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## FROM THE PUBLISHER'S DESK



Giulio Marinescu, Publisher

It's a Catch-22 situation for every business owner – to shell out the expensive investment needed for participation in traditional trade shows ... or not.

Until recently, physically setting up a booth, and all the inherent rental and promotion costs, could easily reach \$100,000. For the largest firms, perhaps that was manageable, but for small and medium businesses those expenditures were becoming unmanageable.

Now, however, with the advent of virtual trade shows, business owners can instantly get much more bang for their buck – and all from the comfort of their offices, without the financial burden and logistical inconvenience of the traditional option.

In many ways, this shift is an industry game-changer, with more budget-friendly costs, and a green stamp of approval to boot. The virtual alternative eliminates the need for transportation of people and materials; that alone reduces a company's carbon footprint.

For the uninitiated, virtual trade shows are designed for online use, designed to resemble a convention centre, with lobbies, networking lounges and exhibit halls. There are booths for showcasing products and services. An online attendee can view demos, peruse literature, or chat with sales reps in real time. Often, there are keynote speeches or webinars, videocasts and podcasts, as well.

With companies these days adhering to green, sustainable policies, the virtual trade show concept is catching on in a big way. This year, in fact, Green Building + Architecture magazine is presenting the first Canadian virtual trade show for green and sustainable building. Called Green Building Expo, it is utilizing cutting-edge technology. It's definitely budget-friendly and free for attendees.

Companies, traditionally, participated in trade shows to generate new sales leads. People attended conferences for content and networking. The same results, as it turns out, can be attained by becoming involved in virtual alternatives such as the Green Building Expo.

And in many ways, beyond the financial implications, a virtual show has much more going for it. A physical trade show, to recap, can be a hassle for a large corporation and a major logistical nightmare for small and medium players. At a physical

## A no-brainer – virtually

## Switching from a costly traditional trade show to a more affordable cyberspace model

## Canada's premier virtual trade show for green building



November 1st, 2017 from 9a.m. to 6 p.m.

attendees are jammed into a cramped, noisy space. Often, the "little guy" gets dwarfed by the "big boys," armed with substantial war chests, premium advertising and booth space, as well as high-profile keynote presentation exposure.

Now, thanks to computer technology, the playing field is level. There's no doubt we'll see explosive growth. It's not a stretch to suggest that the virtual event market could replace the traditional conference and trade show concept.

Some of the more obvious advantages to virtual trade shows include:

- **The green effect:** Not only does the virtual model reduce a company's carbon footprint on the front end, but it also eliminates **the production of materials that will go to waste** after an event.
- **Making perfect sense:** It's logical to utilize new technologies and trends — after all, that's what you're encouraging your buyer to do. So it goes hand in hand with sustainability.
- **Tracking lead generation:** Virtual trade show platforms make it easy to provide prospects with downloadable materials, and many offer **built-in tracking, lead management, and attendee profiles** so you know exactly who is downloading what.
- **Saving money:** For those who've been to trade shows, you know it costs a lot, both to sponsor booths and to attend. Among the expenditures are paying for employee time, travel, lodging, and meals, not to mention the various outlays

ing, electricity and shipping. There is absolutely no question that **exhibiting at a virtual trade show costs significantly less.**

- **Better time management:** Virtual trade shows not only allow you to save time on travel, **but they often house your virtual booth for up to a year after the actual event.** That means that the money you pay for your space isn't buying you a few days, it's buying a more long-term marketing platform.

- **The cool factor:** Booths can link directly to an exhibitor's Twitter, LinkedIn, Facebook or YouTube social media accounts. Impossible to dispute the value of that.
- **Extended reach:** Companies can reach out to a global audience to generate a high volume of leads and prospects.

Moreover, virtual events are quickly evolving, becoming much more user-friendly. No longer do you have to understand complex computer functions to take part. While the basic computer skills of sponsors and attendees have likely progressed over the years, the virtual trade show developers have made the experience much more accessible, as well.

*For additional information about the first Canadian virtual trade show for green and sustainable building, contact Executive Managing Director, Giulio Marinescu at 416.250.0664.  
**www.green-building-expo.com**  
giulio@green-building-expo.com*





# ALL ABOUT THE DETAILS

Wallzcorp Inc.  
dedicated to clients  
and takes a  
personalized approach

Project managers at Wallzcorp don't beat around the bush – they have a very clear modus operandi. For starters, they are the creators of a modern-day design-build process. They are their clients' most trusted providers of professional services, consistently exceeding expectations and bringing the highest value to each and every relationship. That's a key element as they take a partnership approach to help promote sustainable and economic growth of communities. Wallzcorp managers work tirelessly to ensure their projects are mutually successful, with a contribution that reaches far beyond bricks and mortar.



By continuously striving to excel at these core set of values, Wallzcorp believes long-term profitability, growth and client satisfaction will result. And A. Nima Ahmadi, President of Wallzcorp Inc., fully supports these key company principles. "Our expertise is to understand our clients' needs and vision," says Ahmadi. "We usually discuss all aspects of construction, the pros and the cons of different ideas, and work with our client step by step to bring their visions into a reality." "We recognize issues way ahead of time and address them one by one in order to get a project started and keep it progressing smoothly. We have learned that the only constant in the construction management industry is change so we anticipate potential obstacles and ask the difficult questions so we don't get any surprises in the process. We guide our client through the entire design and building process, from start to finish." Call it the one-stop-shop advantage. Wallzcorp provides everything from participation in property acquisition, to floor-plan design and assistance with the complete municipal approval process, to preparation of financial feasibility studies, to monitoring and managing all phases of development. Wallzcorp has access to award-winning architects and designers, and most of its professional trades have worked with the company for several years.



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"The first thing that we will discuss with all our customers is their requirements," says Ahmadi, whose company is based in North York in the GTA. "We discuss their wish list and we systematically manage all the information that they are looking for. This way, our clients save time and money and have single-point accountability.

At the same time, we do our best to maintain a crystal clear communication channel."

To emphasize his point, Ahmadi provides a step-by-step guide to the meticulous process Wallzcorp adheres to. And he breaks that process down into sections entitled Briefing, Idea, Sketch, Design, Develop and Celebrate.

One thing that is obvious in this process is that at Wallzcorp: *It's all about attention to detail.*

#### Briefing

"Our philosophy is that a construction project should elicit excitement, joy, and pleasure as you come home or go to your workplace.



A true custom build should reflect the personality and lifestyle of its owner, and should integrate the interior and exterior spaces with the land and gardens that surround it."

#### Idea

"In this important stage, we take the time to learn about the clients' tastes and ideas, their lifestyle requirements.

We incorporate all of this into a Personalized Project Criteria, which we use to design and prepare conceptual drawings."

#### Sketch

"In the preliminary design stage we provide three-dimensional rendering services in order to review the clients' ideas and identify the details. This will allow our client to actually see how the final project will look like before we proceed, which will also allow the client to make unlimited changes earlier rather than incurring a change that costs during the construction phase."

#### Design

"Once the client has approved the conceptual designs, we work with our team of professionals, architects, engineers and interior designers to create detailed working drawings.

This step allows the client one more opportunity to view the construction drawings, and provides a unique insight into how the design will eventually come together."



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#### Budget

"We know that every client has a budget, and we strive to provide the best bang for their buck."

After a client finalizes a style, square-footage, and wish list, we sit down and do a

complete financial analysis and discuss the most economical overall budget."

#### Development

"As construction gets started, we feel an open and consistent communication is the most

important factor for a smooth-running, stress-free experience."

We will schedule periodic meetings with the client to review interior and exterior finish material options, make selections, and to get updates on the construction progress.



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It is critical to keep everyone informed by quickly adding daily logs, updating schedules, marking up plans and more to our online construction management platform. We will also have “site walk-through” with the client at key points in the construction to

make sure that the work is according to our plan. In addition, our site manager will automatically e-mail a client a weekly construction report, outlining what took place at the site that week. Ongoing collaboration between our team

and the client continues throughout the project and until it is completed. This ensures a pleasurable building experience and guarantees that each project will be finished on time and on budget, and at the highest level of quality.”



### Celebrate

“At Wallzcorp, we pride ourselves on our quality consultants and trades as much as our projects. We recognize that our diverse, multi-skilled workforce has the desirable skills and competencies to deliver excellence in all our activities. Working together, we provide customer satisfaction at every level to maintain our reputation as honest, reliable and quality contractors. Our management team brings a vast wealth of experience and helps drive the company towards continued success.”

[www.wallzcorp.com](http://www.wallzcorp.com)

### About Wallzcorp Inc.

Wallzcorp offers all-inclusive, fully-integrated design and development management services that honour and reflect the preferences, requirements, and vision of each client. Wallzcorp represents the highest level in design creativity. The company is distinguished by its imaginative combination of artistic ingenuity, high-quality craftsmanship, and timeless elegance. Wallzcorp is deeply committed to serving its clients through a collaborative team-approach and single-point accountability. Wallzcorp focuses on the residential and commercial market in GTA, and throughout southern Ontario.



### About A. Nima Ahmadi

Ahmadi graduated from Ryerson University's Master of Architecture (MArch) program and his company has membership with Tarion, Building Industry and Land Development (BILD) Association and Project Management Institute (PMI). Previously, Ahmadi spent four years as an architectural designer with Melillo Architects in design and construction management, and two years as the principle designer at Pionova Studio. He has been President of Wallzcorp Inc. for nearly four years, doing design and construction management, and completing more than 60 small-to-medium sized projects during that time period. He has received a Thermador award of kitchen design in North America, and his client RE/MAX Hallmark has been the recipient of RE/MAX Integra best real estate office design award in both 2014 and 2016.



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# NOT TO BE CONFUSED WITH TINY HOMES

How to downsize, co-habitate,  
build income property,  
and go greener by leveraging  
offsite construction systems

By Tim Kuntz  
President Revenu SGC  
(Strategic Growth Consultants)

**Y**ou have watched it on TV, it's all over the internet – as people are talking about it with curious excitement – while urban and rural municipal by-laws are changing to accommodate it.

What I'm talking about is MicroHome Living (small houses), not to be confused with Tiny Homes, which are usually on wheels and under 500 square feet in size. MicroHome designs generally range in size from 600-1,000 square feet.

HGTV's Tiny House Builders, Tiny House Nation and Tiny House Hunters are at the forefront of mass media attention, conveying the message of "size doesn't matter" when it comes to alternative housing.

Just ask Graham Hill, Montreal born designer/entrepreneur who founded treehugger.com and lifeedited.com who is on a mission to: Design your life to include more money, health and happiness with less stuff, space and energy.

Lifeedited is working with architects and developers to bring small space living ideas to larger buildings in cities such as New York and San Paulo, Brazil.

My passion for small homes began almost immediately when I was hired as a project manager for an offsite construction systems (OCS) housing company in North Bay, Ontario back in 2010. I was amazed at the quality and efficiency of OCS logistics.

And I quickly noticed a couple of Quebec-based designers/fabricators that had begun to pioneer modern homes that allowed end-users to live smaller lower carbon lives without sacrificing great design. These smaller home designs have continued to evolve over the past years, mostly in Quebec, although Kent Homes from the Atlantic provinces launched a modern "tech-home" in 2015. One of the most recent

advanced MicroHome designs comes from Laprise Group. In the fall of 2016 they launched a MicroHome called "AIR". This innovative small space design incorporates many of the innovative features that were missing from earlier designs, such as built-in cabinets, furniture, beds, LED lighting, storage, roof deck, and room dividers. "We are very excited to be entering Canada's largest market (Ontario) with our OCS portfolio," says Bert Rioux, business development manager with Laprise Group.

The MicroHome market has generated some great designs, so why don't we see more of these energy efficient homes in the market place? Simply because these alternative housing communities just don't exist yet.







We are witnessing a shift in the multi-residential condo market, with innovative small spaces (300-600 square feet), and it's fast becoming mainstream (and cool) to live with less ... however it is still very much the status quo when it comes to single and multi residential communities.

The reasons we haven't noticed these innovative homes and communities in the market is because it's a radically new concept.

Most developers, investors, architects, city planners, designers and builders are still producing traditional housing projects (average

2,500 square feet).

Yes, some of them are branding NetZero or offering Net Zero Energy (NZE) ready homes, however size, design and value are still being approached from a very traditional perspective.

"Living small is possible and it could really work for your communities," says Kevin Deck, senior associate at SFCS Architects. "But in order for that to happen, we have to disrupt the norm."

We have to challenge historical square footage expectations and challenge the idea that quantity is king and think quality really

matters."

Municipalities, building officials and city planners, along with architects and developers, haven't fully grasped the concept of the MicroHome Lifestyle Community or Low Carbon Living alternative.

It will require a disruptive shift in traditional municipal development models: smaller land parcels, alternative zoning models, new infrastructure models, alternative landscaping designs, innovative packaging of value-added services like share libraries, built-in vehicle charging stations, bi-directional metering.



For proof, you just have to just look at a recent joint venture between Japanese developers and Panasonic – the Fujisawa Sustainable Smart Town.

We are not the Japanese, nor are we like New York City. We live in Ontario and we have urban cities like Toronto, Ottawa, London ... we have growing communities, like Fergus, King City, Bowmanville, and Orillia.

We need to define our own vision of smaller space living and a lifeedited community.

If we asked, here's what the market might be saying:

- Smaller is good, as long as quality, design and space flexibility remain high;
- Affordability is critical, if I choose to downsize my life, live smaller, then it has to make fiscal sense (\$139,000 – \$299,000). ie. all-inclusive fixed pricing packaging and mortgage financing;
- Smarter greener technology and security is important ie. eco "lock 'n' go" lifestyle;
- Maintenance free, hassle free, easier living with like-minded neighbours, sharing community;
- If I choose to live smaller, I want options, lots of options: from economy to premium fit and finishes, interior design professionals (option) best-in-class accessories ie. Panasonic, Jaga, Spaberry;
- I want it delivered 50 per cent faster. I want plug 'n' play, I want it to have everything I ordered, installed, running, and tested prior to taking possession (easy knowledge transfer and ongoing support);
- Built-in appliances, furniture, solar and storage (option), R62 insulation upgrade (option);
- Hydronic heating systems with low temp boiler and hot water on demand, cooling options: fan versus AC;
- Built-in cabinets, beds(resource furniture), smart blinds (somfy), exterior door/hard-

ware (options);

- Options: outdoor kitchen/barbecue and furniture, spa/sauna, lap pool, garden, flowerbed;
- Options: carport/garage, decks, glass railings, pergolas, fences, storages sheds, sitting room;
- Options: awnings, gas fire-pit, wall art, fans, media and sound systems and WiFi;
- Specialty lifestyle options (doors sizes, bathing systems, support rails, communication systems);
- Costs me significantly less to operate and maintain on a yearly basis (eco options);
- To be greener, to be more environmentally conscious throughout design selections;
- And to hold its value in the market, and be attractive to the next buyers, and future generations.

Co-habitation (aging parent(s) and/or family caregivers) as well as added rental income are two big trends driving the demand for innovative MicroHome designs.

As cities like Ottawa and Toronto revisit by-laws to accommodate rising costs of living in these urban centres, and boomers look to downsize with aging parents, new by-laws will surely open the way to adding a Microhome to your existing property, commercial roof top, or allow for a community of homes that offers a new level of design flexibility.

Vancouver has some great lane house designs available and real-estate valuations and rents justify designing custom MicroHomes there.

Most Ontario markets, however, will require a more standardized design approach, leveraging OCS combined with value added: design options, add-ons, and accessories.

Does all of this sound too good to be true?

Great design, affordability, lower energy costs, best-in-class design options, green technologies, great design space for aging

parents, extra income, a simpler lifestyle ... what's the catch? Well until a leading-edge developer starts to package these products, you will have to take matters into your own hands.

Here are some tips when considering a MicroHome project:

- Understand the regulatory process – hire a professional to manage your building application;
- Site survey: crane and transport access, understand your current physical framework and infrastructure: water, sewer, power, gas, cable, setbacks, easements, design by-laws, setbacks;
- Proforma analysis: is it financially feasible to execute this project?
- Select a design and blueprints and foundation drawings with site plan drawings to submit for approval;
- Get pre-construction appraisal based on blueprints, land value and current comparable, get pre-approved financing;
- Select an Ontario Home Builders' Association-approved contractor or a recognized project manager who will deliver a fixed budget quote for end-to-end execution and management of project.

We will see the introduction of MicroHomes in Ontario in 2017. This year's Cottage Life show will feature a MicroHome design by Guildcrest Homes. You can also watch for an innovative four-season total solution cottage/home.

Regardless of where you are in your accommodation/habitat lifecycle, you can be sure small space design is on its way ... living greener, smaller, happier, with less, with great design, are all possible when considering the MicroHome lifestyle.

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# SUPERIOR CONSTRUCTION

## A road less-travelled



## Non-conformist Gord Pahlbod blazes his own career trail with Superior Construction

**G**ord Pahlbod is a respected builder of custom homes in the GTA, with a career path that certainly sets him apart from his contemporaries in the construction industry.

And, he knows that difference gives him a professional edge and unique perspective.

Pahlbod, Principal with Superior Construction, is well-known as a professionally-trained engineer with an impressive track record building homes, yet the construction business was not his first foray into the working world. Early on, he made his mark as a Senior Manager at Bombardier building GO Transit double deckers in Thunder Bay.

"Prior to Bombardier, I had significant experience in manufacturing," Pahlbod says. "I am a manufacturing guy, a process guy. You can give me a set of drawings, and I can put it together. It doesn't matter how complicated it is."

"It could be a robot, a house, a car or a space ship! I can figure it out, I love challenges and I look for tough projects that keep me awake at night."

Since transitioning to the custom home building industry in 2005, Pahlbod says he's incorporated that competitive edge into his daily work mentality.

"I have an excellent technical understanding

of the construction process" he says. "I pride myself being tough on the trades to make sure they offer their best work every time."

"The client does not often see the effort that has been afforded to do a proper job, but that is irrelevant to me. I make sure that the 'guts' of a job are assembled professionally, to ensure that the house performs well over the long term."

With the Tarion new home warranty program since 2005, Pahlbod says his company has been building custom homes in upscale Toronto neighbourhoods as well as in Brampton, Mississauga, East York and Peterborough.

He says, besides offering in-house custom home design, Pahlbod Homes is now building multi units, as well.







His first town house project is at the prestigious address of Bayview and York Mills. Always reaching, always learning – these are traits Pahlbod has carried with him ever since deciding to make the switch from manufacturing to the home construction industry.

“I simply started by reading books on building homes and wrote an exam with Tarion,

passing with excellent marks,” he recalls. “I was granted a registered builder status right after.”

But the career move was not always seamless. “The technical matters were easy to grasp for me as an engineer.

The issue that was not easy to digest was managing unprofessional trades. Given the

nature of custom home industry the trades are smaller companies with a serious lack of quality control and sound management skills. Often, the deadlines are missed and the builder is at the mercy of non-responsive trades.

There are some good trades but the number of experienced trades with the proper level of experience is dwindling year over year.”



Over the years, he says, there have been many heartaches and challenges in his dealings with that part of the construction industry.

“Real professional trades are rare,” he says. “Some start off well, and then fall down miserably. The ones who are keen to learn and better themselves move up the chain and become general contractors or builders themselves.

“So, for me, managing trades is one part of the job that’s a real challenge. We are short on competent trades in the GTA and this continues to be a real issue that has not been dealt with. I believe the Ontario provincial government needs to give this serious consideration.”

That annoyance aside, Pahlbod doesn’t beat around the bush when describing what his business of choice means to him.

“I love what I do,” he says. “I am so very proud to tell my kids: ‘Hey, look, I built that house.’ And I take great pride in making sure the owners are happy with the performance of my homes over the long term.”

With a wide range of opinions about the state of the construction industry, some of Pahlbod’s thoughts include:

- Studying the production process. “For instance, I use a commercial water delivery system in my homes to reduce the chances of leaks;”
- Finding the combination of the heating/cooling system performance (versus insulation versus basement preparation versus house envelope) is critical in making the environment user-friendly and comfortable. “Home automation is another point of focus for me where I introduce the concept to the buyers, hoping they will realize the long-term benefits;”
- Priding himself as being not only “forward-looking, but pragmatic, as well.”

Although each project he works on has different requirements, Pahlbod uses a similar approach each time, while always trying to improve the construction process.

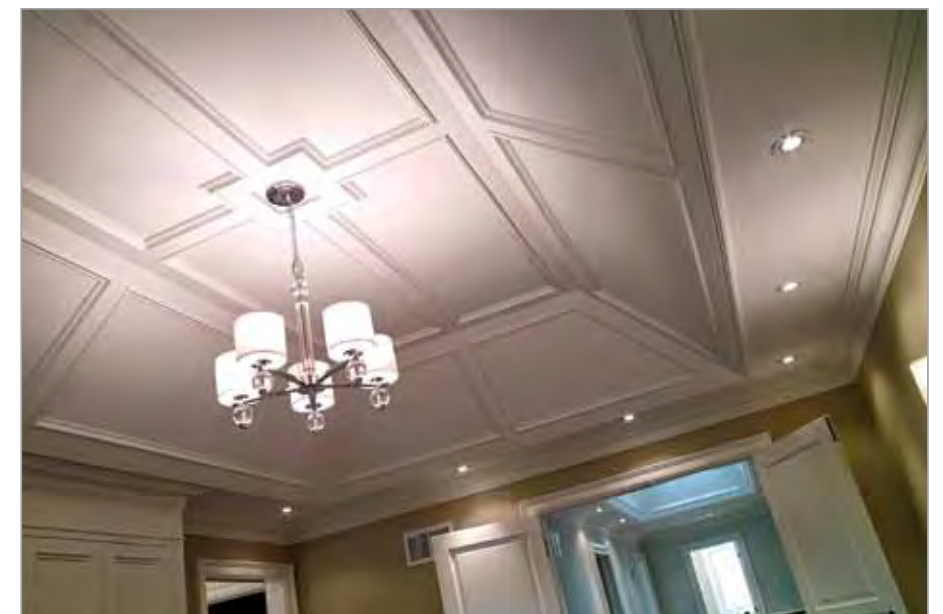
“My brain constantly looks for getting things done in smarter ways,” he adds. “The end result of this is a superior performing home over the long term.”

#### Why Superior Construction?

*“We have a broad experience in building custom homes in many municipalities in and around the GTA. The design and build process is the easy part of what we do. The real challenge is the dealing with the various city authorities, councillors and, often times, demanding neighbours. Our depth of experience in dealing with the various players is the real asset we offer. Ultimately the better builders are the ones who keep their clients protected from the many risks jeopardizing the projects they undertake to manage.”*

Gord Pahlbod,  
Principal with Superior Construction

[www.superiorconstruction.ca](http://www.superiorconstruction.ca)







# ENERQUALITY AWARDS HANDED OUT TO ONTARIO BEST GREEN BUILDERS

After an extensive series of high quality presentations about sustainability in the housing industry at the EnerQuality (EQ) Housing Innovation Forum, a highly talented group of builders took home hardware in recognition of their terrific work.

Corey McBurney, President, EnerQuality, when introducing the EQ Awards said, “Innovation is ideas brought to life. Ideas that change the world. With these awards we celebrate the change-makers – the innovators and leaders who have put their ideas into practice.”

The theme of the Innovation Forum was New, Now, and Next and focused on new thinking, new products, and new techniques for advancing green building performance.

With winners in 16 categories (see below), the Awards Gala saw an evening that combined suspense and waves of applause as the “best of the best” EQ builders were recognized. The loudest applause was for EnerQuality Hall of Fame Award inductee Paul Golini Jr., Co-Founder and Executive Vice President of Empire Communities. Empire Communities is one of Canada’s largest real estate developments companies, having built more than 10,000 new homes and condominiums in Canada and the U.S.A.

New this year was the Impact Award, recognizing a builder’s significant voluntary progress in reducing carbon emissions and outstanding achievements through energy efficiency and sustainability practices. The recipient of the inaugural Impact Award was Mattamy Homes, one of North

America’s largest privately-owned home builders.

## 2016 EQ Award Winners:

### Building Innovation – Low Rise

Award winner: Arista Homes – *Vaughan, Ontario*

### Building Innovation – Mid/High Rise

Award winner: Times Group – *Valleymede Towers, Richmond Hill, Ontario*

### ENERGY STAR for New Homes Builder of the Year - Small

Award winner: Castleform Development Inc. – *Toronto, Ontario*

### ENERGY STAR for New Homes Builder of the Year - Mid

Award winner: Mason Homes – *Concord, Ontario*

### ENERGY STAR for New Homes Builder of the Year - Large

Award winner: The Minto Group – *Toronto and Ottawa, Ontario*

### Best Green Marketing Campaign

Award winner: Great Gulf Homes – *Active House Centennial Park, Toronto, Ontario*

### Green Renovation Project of the Year

Award winner: RND Construction – *106 Bayswater, Ottawa, Ontario*

### Ontario Green Builder of the Year

Award winner: Reid’s Heritage Homes – *Head Office Cambridge, Ontario*

### ENERGY STAR Champion of the Year

Award winner: Lisa Bergeron, JELD-WEN – *Quebec City, Quebec*

### R-2000 Builder of the Year

Award winner: Slood Construction – *Guelph*

(*Arkell*), *Ontario*

### Net Zero Home Builder of the Year

Award winner: Reid’s Heritage Homes – *Head Office Cambridge, Ontario*

### Evaluator of the Year

Award winner: Jack Zhou – *Markham, Ontario*

### Builder Achievement Award

Award winner: Doug Tarry – *St. Thomas, Ontario*

### Leader of the Year

Award winner: Jennifer Weatherston, Reid’s Heritage Homes – *Head Office Cambridge, Ontario*

### Savings by Design

Award winner: Geranium Homes – *Markham, Ontario*

### Impact Award

Award winner: Mattamy Homes – *Toronto, Ontario*

In addition to presentations by leading green building thinkers and doers, there was also the highly competitive and ever-entertaining EQ Innovation Gauntlet (IG). The IG is where an all-star panel of builder “dragons” ask the tough questions to vendors seeking a thumbs-up for new products.

Despite the strong contenders, **Eddy Home** and their water-monitoring technology were selected by the attendees as having the *Most Innovative Product*.

Two new awards this year went to industry leaders - *the Builder Achievement Award*, sponsored by JELD-WEN, went home with **Doug Tarry** in recognition for his significant contributions through his commitment to continuous learning, passion and leadership.

## BUILDING WITH WOOD



## RIISING FROM THE ASHES

### Award-winning rebuild of St. Elias church in Brampton incorporates innovative wood products and new technologies

Like the legendary phoenix, Brampton’s St. Elias Ukrainian Catholic Church has risen from the ashes – literally.

Originally built in 1995, the church was destroyed by fire in 2014. However, members of the congregation in Greater Toronto quickly decided to try to overcome the tragedy and rebuild.

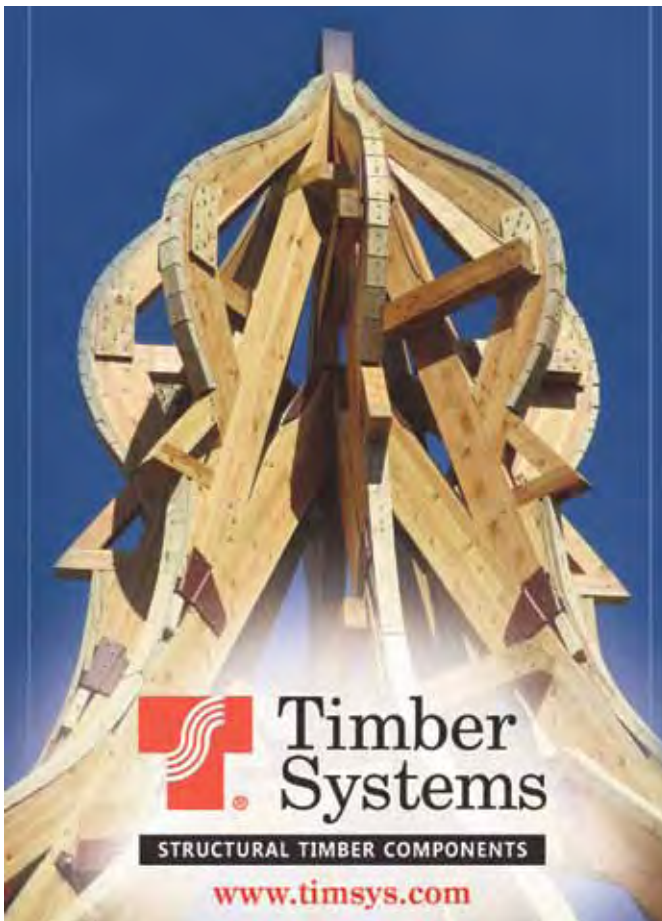
By late 2016, the project was completed in impressive fashion; eventually garnering a coveted Ontario Wood WORKS! Award (Institutional/Commercial category, project valued at less than \$10-million) from Canada’s Wood Council.

The architect was Zimmerman Workshop Architecture + Design, and the engineers

from Moses Structural Engineers.

Originally designed by the late Robert Greenberg, the heavy timber church was modeled after the architectural style known as “Boyko,” which originated in the western part of the Ukraine and features iconic copper-clad domes generally visible from a great distance.





The primary challenge was capturing the spirit and style of the original church while incorporating new technologies and adhering to building code changes that have come into effect since 1995.

It was also an opportunity to find ways to use innovative wood products to improve both functionality and aesthetics. (Of note: the radiant system, passive gravity ventilation and exterior insulation systems all combine to create a highly energy-efficient building — none of these were features in the original building.)

The heavy timber (glulam) and wood construction on a concrete and stone base comprises the entirety of the building, including each of the five domes.

The timber construction portion of the building measures over 75 feet in height (approximating a seven-storey building) from the base up to the foot of the highest cross.

The dramatic copper-clad domes are built from a hybrid of glulam, stick frame, and curved plywood. The largest of the five domes weighs over 18,000 kilograms (just under 20 tons) and bears directly on a 13-by-13-metre-long span glulam space-frame truss. Domes and copper were constructed on the ground and lifted with a 260-ton crane into position.

The main difference between the new and old church — and one that dramatically improves both function and aesthetics — lies in the main truss assemblies spanning the 13-metre nave.

With tension rings and angled struts (or braces), each truss is approximately six tons. The trusses are supported by four corner mega columns, which, together with the diagonal struts, are designed to resist the enormous lateral forces that result from wind on the largest dome.

These columns are almost six metres tall and spread even further apart (three additional metres in both directions) than the columns of the original building.



The new positioning provides for better sightlines and allows for an obstacle-free zone of worship, much like the ones seen in traditional “Boyko” churches. Smaller versions of trusses and beams are used to support the other domes throughout the church.

The new heavy timber design also uses concealed connections. This is an innovation in connector technology, a step ahead from what was used on the original church over 20 years ago.

*The Ontario Wood WORKS! awards honour people and organizations that, through design excellence, advocacy and innovation are advancing the use of wood in all types of construction. A winning project showcases the many benefits of wood construction such as sustainability, versatility and cost-effectiveness.*



**GREENBUILDING**  
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# ENTRANCE TO TORONTO'S FINANCIAL CENTRE



Photography: Tom Arban

## Southcore design uses architecture as a gateway with mix of commercial and residential uses

**T**he Southcore Financial Centre (SFC) is a major mixed-use sustainable development in Toronto's emerging Southcore Financial District owned by bclMC Realty Corporation, comprising three glass towers: the Price Waterhouse Cooper (PwC) Office Tower (18 York Street), the Bremner Office Tower (7B) and the Delta York Hotel.

KPMB Architects designed both office towers. PwC is a 671,000 square foot, 26-storey tower and Bremner Tower is a 700,000 square foot, 30-storey tower.

The design responds to the City of Toronto's district planning strategy to create a new gateway to the downtown financial district and to increase density with a mix of commercial and corporate uses.

All three towers are unified at the street level with an interconnected three-storey podium. The roof of the podium features a publicly-accessible urban forest planted as a boreal environment with indigenous species. Both towers include three levels of below-grade parking and bicycle storage with adjacent change rooms and showers. The ground and second levels of the podium include

retail services.

### Architectural idea and quality of spaces

The two towers are sited to act as a new gateway from the south to downtown Toronto's financial centre. The oblong rectangularity of each tower is characterized by a rigorous simplicity of geometry and elegant proportion. The building envelopes are a high-performance glazing system with maximum-scaled glass panels, which reduce the number of mullions and exterior metal elements.

This strategy achieves three things: minimizes thermal bridging conditions, optimizes daylight transmission and expresses a purity of form that appears prismatic. The lobby of each tower is a 16-metre high light-filled space, anchored at the core by elevator banks clad in Ontario limestone. The lobbies of both towers have escalators leading to the second floor to provide direct access to a sheltered pedestrian route to downtown Toronto's grand central station.

A monumental cylindrical glass and stone exterior stair located at the centre of the south elevation of the Bremner Tower provides access to the public garden terrace located on the second

and third floor terraces of the podium.

### General structure of the projects in relation with the surrounding landscape

The design fulfills the district planning strategy to use architecture as a gateway condition and to achieve a vibrant mix of commercial and residential uses. Committee of adjustment and site plan approval applications were prepared by a multi-disciplinary team of consultants under the leadership of KPMB.

Successful negotiations were conducted with CN Rail, GO Transit, and other stakeholders to address concerns for soil stability during construction – as well as with the City of Toronto for making connections to the PATH system and the West York Teamway. The team also successfully negotiated an alternative solution to a requirement for grade level outdoor public space by convincing the City of Toronto to provide this space at the second level in order to accommodate service access below.

Project choices considered energy efficiency, creating comfortable working conditions to reduce the cost of running technological systems.





Certified LEED SC Gold, the buildings feature state-of-the-art operating and life safety systems including: rainwater collection system, Enwave's deep lake central cooling supplemented by a

thermal storage system, 18-inch raised floors, and enhanced indoor air quality.

Thermal storage tanks are incorporated into the lowest level of the building where they are

used as a cooling source during daytime hours and recharged at night from the Enwave Deep Lake Cooling system when demand and rates are reduced.



The automated roller shading systems are controlled by a computer using a 3D model of the district to anticipate shade masking from adjacent buildings and selectively leaving blinds open where the sun is obscured in order to optimize daylight harvesting.

Rainwater harvesting and an oversize cistern provide both sediment interception and a source of grey water for toilet flushing and irrigation to green roof vegetation during drought conditions.

#### **Functionality, understood as compliance with the project's purpose and brief**

The tower design is conceived around creating a highly supportive and flexible space for work consistent with the shift from conventional compartmentalized approaches to office organization to open, connected workplace design where access to daylight, vistas, and good ventilation are fundamental.

With no columns interrupting the floor plate between the core and the perimeter, the space permits maximum latitude for accommodation of occupants' needs. Floor to ceiling glazing maximizes views and permits daylight deep into floorplate.







The raised access floor system maximizes flexibility of service delivery as well as low velocity ductless air distribution employing the displacement principle. The design is attractive to a broad spectrum of potential tenants, from large corporations seeking to align values and commitment to sustainable practices, to smaller tenants seeking well-served conventional office environments in an accessible, downtown location.

Designed to meet the highest quality

standards and expectations for high-rise office space, the project conforms to a tight financial pro-forma while creating signature architecture. The building's elegant skin takes the capabilities of unitized curtain wall glazing to their limits by using the largest feasible lite size to reduce joints in the exterior skin and enhance the play of reflected and transmitted light.

This approach reduces aluminum framing joinery, thereby lowering the cost of production

while cutting heat transmission at frame members to enhance thermal performance.

The restraint of the massing and skin complements the vegetated roof and terrace areas of the project, providing a stage-like platform and backdrop to showcase the urban forest garden at the third floor terrace where a sample of St. Lawrence Lowland forest ecology will be recreated in full view of the towers of the financial district to the north.



*KPMB Architects is an award winning, internationally recognized Canadian practice. Their approach prioritizes integrated design thinking, and the making of architecture of the highest*

*quality in a manner that supports everything their clients wish to achieve - socially, functionally, financially, aesthetically, and environmentally. The philosophy of sustainability at KPMB is a*

*philosophy of integrated architecture in which beauty, energy efficiency and environmental responsiveness are equally calibrated.*

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Photo credits: Courtesy of Acton Ostry Architects Inc. & University of British Columbia



# TOP OF THE WORLD

## World's tallest wood structure in B.C. a quantum leap forward for Canada's forest and construction industries

It can be easy to get caught up in all the hoopla about the tallest wood building in the world being built in Canada, at the University of British Columbia. Yes, the mass wood structure and façade

has been completed for UBC's Brock Commons student residence, with interior elements soon to follow, and it's 18 storeys high. That, in itself, is impressive. However, the fact that the basic construction came in

at four months ahead of schedule might be even more extraordinary.

Time, as they say, is money ... and that especially holds true in the construction industry.

So, yes, the world-record height is something for all Canadians to be proud about, but the hybrid building appears to represent much more.

"This remarkable building, the first of its kind in the world, is another shining example of Canadian ingenuity and innovation," says Jim Carr, Canada's Minister of Natural Resources. "It's an apt demonstration of how Canada's forest industry is finding new opportunities through technology and innovation — opening up a world of possibilities for our forest and construction industries."

The structure was completed less than

70 days after the prefabricated components were first delivered to the site.

And Brock Commons is the first mass wood, steel and concrete hybrid project taller than 14 storeys anywhere in the world.

The building has a concrete podium and two concrete cores, with 17 storeys of cross-laminated timber floors supported on glue-laminated wood columns.

The cladding for the façade is made with 70 per cent wood fibre.

"As the tallest wood building in Canada, this project will serve as a great example of the research and technology that is involved

in taking wood construction to new heights — resulting in innovative solutions that are safe, sustainable and viable," says Michael Giroux, President Canadian Wood Council.

The \$51.5-million project was designed by Acton Ostry Architects of Vancouver with Architekten Hermann Kaufmann of Austria as tall wood advisors, Fast + Epp as structural engineers and GHL Consultants Ltd. as the fire science and building code consultant.

A key mandate for the innovative project was to demonstrate the viability of mass wood structures for B.C.'s development and construction industries.





This was achieved with a hybrid design that combines the benefits of mass wood and concrete to achieve an economical structural system that is comparable in cost to that of traditional all concrete and steel structures.

Part of the design and construction strategy was recognizing that the level of prefabrication available in B.C. is not as extensive as that which is available in Europe.

However, the speed and skill of high-rise residential trade contractors in Vancouver

proved to be considerable.

To test the speed and efficiency of the erection of the mass wood hybrid structural system, a full-scale two-storey proof of concept mock-up was constructed in July 2015.



Erection of the structure went smoothly and assembly proved to be faster than was initially projected.

Brock Commons has been designed to target LEED Gold certification and to conform to ASHRAE Standard 90.1-2010.

The building will connect to the UBC district energy system and is projected to achieve up to 25 per cent energy savings over a typical building of the same use.

"Brock Commons will demonstrate that mass wood structures offer an economically viable alternative to concrete and steel while providing a way to lessen the carbon footprint of the built environment," says Russell Acton, Principal at Acton Ostry Architects.

*Acton Ostry Architects is a leading Canadian design practice in Vancouver, BC recognized for the creation of eloquent and innovative community, public institutional, multi-family residential and mixed-use buildings. Since our inception in 1992, they have continually demonstrated their commitment to the making of architecture that responds sensitively to social, historical and environmental concerns.*

**[www.actonostry.ca](http://www.actonostry.ca)**





# SUSTAINABLE.TO ARCHITECTURE + BUILDING



## WHEN LESS IS MORE

How Toronto Method quickly delivers well-insulated, air-tight healthy homes utilizing local trades, materials

**T**he clients came to Sustainable.TO with a specific list of desires.

For their forward-thinking Risebrough Residence in North York, they wanted a home that would sip energy, endure for generations and remain comfortable at all times.

And Sustainable.TO, a Toronto firm specializing in sustainable architecture, had just what was needed – a version of their Toronto Method concept, which highlights their philosophy that a better building envelope is a result of placing the right amount, of the right

materials, in the right place.

“Every client we work with has a unique set of needs and wishes,” says Paul Dowsett, principal architect at Sustainable.TO. “In this situation, we were able to deploy many of the technical solutions we’ve resolved with this project on a larger scale and utilized the ability to customize use and individual preference. That is something unique that can only be found when working directly with an architect.”

In the case of the Risebrough Residence, the architecture does the heavy lifting. The

staggered rooflines accommodate high windows that admit daylight naturally. Convection currents passively vent warm, stale indoor air through the upper windows and draw in cooler, fresh air from the garden level.

To reduce energy demand, the home is wrapped in a thick blanket of insulation; while an air-tight building envelope reduces unwanted air leakage. Two fully-ducted energy recovery ventilators (ERVs) handle controlled ventilation, ensuring the fresh incoming air is efficiently preheated and humidified by the outgoing exhaust air.

As heating and cooling loads have passively been reduced by 80 per cent over a typical home, the remaining heating requirements are handled by a hydronic in-floor radiant heating system powered by a super-efficient natural gas boiler.

Henry® Residential Building Envelope Systems® were chosen for the project because of the importance of utilizing a performance-based, integrated system to meet passive building requirements, helping maintain an air-tight, water-tight and weather-tight envelope that stops uncontrolled air leakage, while improving occupant comfort and energy efficiency.

As Sustainable.TO spokespersons like to say: “The home can literally be heated by a toaster.”

At the heart of the philosophy surrounding the Risebrough Residence is the Toronto Method. Dowsett says the concept continues to pique a lot of interest because of its simplicity.

“When we developed this system we weren’t trying to break the mold, but trying to push the ‘envelope,’” he says. “It’s about creating a better building envelope by placing the right amount of the right materials in the right place. The Toronto Method uses readily-available materials with which local builders are familiar.”

To demonstrate the buzz the Toronto Method has been creating within the building industry, Dowsett noted that Sustainable.TO is working

with a consortium of international partner companies in the development of panelized, community-built homes.

They have developed modular building envelope panels that will deliver a well-insulated, air-tight, healthy home that can be built quickly by local trades and that will maximize the use of local materials.

That way, housing can be provided for remote, or post-disaster, rebuilding of communities internationally.

And that housing, using the principles of the Toronto Method, would be healthy, cost-effective, rapid-erect, reduce dependence on fossil fuel, withstand the effects of floods, earthquakes, and other disasters ... and be quickly lived in, post-disaster.

“We have received a lot of recognition from our colleagues in the industry who share our belief that the green building industry needs to make a shift away from foam-plastic, petroleum-based insulation products,” says Dowsett. “There is a commonly-held belief that ‘technology will save us’ from any threat humanity is faced with,” he says. “Unfortunately ‘technology’ is often used interchangeably with ‘gadgetry’ and there seems to be a trend of ‘throwing as many gadgets’ at a problem as possible.

“Sustainable.TO’s approach is to understand the underlying issues and propose a solution with as little complexity and as little material as possible. We truly believe in, and practice, the



Exterior View of Continuous Blueskin Weather and Air Barrier Applied

adage of ‘doing more with less.’

“In a world where ‘smart’ technology strives to make our lives easier, investing in complicated systems that are susceptible to failure is a risky proposition.

“Passive design is the future, and Sustainable.TO’s Toronto Method and Risebrough Residence are proof that ‘simple is the new smart.’”

*SUSTAINABLE.TO Architecture + Building is a leading Canadian full-service sustainable architectural practice. As architects and building scientists, SUSTAINABLE.TO delivers healthy, affordable, and energy-efficient architectural solutions at every scale: from renovations and single-family dwellings, to master planning and institutional new builds.*  
**www.sustainable.to**

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## TEMPLAR FLATS IN HAMILTON AT THE HEAD OF ITS CLASS IN ONTARIO

**By Sarah Hicks**  
Communications Coordinator  
Ontario WoodWORKS!

**T**emplar Flats in Hamilton, Ontario, has the distinction of being the first occupied wood-frame mid-rise building completed in Ontario.

It was constructed under provisions (O. Reg. 191.14) added to the province's building code (2012 OBC) that permit wood-frame construction up to six storeys, an increase of two storeys over the previous iteration of the code.

The new code provisions balanced the

Ontario government's two primary objectives: To help increase opportunities for designers and builders to create innovative, flexible, and affordable new buildings; and to maintain Ontario's high fire safety standards for both the public and fire service personnel.

Templar Flats brings together the best of the old and new in an innovative, hybrid solution that puts a modern six-storey building between two thoughtfully restored heritage buildings that were adapted into a single, unified development. Combined, the three buildings offer 2,346 m<sup>2</sup> of residential and commercial space with 25 modern residential

units above three street-level restaurants in the city's downtown core.

Strategically, mixed-use mid-rise buildings are considered an important building type expected to help municipalities increase housing density, attract businesses and families to urban centres, and revitalize aging downtown cores.

Previous code restrictions on combustible construction made non-combustible solutions the only option for mid-rise development and many potential developments were never realized because they were deemed cost-prohibitive.

Now that the opportunities for wood construction have been expanded, developers have a new, cost-effective construction option for mid-rise buildings, an important development considering densification is mandated in most municipal growth plans in the province.

From a development standpoint, the three buildings that make up Templar Flats would have been expensive to realize as stand-alone projects.

Combining the two renovated buildings with the new construction in the middle made the project more affordable. The infill portion of the development provides the elevator, scissor stairs, and corridor system that internally ties all three buildings together.

By increasing housing density, contributing to a vibrant streetscape, and saving historic buildings, Templar Flats exemplifies many urban development ideals and demonstrates clear leadership in infill construction. For the project developer, Steve Kulakowsky, a partner at Core Urban, Templar Flats is an excellent example of what can be done with infill.

"We really tried to emphasize that all challenges with heritage buildings can be overcome and, at the same time, emphasize that new buildings don't have to be boring," says Kulakowsky.

Infill construction isn't without challenges, however, and construction of Templar Flats was complicated by the lack of a staging area and an existing district energy system that had steam pipe six feet under the site, which needed to be considered when designing the placement of the foundation piers.

Overcoming these challenges was well worth the resulting benefit since the steam pipe provided the opportunity to tie into the district energy service to heat the building. Templar Flats was the first private project to tie into the system and this state-of-the-art heating and cooling system is just one of the project's several sustainable features.

The products used to build, renovate, and maintain structures have a significant effect on the environment, so it is important to thoughtfully consider the full impact when specifying materials, or when deciding whether to adapt and reuse an old building or tear it down and start from scratch.

The pursuit of design solutions that rehabilitate old buildings and incorporate sustainably-sourced wood products in new construction helps reduce the carbon footprint of the built environment. Considering the reality of climate change and the growing impact of human development,

it is clear that building with wood isn't just a more responsible choice, it is a necessary one. From extraction, through processing, to finished components, wood products have the smallest environmental footprint of any commonly used building material. Using wood in the new ways made possible through advanced manufacturing, computer-aided design, and progressive, science-based building codes, has ensured that today's wood buildings are not only sustainable, they're also smarter, stronger and more versatile.

In Canada there is a long tradition of building with wood. It is a fundamental part of Canada's architectural heritage, embraced for its warmth, beauty and availability. Yet, as significant as wood is to the past, it is going to play an even more important role in the future. Jurisdictions across Canada are striving for more rigorous environmental standards and seeking solutions for affordable and sustainable densification. As a result, building designers are under significant pressure to balance functionality and cost objectives with reduced environmental impact. Wood construction is a strategic way to meet all of these goals and its strength and versatility enable it to be used in a wide range of



buildings.

From the outset, the Templar Flats team believed that the mid-rise wood-frame code changes were geared to projects like this and that a six-storey solution was the obvious choice for the site. It's clear that they were right. The team took a relatively small, irregularly shaped empty lot and in a short time frame built a beautiful new six-storey hybrid wood building, with minimal disruption to the surrounding neighbourhood. Through carefully considered design, the team delivered a vibrant new mixed-use occupancy that enhances and reflects the charming and inviting character of the neighbourhood.

The architect on the project was Rick Lintack, who has worked with Core Urban on multiple projects.



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# BUILDING WITH WOOD



BC Passive House Plant, Pemberton BC  
Photo Credit: Ema Peter  
Courtesy of the Wood Design & Building Awards Program

## THE THREE C'S

### With wood building products and climate change goals that means carbon, construction and COP21

By Peter Moonen  
National Sustainability Manager  
Canadian Wood Council

The April 2016 signing of the 21st Conference of Parties (COP21) summit accord represented a universal agreement on climate change, and subsequently brought with it new opportunities for wood in construction and design.

How are the COP21 and wood related? Various national, regional and local government policies are targeting embodied carbon footprint

reductions from construction activities. Reducing embodied greenhouse gas (GHG) emissions becomes a critical factor in construction material selection since these decisions have both immediate and long-term effects on the environment.

Wood building products represent a solution to architects, engineers and other stakeholders in the design and construction community who are being asked to understand and realize the climate change goals set out by the shifting regulatory and policy framework throughout Canada and the world.

Construction and operations of the built envi-

ronment constitute the single greatest consumer of natural resources, including energy. In examining the global factors impacting climate change, it becomes apparent that changes to our built environment are necessary – both in operational efficiencies and reductions in embodied impacts.

Understanding how wood use can play a role in mitigating climate change, coupled with a clear appreciation of the decarbonization initiatives and requirements affecting the built environment, will better enable designers to position their work as a solution that meets the needs of a multitude of stakeholders.

#### SUSTAINABLE FORESTRY, SINK, SEQUESTER & SUBSTITUTE

A sustainably managed forest is a carbon sink; wood sequesters carbon; and wood can play an important role in displacing GHG emissions through material substitution, where opportunities exist.

base, the second largest in the world after Russia, and is the world's largest exporter of forest products.

It is also, on a per capita basis, one of the largest emitters of CO2. As such, it has both an opportunity and a responsibility to take carbon emissions reductions seriously.



Sustainable forestry – Canada is recognized as a world leader in forest management, using science-based principles that balance environmental, social and economic considerations; resulting in an impressive 166 million hectares of forest independently certified, which is about 40 per cent of all the certified forests in the world.

When Canada signed the COP21 agreement to reduce the country's carbon output, this signalled a shift in priorities, which has been recognized by provincial and municipal governments across the country.

At present, British Columbia and Alberta have both implemented a provincial carbon tax of CAD \$30 per tonne, the highest in North America.

Québec and Ontario have implemented

cap-and-trade programs and the Government of Canada has also pledged to significantly reduce its carbon emissions by 2030 and beyond.

Regions and cities are also taking steps to address GHG emissions reductions. The City of Brussels in Belgium, the political capital of Europe, was the first city in the world to require passive-level performance for all new construction and major renovations as of January 1, 2015.

While not specifically addressing embodied emissions, the move to passive-level performance creates opportunities for wood use, especially in the design and construction of building envelopes with high thermal resistance.

As well, the City of Vancouver, in its quest to achieve net zero energy and carbon, recently passed a requirement that all new rezoning and affordable housing projects provide information about the embodied impacts of the project – a first for North America.

Canadian research indicates there is an increased benefit to climate change mitigation by reducing emissions today rather than reducing emissions in the future. Just like a retirement savings account, the first monies invested have greater benefits over time than later contributions.

When it comes to carbon impacts, time really does matter.

First, at the point a building becomes occupied, all of the carbon impacts associated with the manufacturing of the components and assembly of the building have already occurred.

They are done and there is no going back. It is only when occupancy occurs that the carbon emissions associated with building operation begin.

**Carbon sink and sequestration** - Photosynthesis converts atmospheric carbon dioxide (CO2) into the simple sugars used by trees to produce long-chain polymers called cellulose, the building block of all wood.

Since wood is approximately 50% carbon by weight, one tonne of wood contains approximately 500 kilograms of carbon, which corresponds to about 1.8 tonnes of CO2 equivalent. In effect, nature has already given us a superb weapon to reduce atmospheric GHGs – trees; solar-powered carbon dioxide-sucking machines that store energy in a building material.

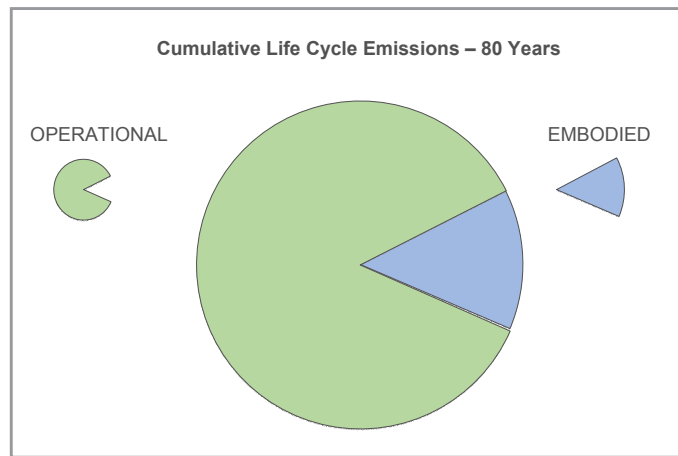
**Carbon substitution** - By replacing one material with a less GHG-intensive one, it is possible to displace and reduce carbon emissions by material substitution.

Wood is the only major building material that has the ability to remove more carbon from the atmosphere during the growth phase than is emitted during the raw materials extraction, processing and transportation phases combined.

Canada has 10% of the global forestland







Theoretical comparison of relationship between embodied and operational emissions over an 80 year building life span.

It may take several years before the cumulative operational emissions are equivalent to the embodied emissions; and the higher the operational performance level of the building, the longer it will take to reach parity with the embodied impacts.

Secondly, as many scientists fear, if a carbon tipping point is likely or even inevitable, then the emissions we avoid today are even more important than those we hope to avoid in 20, 50, or 100 years.

'The conclusion that CO2 must be reduced to a level <350 ppm was startling at first, but

obvious in retrospect.

Earth's history shows that an atmospheric CO2 amount of say 450 ppm eventually would yield dramatic changes, including sea level tens of meters higher than today.' James Hansen on Climate Tipping Points and Political Leadership

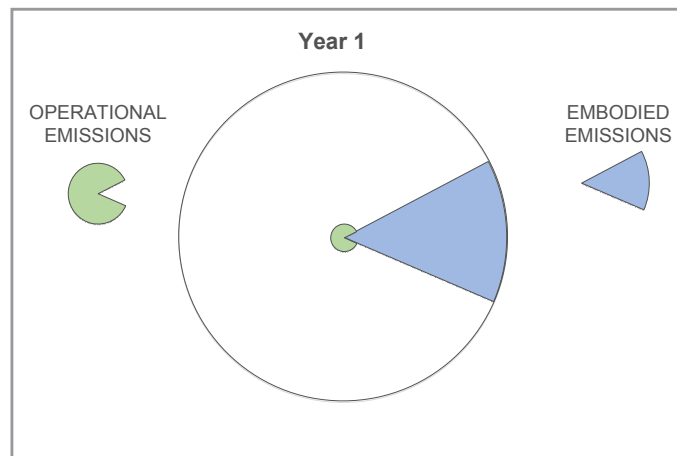
Designers have both a responsibility and an opportunity to undertake more accurate evaluations of the embodied impact of the structures they design.

As governments around the world take steps to implement regulations aimed at

reducing GHG emissions, designers of wood structures will find future legislation and policy to encourage the use of wood in the built environment.

Understanding how wood can fulfil regulatory requirements, societal aspirations and environmental imperatives surrounding carbon reduction will tremendously increase the potential for wood use in the near- and long-term.

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Theoretical comparison of relationship between embodied and operational emissions in year one.

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