

# Breakthroughs Inspired by Buildings

Existing Commercial Buildings -  
The Transition to Zero Carbon

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## THE CHALLENGE AND THE OPPORTUNITY

The challenge addressed here is the transition of existing commercial and institutional buildings in Canada to zero carbon. Notwithstanding the attention given to the important goal of eliminating greenhouse gas (GHG) emissions from new buildings, there are more than 750 million square metres of existing commercial and institutional buildings in Canada – with office buildings comprising 40% of that total – that will continue to dominate the footprint of this sector for decades to come. They have a replacement value, not counting the land they are built on, of more than \$2 trillion, equivalent to the annual output of the Canadian economy.

There is no path to a net zero carbon future for Canada that does not include the decarbonization of these buildings. The GHG emissions associated with the direct consumption of fuels and electricity by existing commercial and institutional buildings (including high-rise apartments) total over 55 Mt CO<sub>2</sub>e per year. Electricity accounts for 42% of total energy use in these buildings, but nearly 70% of the total energy bill – which is about \$25 billion per year, or \$30/sqm (\$2.75/sqft), averaged over all building types.

In consultations with industry thought leaders about the challenge of decarbonization of the existing building stock, the opportunities it presents, and the solutions that are needed, a number of recurring themes arose that are summarized below. The intent of this paper is to stimulate further conversation on how to better define the elements of building decarbonization, and on the identification of strategies and next steps for realizing those solutions.

## **FLEXIBILITY AND VERSATILITY ARE KEY IN THE POST PANDEMIC PERIOD**

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The pandemic has disrupted the buildings sector, and it is likely that there will be a “new normal” as the pandemic recedes. Some workers will be eager to return to the social work environment and others will shift permanently to spending a greater portion of their working time at home. Social distancing protocols may remain in place in office and other work environments, triggering a recalibration of workspace design and density. Retail in-store shopping may not return to its pre-pandemic levels and the in-store experience will be permanently affected by changes implemented to facilitate social distancing. The shift to “work-at-home” will increase the demand for services and amenities in or near residential spaces that were formerly accessed near commercial and institutional buildings, creating new expectations and demands of residential and mixed-use buildings. The pandemic has been a boon to the already booming on-line procurement sector, which translates into an increased need for space and performance in the buildings that support on-line supply chains.

In short, there will be a heightened amount of repurposing of buildings in the post-pandemic period. Repurposing of buildings is not new (many fashionable residential neighbourhoods in our cities are comprised of repurposed factories and warehouses from an earlier economic period) but it requires flexibility and creativity in the refitting and recapitalization of the existing building stock.

## **TECHNOLOGICAL SOLUTIONS**

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Electrification and efficiency are the keys to building decarbonization. In fact, with modern heat pump systems, electrification is the key to efficiency, including by switching current electric resistance heating to heat pump technology. From LED technology for lights and computer monitors to variable speed drives to paperless information management systems and heat pump technologies for space conditioning, modern electric-powered technologies are dramatically more efficient than their predecessors or their combustion-based alternatives. In a deep building retrofit, these efficiency gains can drive reductions in power consumption that are larger than the additional electricity required to switch from natural gas to heat pumps. By combining building energy efficiency and electrification, the decarbonization of commercial and institutional buildings can facilitate grid decarbonization.

## **ORGANIZATIONAL SOLUTIONS**

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A recurring theme in conversations with industry thought leaders is the need for more interconnectivity, coordination and collaboration throughout the design-build-commission process. This includes greater collaboration among the trades and earlier engagement of all stakeholders. It includes engagement with the tenants and building users early in the retrofit design process, and continuing throughout the build and commissioning phases.

Commercial buildings are the “factories” of the post-industrial economy, but they have been treated largely as cost centres rather than productive assets. This has resulted in an obsession with capital cost minimization over value maximization, and to inadequate and sometimes no involvement of the building users in the design-build and design-retrofit stages of asset life. This is a recipe for suboptimal outcomes. Not surprisingly, builders who engage tenants and users throughout the design and building/retrofit process are getting better results.

## FINANCING SOLUTIONS

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The decarbonization of buildings is capital intensive, with many of the benefits accruing over time in the form of higher productivity, healthier occupants, and reduced operation and maintenance costs. Innovative financing will be key to minimizing life cycle costs and emissions.

The commercial and institutional building stock is aging, reflecting the growth of the service and government sectors that took place 40-50 years ago. The condition of many of these buildings has deteriorated, and this presents both a challenge and an opportunity. This deterioration reflects inadequate maintenance capital investment by owners, primarily due to limited budgets, split incentives and/or a lack of appreciation of the value, or the ability to capture the value, of maintaining healthy, productive indoor environments for service sector workers. The problem of split incentives is structural and intractable. Corners get cut to lower capital costs, even when they decrease the productivity of the building and increase operating costs, GHG emissions and the total cost of ownership. The integrated and collaborative approaches described above will help to redress this problem, as will building codes, regulations, and disclosure requirements.

## REGULATORY SOLUTIONS

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The speed with which the building industry incorporates decarbonization in building recapitalization and renewal is impeded by competitive pressures and split incentives that lead to capital cost minimization too often trumping the recognized life cycle benefits of the low carbon alternative. Notwithstanding the growing appreciation of the business case for creating productive, healthy, zero emitting indoor environments, regulatory measures could accelerate the rate of progress in changing “business as usual” practices in the industry.

## CONCLUSION AND NEXT STEPS

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The decarbonization imperative in the building sector coincides with other disruptive trends, such as changing use patterns, rapid technological innovation and growing expectations from clients for healthy, versatile, productive indoor environments that deliver high performance and lower costs. These trends have been accelerated by the pandemic, and the building sector will need to build back better to realize its potential contribution to the post-pandemic economy. This presents a generational opportunity to integrate the zero-carbon objective in the recapitalization and renewal of the existing building stock by implementing the efficiency and electrification investments that are the key to their decarbonization.

This paper is intended as an agenda for a conversation that needs to take place among the stakeholders in the building sector, including financiers and developers, policy makers and regulators, builders and suppliers, owners and the tenants, architects and the trades, and perhaps most importantly the building occupants and users. To help facilitate this conversation, the Globe Series/Corporate Knights Clean Recovery Breakthroughs Series will convene a Roundtable of invited stakeholders to address the issues raised here and respond with a strategy for decarbonizing Canada's commercial and institutional buildings.

## #CleanRecoveryBreakthroughs

*From talk...to action...to outcomes*

We are on the brink of an unprecedented transformation. The Clean Recovery Breakthrough Series is a collaboration of Corporate Knights and Globe Series where thought leaders from across the country will shape that transformation. Together, we will identify industrial breakthrough opportunities that reduce carbon, attract investment, create jobs...and position Canada as a global leader in the clean recovery.

The Clean Recovery Breakthrough Series features leader dialogues and transactional activities that take us beyond talk to transformational outcomes, beyond recovery to resilience and prosperity.

This paper is part of the Series' "Breakthroughs Inspired by Buildings" track of activities and is intended as a discussion-starter for a forthcoming Roundtable of leaders in the commercial building sector in Spring 2021. It picks up a number of critical themes that came out of our February 18 webinar on the same topic and puts them into a framework for thinking about how to make progress towards deeper decarbonization of commercial and institutional buildings in Canada, and at a faster pace.

**The "Breakthroughs Inspired by Buildings" track of the Clean Recovery Breakthroughs Series is sponsored by:**



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