Beyond Great

Specialists in green building design are coming up with solutions for every eventuality

by **NATALIE BRUCKNER**

Green building design is hardly a new concept, and yet its meaning has changed dramatically over the past four decades, and even more so over the past few years.

At one time it was a reference to air tight buildings; today it is a more holistic concept that covers everything from reducing the harmful effects of a building on its occupants to structures that will withstand increasingly extreme weather events. One major benefit of this sector is the experts' willingness to evolve and pivot as necessary, according to new findings and a changing world.

Case in point, Williams Engineering. Lindsay Austrom, team lead, sustainability at Williams says that after seeing a shift in focus during the pandemic toward building health, interest in green building design is once again at an all-time high.

"In many ways the pandemic made us take a step back as buildings were running their air systems for longer and running at reduced capacity – from an energy efficiency perspective, it wasn't great. Now, especially with some of the extreme weather events that have occurred, we are more focussed than before and considering how our buildings can handle those stressors. It shifts the focus onto adaptation, mitigation, and resilience, as well as how to support the people in the building," says Austrom.

The future, as Austrom rightly says, is largely unknown, and challenges with the supply chain, for example, have shown the industry it needs to be prepared for every eventuality. "It has made us question assumptions such as preparedness, and consider, 'are we being resilient in our approach?'"

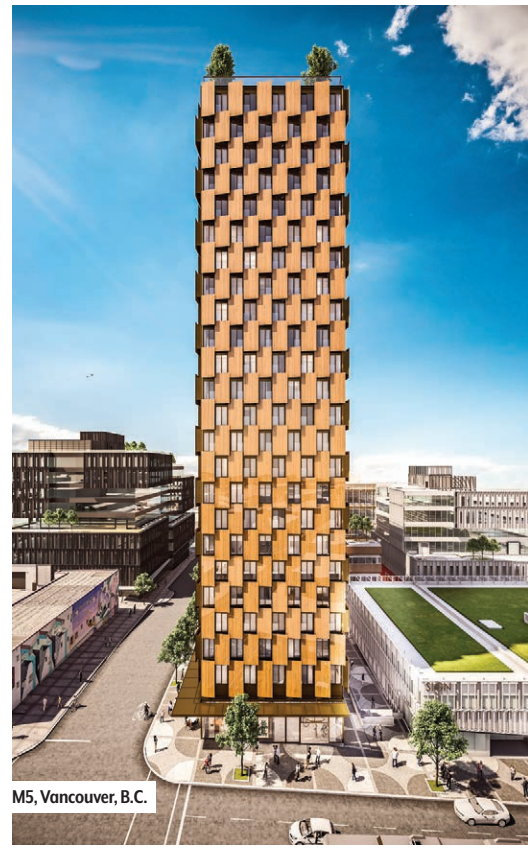
This has in turn resulted in some great opportunities. "Through a combination of smart new construction and developments, as well as creative rehabilitations and conversions, there are some great opportunities ahead. The Reframed Initiative is a great example of what is being explored when it comes to this," says Austrom, who is one of six teams involved in the B.C.-based program that is aimed at developing replicable deep retrofit solutions and scaling their implementation.

The program (an initiative of the BC Non-Profit Housing Association, the City of Vancouver, Metro Vancouver Housing Corporation, and the Pembina Institute) is now wrapping up. Findings from the six-month program that explored various deep retrofit design solutions for six multi-unit residential buildings will soon be available. "It has been an interesting process as we looked at various scenarios and systems. Projects like this allow us to access more information to make better decisions."

Teamwork is indeed key to the future of the sector, and as such, Glotman Simpson joined the SE2050 initiative with the goal of working towards net zero embodied carbon structural systems by 2050. In addition, internally the team is developing tools to calculate the embodied carbon of all of its projects to better understand the environmental impact of each design decision. "The structural embodied carbon data will soon be displayed on the cover sheet of all of our projects," explains Harrison Glotman, project engineer at Glotman Simpson.

"Calculating the embodied carbon is becoming much easier with new technologies, programs, and the increased availability of EPDs," says Glotman.

In addition to conducting LCAs at various stages of a project, Glotman says he is seeing a trend towards new green building materials such as eco-friendly concrete, green steel, and mass timber. Glotman Simpson has worked on a number of mass timber projects including CT7 in Los Angeles, the Burrard Exchange Building in Vancouver, and M5, which will serve as a tall wood net zero carbon prototype. "These projects push the boundary of what is achievable in mass timber," says Glotman. "Also, CT7 was able to adapt and reuse most of the concrete substructure – adaptive retrofit and reuse is a very important strategy in getting to net zero."



M5, Vancouver, B.C.

RENDERING BY HENRIQUEZ PARTNERS ARCHITECTS/COURTESY GLOTMAN SIMPSON

Park Habitat with Westbank in San Jose is another stand-out project, because, as Glotman explains, "this is a concrete building, but the project team was very deliberate in its choices from the outset to reduce embodied carbon where possible. Through strategies like post-tensioning and by using mixes with lower cement content, we were able to substantially reduce the embodied carbon footprint from the baseline. These types of projects excite me because armed with embodied carbon data, we see that little changes in our design choices can make a big impact."

According to Wendy C. Macdonald, sustainability consultant at RJC Engineers, she is seeing three areas of focus lately when it comes to green building design: Carbon (embodied, operational, fuel switching, electrification of the grid); wellness (from ventilation to transparency of material ingredients); and climate resilience.

"People are talking about these three elements in a far more nuanced way these days as peoples' understanding has evolved. Moving forward, these conversations will need to be more interactive as they demand a greater understanding of how carbon, wellness, and resilience relate to each other," says Macdonald.

One way these elements can come together well is in designing for the passive survivability of buildings – which is defined as "maintaining livable conditions in the event of extended loss of power or interruptions in heating fuel." As a carbon reduction firm and strong advocates for the "envelope first" approach, this is right up RJC's alley.

As we know, more extreme weather events are a reality, but as Macdonald says, this is just the beginning of it. "The climate we are experiencing now is a result of what we did a couple of decades ago. We need to get on top of this in a hurry because what we're doing now locks in what's coming in the next few decades." As for what the future holds, no-one really knows, but Macdonald explains the same old, same old will no longer cut it. "In the past we designed to historical data but that's not all you need to think about now. We now need to consider things we don't have the answer to. While technology like mechanical systems can be swapped out should demands change, that's not so easy with the structure or envelope, so you want to make sure you get that right the first time." And that is indeed where RJC shines.

Addressing embodied carbon still remains a hot topic, says Lindsay Oster, principal architect at prairie architects inc., and one project they are working on is taking a unique approach to this.

"For the Bannerman Green Housing Co-operative we are looking through the lens of the International Living Future Institute's [ILFI] Living Building Challenge [LBC]," explains Oster. "With the LBC, energy is treated as a precious resource and significant effort is required to minimize energy-related carbon emissions that contribute to climate change. Projects, both new and existing, must achieve significant reduction in total net annual energy consumption after accounting for on-site renewable power and must also demonstrate reduction in embodied carbon of primary materials. Additionally, there is focus on the project to be net-positive with respect to carbon – supplying at least 105 percent of the energy needs through on-site renewables without the use of combustion."

Oster adds that the project will also need to account for the total embodied carbon emissions from construction, which includes the energy consumed

during construction, and therefore relies heavily on the use of carbon-sequestering materials. "These goals, coupled with Passive House targets, are a tall order on a limited site located in an extreme Winnipeg climate, and we are just in the beginning stages of the project, so stay tuned!"

How we approach green building design has changed rather dramatically over the years, and Oster says "building better than average" will no longer cut it. "As architects, we need to look seriously at designing with mitigation, adaptation, and resilience in mind. With rigorous programs like the LBC, there is a growing focus on developing and incorporating resilience strategies to allow buildings to remain habitable for stretches of time after disasters or energy outages, which are a frightening reality of the climate crisis."

While challenges remain, especially when it comes to harmful toxins and ingredients in building materials, Oster says that there are plenty of opportunities ahead: "Through advocacy and education, manufacturers will become more transparent with the ingredients in products and move to providing healthier and more ecologically sound options for architects."

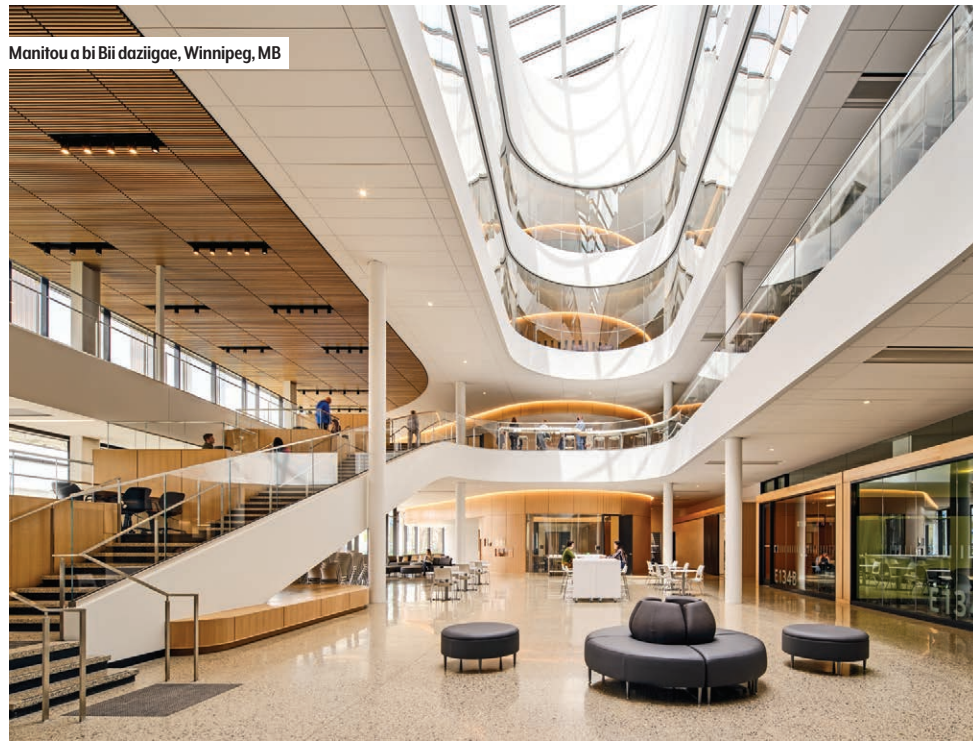
Over at Diamond Schmitt Architects, the team is seeing reinforced enthusiasm for mass timber structures and hybrid structural solutions to reduce the embodied carbon, and cost, of buildings. "Comprehensive lifecycle analyses are becoming more commonly requested from clients, allowing us to make informed decisions about balancing additional resiliency measures with reducing construction emissions and energy consumption," says Jeff Mitchell, associate at Diamond Schmitt.

This increase in energy and environmental literacy is allowing Diamond Schmitt to be proactive in pursuing design that promotes social well-being, environmental well-being, and healthy communities.

Diamond Schmitt approaches each project as an opportunity for research, and as such has established what they refer to as "Diamond Schmitt University"– a valuable platform to consolidate lessons learned that every other team at the office can tap into, as well as be shared with a wider community.

Among the many projects Diamond Schmitt have been involved with that are targeting or have reached net-zero energy or emissions are Ādisōke – Ottawa Public Library – Library and Archives Canada's new joint facility, the Toronto Paramedic

"Recently, we completed Manitou a bi Bii daziigae at Red River College in Winnipeg, which includes a façade system of Building Integrated Photovoltaic [BIPV] panels that provides more than 75 percent of its operational energy, while also being key to the expression and the identity of the building. It is the first time that this innovative concept has been applied in Canada," says Mitchell.



Manitou a bi Bii daziigae, Winnipeg, MB

PHOTOGRAPHY BY DOUBLESPACE/COURTESY DIAMOND SCHMITT ARCHITECTS

STUDY BUDDY

Much has been reported on the need to slash emissions by retrofitting large buildings, and to encourage this further, Canada Green Building Council (CAGBC) commissioned a study to evaluate the potential technical pathways to decarbonize building operations.

The study consisted of a team of researchers from RDH Building Science, in partnership with Dunsky Energy + Climate Advisors, who calculated estimated costs of deep carbon retrofits and identified market barriers and solutions.

The research team used whole-building energy modelling to evaluate deep carbon retrofit opportunities across 50 different building archetypes and regions. Among its many findings was that Canada can decarbonize existing large buildings by 2050 if we start today and owners of all large buildings can slash energy use by more than 70 percent.

"The work we're doing around retrofits is interesting and so necessary to meet Canada's climate targets. We can't get to zero without retrofitting existing buildings," explains CAGBC spokesperson Lesley Sturla.

For this to succeed, the CAGBC says it will be necessary to have access to financing that leverages energy efficiency savings to fund retrofits, like the Investor Ready Energy Efficiency (IREE) certification that facilitates retrofit proposal reviews, reduces transaction costs, and streamlines projects.

BRANCHING OUT

To succeed with plans to build green, we must incorporate all sectors. A great example of this is WSP that has been awarded the detailed design for two hydrogen production and refuelling facilities in Alberta. The facilities, located in Calgary and Edmonton, are being constructed to support Canada Pacific's (CP) Hydrogen Locomotive Program.

Low carbon intensity hydrogen has the potential to be an integral part of Canada's clean energy mix in the decades ahead. "Our team is proud to play an important role in Canada's energy transition, helping companies develop new resources for the transition to a low-emission economy," says Satvinder Flore, executive VP, Energy, Resources and Industry.

The hydrogen infrastructure at each CP site will include a 1MW electrolyzer, compression, storage, and dispensing for locomotive refuelling. In Calgary, the electrolyzer will be powered in part by renewable electricity from CP's existing 5 MW solar power facility co-located at CP's headquarters.

"Alberta presents a real opportunity for the development and execution of significant clean energy generation through hydrogen production, as well as solar, wind, and biofuel resources. This agreement presents an opportunity for our team to continue to demonstrate its expertise in the development of next generation clean energy projects," says Peter Hatcher, executive VP, Western Canada and Territories.

Construction of the two facilities is expected to begin in late 2022, with the first hydrogen to be supplied to CP hydrogen locomotive in 2023.

UTILITY COMPANIES FORGE AHEAD

Last year, FortisBC made record investment in its energy conservation and management programs, close to $120 million. While much of the funding supports traditional rebate offerings, FortisBC has also turned its attention to how best to support the much deeper emission reductions needed in existing building stock.

A deep energy retrofit is a comprehensive energy conservation upgrade to both the building envelope and energy systems with the aim of decreasing energy use by 50 percent or more.

With much of today's buildings expected to still be in active use in 2050, deep energy retrofits are needed to achieve net-zero climate action goals, especially for buildings where the gas system remains the best option. To meet this goal, FortisBC is investing $8.5 million in deep energy retrofit pilots this year and has a request to its regulator, the BC Utilities Commission, for $13.5 million in 2023.

It's now working together with key industry stakeholder groups to conduct pilots in 36 single-family homes and four multi-family buildings across the province, including a concrete high-rise in downtown Vancouver.

FortisBC is also researching technologies to support deep energy retrofits, such as air sealing advances, AI-enabled energy evaluation software, and ultra-efficient natural gas heat pumps. The information gained from these pilot projects is expected to provide critical information on how best to achieve net-zero targets in gas-heated buildings and help FortisBC determine the next generation of energy conservation programs. **A**