and cost-competitive with conventional builds – less than 5% more."

He adds, "By building this way, we'll be compliant with new building codes and standards for lower energy use and reduced emissions. At the same time, we can deliver a high-quality living experience for our tenants while helping meet Canada's Paris Agreement commitments on climate change."

“Buildings consume up to 40 per cent of global energy use and contribute up to 30 per cent of annual global greenhouse gas emissions.”

- Passive House Canada

Passive House Canada⁵ notes that "Buildings consume up to 40 per cent of global energy use and contribute up to 30 per cent of annual global greenhouse gas emissions."

Cubitt says, "For now, there's no extra bill for that greenhouse gas, but it's smart to plan ahead. It's possible to build now to meet future higher standards, so we won't have to retrofit to get there. Plus it's the right thing to do."

The contractors working with Indwell have embraced that forward-thinking approach. Cubitt says they have been willing to send their staff for training and learn new methods for thermal bridging and other techniques. They have also worked through the design process with Indwell's architects at Invizij.

⁵ Passive House Canada, <http://www.passivehousecanada.com/about-passive-house/>





Figure 6 Photo of Graham Cubitt, Indwell's Director of Projects and Development

"Building to Passive House standards isn't without challenges, but it's not onerous," Cubitt says. "And it's so meaningful to be able to provide high-quality homes for people who have experienced homelessness or unstable housing."

As Indwell has shown, low-energy design can be both a practical and visionary answer to more and better affordable housing.

Find out more

Indwell: <http://indwell.ca/>

Passive House Canada:
www.passivehousecanada.com

Passive Buildings Canada: www.passivebuildings.ca

Canadian Passive House Institute:
www.passivehouse.ca

Passive Approaches to Low-energy Affordable Housing Projects – Literature Review and Annotated Bibliography: ftp://ftp.cmhc-schl.gc.ca/chic-ccd/h/Research_Reports-Rapports_de_recherche/2017/RR_Passive_Approaches_to_Low_energy_Affordable_Housing_Projects.pdf

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Alternative text and data for figures

Figure 5: Total Energy Intensity in KWH/(M²/Year)

Building	Energy Intensity in kWh/(m ² a)
Typical MURB	300
Ontario Building Code	200
Rudy Hulst Commons	178
Perkins Centre	136
Harvey Woods Lofts	86
Parkdale Landing	101
Passive House Criteria	65
Blossom Park	64
500 James North	52

Source: Invizij Architects Inc.

