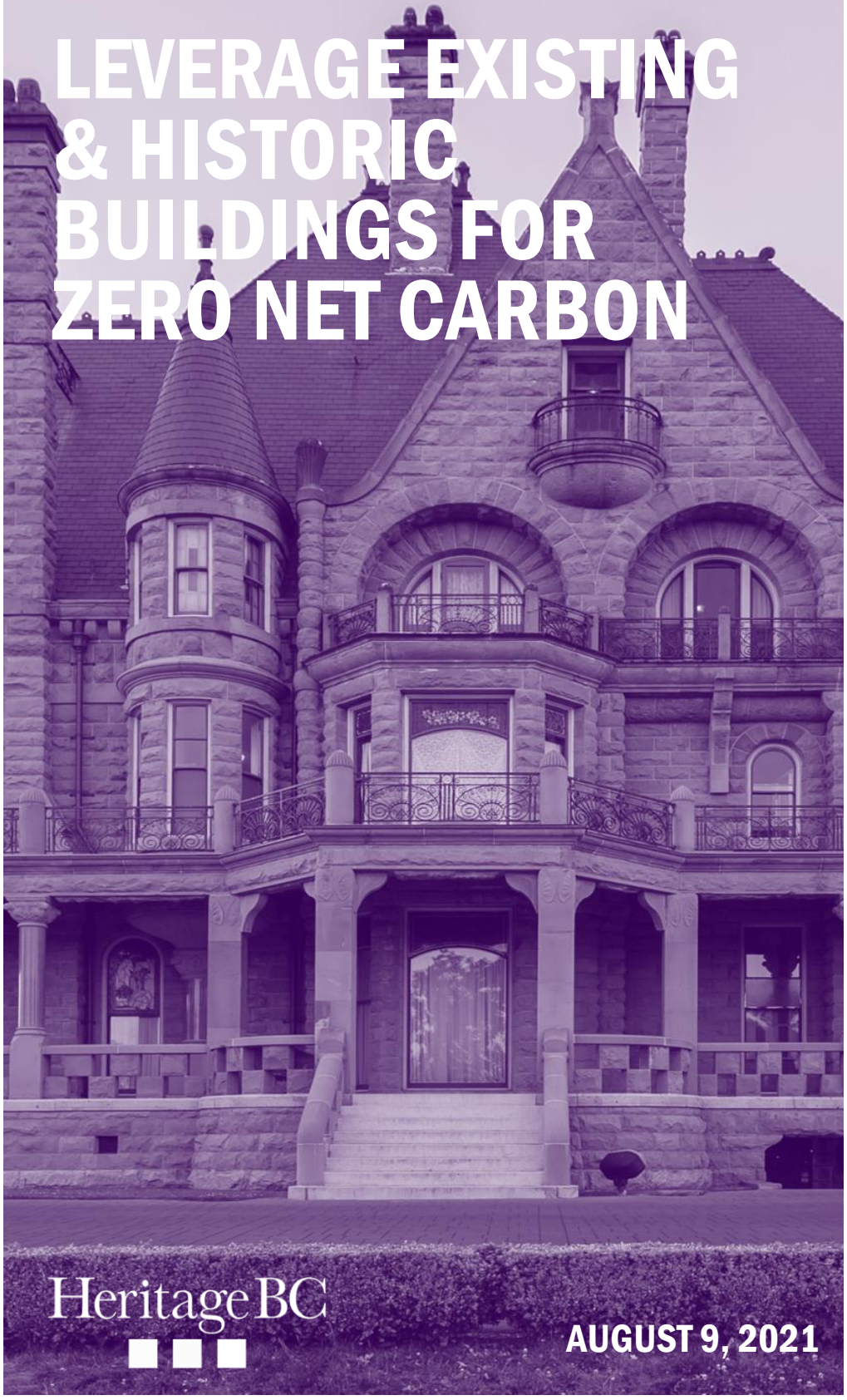
HERITAGE BC SUBMISSION TO BC ROADMAP TO 2030 – BUILDINGS PATHWAY

LEVERAGE EXISTING & HISTORIC BUILDINGS FOR ZERO NET CARBON



Heritage BC

AUGUST 9, 2021

HERITAGE BC SUBMISSION TO BC ROADMAP TO 2030 – BUILDINGS PATHWAY

LEVERAGE EXISTING AND HISTORIC BUILDINGS FOR ZERO NET CARBON

AUGUST 9, 2021

1 INTRODUCTION

CleanBC is the Province's plan towards a more prosperous and sustainable future. Since the release of *CleanBC* in 2018, the gap to achieve our legislated greenhouse gas targets has grown. The Province is developing the Roadmap to 2030 which will be the Province's response to the challenge of reducing our emissions further to meet our targets. Release of the Roadmap is expected in Fall 2021. The Building and Safety Standards Branch (Ministry of Attorney General and Minister Responsible for Housing) and the Built Environment Branch (Ministry of Energy, Mines and Low Carbon Innovation) hosted a consultation session on reducing carbon emissions in the building sector on August 4th, 2021. Heritage BC representatives attended, and this submission is related feedback and comments. It is also understood that a deeper dive consult session into "Existing Buildings Renewal Strategy" will be scheduled later in the Fall 2021 to continue discussions and collaboration with affected parties and key influencers, which Heritage BC would like to be invited to.

Through *CleanBC* , the Province is raising the standards for new construction and encouraging energy-saving improvements in some existing buildings, such as homes, schools and workplaces. BC is also supporting communities in reducing greenhouse gasses ('prevention') and preparing for the effects of climate change ('mitigation' and 'adaptation'). These are good initiatives, but we must do more in this sector in order to meet our carbon reduction targets for 2030. **BC is a leader in North America in new building energy efficiency; however, globally almost 40% of GHG emissions relate to buildings and the vast majority are existing buildings, including historic buildings.** In larger cities, such as Victoria or Vancouver, the share of emissions attributable to buildings increases, up to 70% and beyond. In fact, 67% of today's buildings will still be with us in 2030. [1] **Therefore, of the 3 building sector policy levers being considered for the Roadmap to 2030, Lever #2 Existing Buildings, should logically be prioritized.** [2]

Existing buildings are a vast resource that we are missing opportunities to leverage, through proper stewardship. Not just to reduce major amounts of carbon emissions and increase overall sustainability and resilience, but also to improve community place-making and continuity, increase achievement of social and cultural objectives such as inclusivity and commemoration, and reduce urban intensification impacts and costs. In a ground-breaking program at the University of British Columbia, "UBC Renews", results showed that for the cost of two new buildings constructed on campus, they could rehabilitate 3 buildings of equivalent floor space. It is difficult to argue against "buy two – get one free" thinking! [3]

Globally, North Americans built as much in the post war years (1945 to 1975) as they had in all of the previous recorded history of buildings. These 45 to 75 year-old buildings are now coming to the end of their lifecycle phase and many need major rehabilitation anyway. Incorporating deep green retrofit to reduce energy and GHG emissions, actions that pay back over time, is a fiscal "no-brainer". The revitalization of buildings of this period alone, provides opportunity to significantly reduce carbon in our environment.

Heritage buildings are a subset of all existing buildings. Both traditional buildings and exemplars from the Modern era ("Modern Heritage") showcase opportunities to demonstrate the powerful impact of deep green rehabilitation. This is because they are boosted by the fact that preserving the structure and many other elements, reduces emissions from their "embodied carbon", which represents over a quarter of a building's total carbon. The other portion is "operational" carbon, which, as we increase energy efficiency through new technologies, will make that embodied carbon a larger and more important aspect of building carbon over time.

Heritage conservation professionals have harnessed the skills to design contemporary interventions into existing buildings that still preserve their value – heritage value, as well as economic value, socio-cultural value and environmental value, all of which most existing and historic buildings possess, to at least some degree.

In the Autumn of 2021, BC will be developing an **Existing Buildings Renewal Strategy (EBRS)**. This strategy will consider regulatory options to ensure existing buildings are more energy efficient, lower carbon and at the same time, make them more resilient to

events like earthquakes, wildfires, heat waves, floods and other impacts of the Climate Change Emergency now upon us. **Heritage BC requests to be a part of the EBRS process.**

As part of BC's 2030 commitment to reduce province-wide emissions by 40% from 2007 levels, BC has set a 2030 buildings and communities target to reduce emissions in the building sector by **more than half.** In developing a Roadmap to meet our 2030 targets, **we hope that this submission can help formulate part of that Roadmap.**

2 HERITAGE CONSERVATION & BUILDING REUSE ARE CLIMATE ACTION

The Intergovernmental Panel on Climate Change (IPCC) notes that, "over the whole building stock, the largest portion of carbon savings by 2030 is in retrofitting existing buildings" (B. Metz, et al). [4] Older, traditional buildings are often more "inherently sustainable" than contemporary buildings, given their traditional construction techniques, durable materials, emphasis on passive approaches to occupant comfort and repairable components. [4]

According to a Canadian Commission on Building and Fire Codes recent Task Force report, Authorities Having Jurisdiction (AHJs) have expressed the desire for a variety of tools to support their policy objectives and are increasingly turning to building codes to address their most pressing social policy goals, such as climate change resilience. There is an increasing interest in BC, Canada and abroad to use regulation as a tool to address the shortfalls of new construction and the existing building stock. For example, jurisdictions are increasingly turning to more ambitious building codes as a means of reducing energy use and, in turn, greenhouse gas emissions (GHG) of buildings. Although the application to existing buildings is stated in the National Building Code (NBC), jurisdictions often only apply the NBC to the design and construction of new buildings. [5]

The development of National Model Codes for existing buildings could be a key component of improving the performance of existing buildings at the time of alterations, working toward provincial, territorial and federal long-term policy goals. In the absence of consistent regulatory measures regarding the improvement of building performance at the time of alterations, or non-regulatory measures encouraging these improvements, many existing buildings will be left unchanged for years to come. We understand that BC is currently working on an Energy Code for Existing Buildings that incorporates new energy efficiency standards for building upgrades, to be adopted into the BC Building code by 2024, in collaboration with Codes Canada. Heritage BC supports this initiative, with some caveats pertaining to protection of character-defining elements of designated heritage buildings.

Is there a way to accelerate this launch, to better position existing and historic buildings for reductions by 2030?

Architecture 2030's *Road Map 2050 to Zero Emissions* include action items guidelines for existing buildings in developed countries, such as renovating a minimum of 2-3% of the total existing building stock each year to meet EUI (energy use intensity) of 50% below the regional average, for each building type. [6] The goal was to have 80% carbon reduction by 2020 and carbon neutral by 2030. In the last decade, however, most jurisdictions, including British Columbia, have fallen behind**. It is therefore essential to increase that amount of total building stock being retrofitted for zero-carbon to a significantly higher rate than 2-3% per year.** [6] **This means that a major push on building renovation and decarbonization is now a necessity. Programs that BC can bring forward to further enhance the feasibility and attractiveness of deep green rehabilitation to existing and historic buildings would be useful.**

In the area of energy improvements for existing buildings, continuing with the status quo vs. a significant set of programs to boost decarbonization, could also have a big impact on whether BC and Canada can achieve specific policy goals, such as **our commitment to the Paris Climate Agreement.** Canada's Building Sector accounts for a *quarter of final energy demand* and a *fifth of our energy-related carbon emissions*; building codes are an opportunity to reduce and eliminate significant energy waste. [7]

20% of Canada's built heritage was lost between 1970 and 2000. This is almost entirely due to demolition and new construction, which have had a tremendous impact on the environment. **Construction & demolition generate ~ 35% of Canada's landfill waste.**

Demolitions produce 20-30 times more waste material per sq. m. than reno or new construction; 20% of Canadian landfill is occupied by construction waste; 50% of that waste is salvageable and 45% recyclable. Refurbishing existing buildings can reduce Canada's waste stream by at least 6%, since renos to existing buildings have similar energy consumptions as for typical new builds. [7]

While the case for building and renovating green buildings has been proven from financial and environmental perspectives, it is time to scale up solutions, including promoting building renovation that has measurable impact. Prior focus was on the operational carbon of buildings which accounts for 28% of global emissions, but embodied carbon accounts for a further 11%. [8]

A study comparing life cycle carbon emissions for the refurbishment versus demolition and new build of two properties was conducted by Carrig International for English Heritage and determined that the carbon emissions for both were comparatively lower using a 60-year Reference Study Period (RSP) due to the high embodied carbon emissions associated with the demolition and construction of the new build. They also performed considerably better in terms of Marginal Abatement Cost (MAC) and Savings to Investment Ratios (SIR), indicating that it would be more cost effective and attractive as a policy than new-build, and cheaper to make attractive to developers and homeowners. [9]

3 ECONOMICS – LOW CARBON ECONOMY & OTHER FACTORS

Heritage generates jobs and income, avoids waste from demolition, reduces the use of new materials and their associated costs, reducing the overall carbon footprint. This mindset is applicable to all existing buildings, whether deemed as heritage or not. **The economic sustainability of heritage is greater** when we invest in repair and maintenance of heritage assets; this in turn generates growth in the communities' appreciation of heritage. Policies and activities that improve or increase these factors **contribute to a low-carbon economy** and to the sustainability of heritage capital. [10]

In Europe, where there are strong government policies with respect to the energy performance of new and existing buildings, energy efficiency renovations (i.e. alterations) have played a strong role as a stabilizer of the building sector and the European economy, since the financial crisis of 2008. According to CHBA's Economic Impacts of Home Renovation and Repair, home reno/repair in Canada had a greater economic impact than new construction. Any regulatory measure or non-regulatory instrument facilitating the uptake of alterations to existing buildings may increase the economic potential of this industry, provided that the regulatory measures are reasonable. [5]

Referring back to the UBC example: *UBC Renews* showed that the cost of renewal was no more than 67% of the cost of a comparable new building, essentially meaning that every third renewed building is free. Part of a partnership with UBC and the BC government, they started with $320M in deferred maintenance. Buildings had no official heritage designation, but they were still worthy of retention. Approximately 60% of interiors were retained; 80% of materials were recycled/refurbished. They achieved an overall 21% energy savings in retrofitting. Initiating more programs based on the success of UBC Renews is recommended. [3]

Heritage conservation is an important part of the economic sector, from providing employment growth during the conservation/construction process, to maintaining and managing its assets and attracting further investment (for example, for tourism). [10]

Repairing, reusing, and retrofitting is a labour-intensive process, more so than new buildings, resulting in the creation of new jobs. Members of the public (based upon a UK Study) are more inclined to prioritise maintaining and repairing existing infrastructure before spending on new. An estimated 1 million new green jobs will be created in Europe to achieve the 2030 climate and energy targets, adding 1% to GDP. A transition to a low-carbon, efficient and resilient economy brings productivity benefits into the economy. [10]

Moving towards a circular economy, optimizing productivity, and using the existing building stock and heritage assets, contributes to a distinctiveness of a place, improving it for residents and tourists alike. [10]

The **Historic Tax Credits** for qualified improvements to heritage properties brought in by the Reagan Administration in the 1980s in the United States, has now been proven to be a net income generator for the US Treasury. BC should review the benefits to government that a program like this could provide, and potentially link it also to decarbonization.

4 EMBODIED CARBON

Embodied carbon is the associated carbon-dioxide emissions as a result of production, transportation and installation of building materials and components on site. They account for a large percentage of a building's total life cycle emissions, especially in high embodied carbon materials such as concrete, cement mortar, steel, aluminium, PVC products and petroleum-based products. Europe recognizes the importance of reducing embodied carbon in cross-sector supply chains, the reuse of existing infrastructure and buildings are part of this wave of sustainable construction practices. [11]

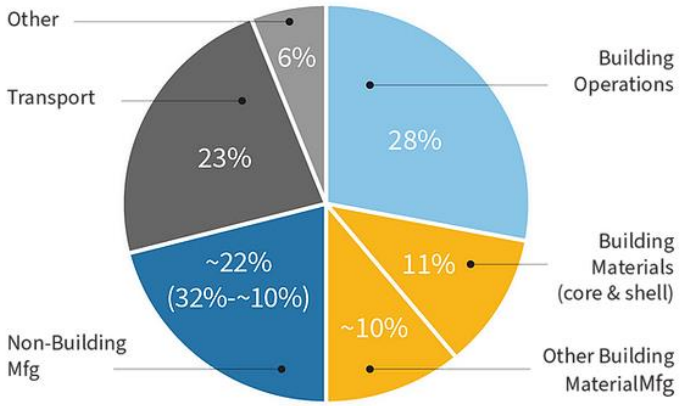
If a building is demolished, there is a waste of embodied energy from its entire lifecycle.

For example, carbon emissions released before the building or infrastructure begins to be used, or upfront carbon, will be responsible for half of the entire carbon footprint of new construction between now and 2050. This threatens to consume a large part of our remaining carbon budget. A net zero embodied carbon building (new or renovated), is highly resource efficient with upfront carbon minimised to the greatest extent possible, and all remaining embodied carbon reduced or offset in order to achieve net zero across the lifecycle. [12]

Principles to follow in reducing embodied carbon: 1. Prevent; 2. Reduce and optimize; 3. Plan for the future; 4. Offset [12]

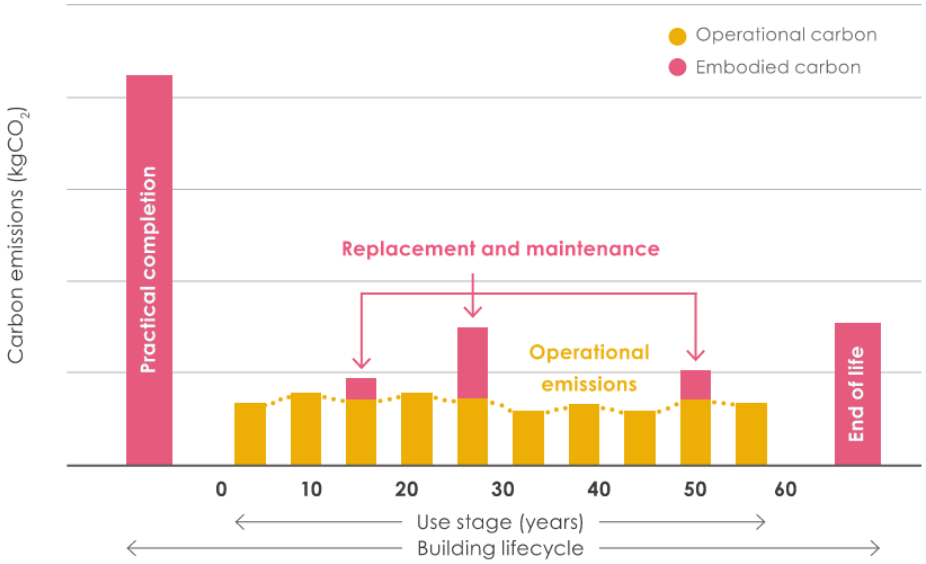
Load-bearing elements such as concrete, steel and asphalt, are carbon intensive materials, and often contribute the majority of emissions. Focusing on building elements as a principal source of embodied carbon presents an opportunity to ensure that structures achieve the maximum possible useful life, which therefore supports a case for retrofitting against demolition.
For instance, cement manufacture is responsible for around 7% of global carbon emissions, with steel also contributing 7-9% to the global total, around half of which can be attributed to buildings and construction. Each building renewal project is unique, but almost all of them retain the biggest source of embodied carbon: the structure. [12]

1 Embodied Carbon vs. Operational Carbon. Understanding Carbon; Stacy Smedley, SKANSKA/CLF.

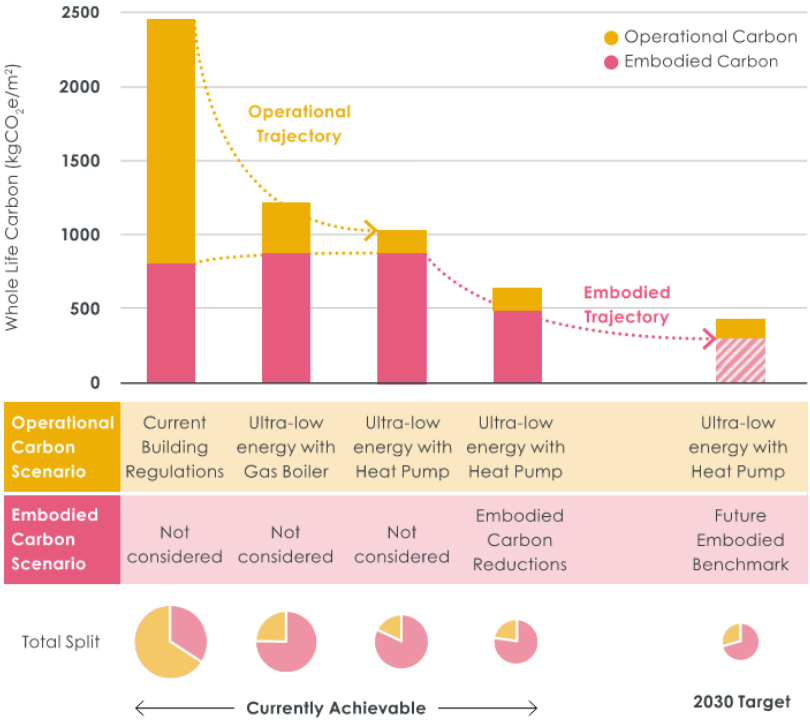


Adapted from 2019 Global Status Report, Global Alliance for Building and Construction (GABC) and Architecture 2030.

2 Breakdown of global carbon emissions by sector. Global Alliance for Building and Construction and Architecture 2030.



3 Emissions breakdown throughout a building's lifecycle. London Energy Transformation Initiative. LETI Embodied Carbon Primer: Supplementary Guidance to the Climate Emergency Design Guide. World Green Building Council, 2020. (p. 9)



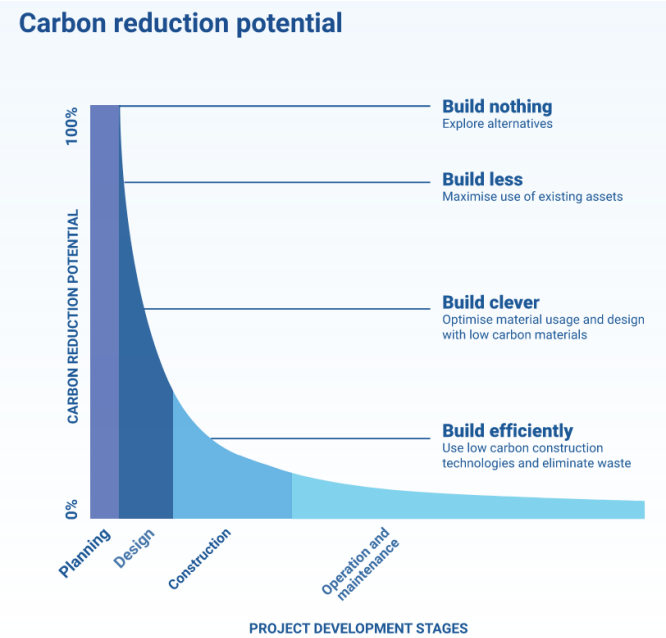
4 Operational and embodied carbon trajectories. London Energy Transformation Initiative. LETI Embodied Carbon Primer: Supplementary Guidance to the Climate Emergency Design Guide. World Green Building Council, 2020. (p.18)

5 COMPARISON: REHABILITATION/EXISTING VS DEMOLITION/NEW-BUILD

Every year in the United States, an estimated 1 billion square feet of buildings are demolished and replaced with new construction, a statistic that accompanies the replacement of one quarter of today's existing building stock between 2005 and 2030. [13] Estimates for Canada and British Columbia are not dissimilar, to scale.

A study conducted in 2011 by the Preservation Green Lab, National Trust for Historic Preservation, confirmed that building reuse almost always offers environmental savings over demolition and new construction when comparing buildings of similar size and functionality. [13] Accompanied by careful consideration for material selection and efficient design strategies for reuse, retrofitting existing buildings with appropriate energy upgrades offers the most substantial emissions reductions over time and is an option for immediate climate action. The study, which compared a variety of building typologies in a range of USA locations, confirmed a 4-46% in savings for reuse compared to new construction for buildings of the same energy performance level. Reusing existing buildings can provide communities with an opportunity to avoid unnecessary carbon outlays and a means of achieving near-future carbon reduction goals. [13]

The impact of savings in reuse at the individual scale may reap minimal benefits, however, the impact of these savings at a city scale is substantial. Scaling up the benefits of carbon-savings for building reuse is a known way to meet carbon reduction targets. The most impactful changes for building reuse and retrofit are in areas where coal is the dominant energy source and where the environment experiences extreme climate variations. New "energy-efficient" buildings can take between 10-80 years to overcome the negative climate change impacts created during the construction process for a building that is 30% more efficient than an average performing existing building. [13]



5 Carbon reduction potential during project development stages. Advancing Net Zero, WGBC, RAMBOLL and C40 Cities. *Bringing Embodied Carbon Upfront: Coordinated action for the building and construction sector to tackle embodied carbon.* (p.20).

6 CONCLUSION

First, a word of caution as we bring heritage structures into the decarbonizing fold: ***Damage can be caused to the cultural heritage values of the built environment, the fabric and performance of individual buildings and the health and well-being of their occupants by inappropriate upgrading works carried out in the name of climate action. Such maladaptation, however well-intentioned, is wasteful and destructive and must be avoided in order to provide effective and durable solutions.*** [14]

Heritage-conservation professionals have strong insights to contribute to the planning, testing, and implementation of decarbonization, mitigation and adaptation that are needed to address climate-change disruption. Experience in collaborative solutions and community planning, rationale development and vetting, envisioning of creative alternatives, logic sequencing of potential outcomes, and other skills developed by conservation architects and other professionals in their design and change-management practices for existing and historic properties—all will provide valuable foundational expertise for vulnerability assessment and the required complex matrix of decarbonizing and adaptation solutions.

Conservation professionals have developed advanced relevant skillsets of questioning further, delving deeper into root causes, and probing wider to gain a clearer understanding of building renewal projects and work with interventions to existing buildings - the single largest contributor to carbonization and Climate Chaos. The conservation community (can) take a leadership role in the "Race to Net Zero," using its members' expertise in "managing change to existing buildings while retaining value". This work must address the required **dramatic acceleration of context-sensitive rehabilitation of the massive stock of existing, abandoned and heritage properties.** A large task will be the sustainable rehabilitation of heritage buildings from the modern era, which collectively, mainly due to their abundance, are the greatest greenhouse-gas "culprits". The recent improvements in the understanding of embodied carbon in existing buildings underscores the necessity of "recycling" buildings rather than building new.

Life-cycle assessments help us better understand how the choices of materials and decisions to reuse and rehabilitate can dramatically decrease our carbon footprint. Interestingly, "mainstream" architecture and green-building construction have just recently started to embrace the fact that to "slay the carbon dragon," we need to be mostly focused on "deep green" rehabilitation of existing buildings, not new green buildings.

The Roadmap to 2030 must involve collaborative and strategic efforts by conservation professionals, particularly by those whose particular skills and leadership can provide major contributions to scaled-up decarbonization solutions for existing buildings.
In conclusion, we quote from the Climate Heritage Network's *** very recent statement on the Architecture 2030 Communique, being developed for COP 26:

"Worldwide, built heritage is being lost to climate change at an alarming rate. Along with cherished structures and places, the legacy of its creators is also lost. Cultural and social bonds are being weakened at a time when greater strength and resilience is needed most. The most vulnerable are being impacted disproportionately. The loss of built heritage is not limited to the destruction of iconic structures, far from it. It also means the loss of everyday buildings that continue to serve essential human purposes, the very fabric of our cities and towns.

Even more alarming than the rate of building loss to climate change, is the wanton destruction of millions of useful buildings in the name of progress – even in the name of climate action. The climate crisis demands that every source of carbon pollution be zeroed-out quickly. The world cannot afford to waste viable buildings. ***The first step in decarbonizing the building sector is to keep and use every building.***

In 2030, 85% of existing buildings will still be standing and still be viable for use. This is a tremendous resource that requires global attention.

The quickest and surest path to a zero-carbon building sector is to conserve and appropriately adapt existing buildings. The principles and practices of heritage building conservation are of tremendous importance and usefulness as the world confronts climate change. They are the fundamental skillsets required to extend the low-carbon or zero-carbon service life of all existing buildings, not only heritage structures.

BUILDING REUSE IS CLIMATE ACTION

SUMMARY LIST OF BENEFITS OF FOCUSING ON EXISTING & HISTORIC BUILDINGS:

- Increase overall sustainability and resilience;
- Improve community place-making and continuity;
- Increase achievement of social and cultural objectives such as inclusivity and commemoration;
- Reduce urban intensification impacts and costs;
- Heritage generates jobs and income and avoids waste from demolition;
- Retrofitting existing buildings offers the most substantial emissions reductions over time.

Summary List of Recommendations:

- **Include Heritage BC in the Existing Buildings Renewal Strategy;**
- **Dramatic acceleration of context-sensitive rehabilitation of the massive stock of existing, abandoned and heritage properties;**
- **Bring forward policies and programs to further enhance the feasibility and attractiveness of deep green rehabilitation to existing and historic buildings;**
- **Energy Code for Existing Buildings to be adopted into the BC Building code: launch before 2024 if possible;**
- **Policy tools that help remove obstacles for building reuse and remove barriers to retrofit and retrofit policies;**
- **Consider a range of tax benefits for existing and historic building renewal that decreases carbon emissions;**
- **Policy levers that enhance sustainable finance for decarbonizing rehab/retrofit for existing & historic buildings;**
- **Engage conservation professionals with experience in new interventions into existing buildings to assist with policy and program development;**
- **Collaborate with Heritage BC to review policy and program proposals, to ensure conservation community input is considered and existing & historic buildings are optimally decarbonized while protecting and leveraging their values.**

NOTES:

*** The Climate Heritage Network serves as a clearinghouse for a wealth of resources on stewardship and climate adaptation, including:

- project case studies for climate retrofits of heritage and existing buildings;
- retrofit guidelines based on building science;
- easy-to-use life-cycle carbon calculators factoring both operational and embodied emissions;
- policy models for protecting existing resources and building decarbonization.

Founded in 2019, the **Climate Heritage Network** is a voluntary, mutual support network of arts, culture and heritage organizations committed to aiding their communities in tackling climate change and achieving the ambitions of the Paris Agreement.

Additional reading by Mark Thompson Brandt can be found here:
Buildings and stories: mindset, climate change and mid-century modern, Journal of Architectural Conservation 2017
https://mtbarch.com/wp-content/uploads/2017/06/Buildings-and-stories-mindset-climate-change-and-mid-century-modern.pdf

REFERENCES

[1] British Columbia Government. "Heritage and Sustainability Facts." Heritage & Sustainability Facts - Province of British Columbia (gov.bc.ca)

[2] Roadmap to 2030 – Buildings Pathway Stakeholder Engagement. *CleanBC,* August 4, 2021.

[3] Hallé, Renée. "Renewal of University of British Columbia's Chemistry Building Centre Block through Retrofits for Energy Efficiency." *UBC Renew*, December 22, 2019.

[4] National Trust for Canada. *Making Reuse the New Normal: Accelerating the Reuse and Retrofit of Canada's Built Environment.* 2020.

[5] Canadian Commission on Building and Fire Codes. *Final Report-Alterations to Existing Buildings: Joint CCBFC/PTPACC Task Group on Alterations to Existing Buildings.* National Research Council Canada, 2020.

[6] Architecture 2030. *Roadmap to Zero Emissions: Submission to the AD HOC Working Group on the Durban Platform for Enhanced Action*. 2014.

[7] Efficiency Canada. "What You Need to Know About the New Building Codes." *Efficiency Canada (blog).* February 4, 2020.

[8] World Green Building Council. *Building a Better Future, Annual Report.* 2018-2019.

[9] Carrig Conservation International. *Understanding Carbon in the Historic Environment, Scoping Study Final Report.* Historic England, 2019.

[10] Heritage Counts. *Heritage and the Economy.* Historic England, 2020.

[11] Carrig Conservation International. *Energy Efficiency in Traditional Buildings: Draft guidance for public consultation*. Government of Ireland, Department of Housing, Local Government and Heritage, 2021.

[12] Advancing Net Zero, WGBC, RAMBOLL and C40 Cities. *Bringing Embodied Carbon Upfront: Coordinated action for the building and construction sector to tackle embodied carbon.* P. 11-24.

[13] Preservation Green Lab. *The Greenest Building: Quantifying the Environmental Value of Building Reuse*. National Trust for Historic Preservation, 2011.

[14] Jacqui Donnelly, Senior Architect, Built Heritage Policy, Department of Housing, Local Government & Heritage, Government of Ireland.

OTHER SOURCES:

Architects Climate Action Network. *The Carbon Footprint of Construction: a case for regulating embodied carbon in construction to significantly address the impact of the industry on the climate.* 2021

Hallé, Renée. *Renewing UBC'S Campus.* Carleton University, November 14, 2019. PowerPoint Presentation.

Heritage BC. "Making a Case for Building Conservation." *Heritage BC Learning Centre.* Making a Case for Heritage: Building Conservation - Heritage BC

London Energy Transformation Initiative. *LETI Embodied Carbon Primer: Supplementary Guidance to the Climate Emergency Design Guide.* World Green Building Council, 2020.

Sanders, Helen. "Carbon Counting: Why 'Embodied' Carbon Matters." *US Glass Mag,* August 2, 2019. https://www.usglassmag.com/insights/2019/08/carbon-counting-why-embodied-carbon-matters-part-1/

Thompson Brandt, Mark, and Cory Rouillard. "Climate Chaos and Heritage- Conservation Values: The Urgency for Action." *Traditional Building, October 2020.* https://lsc-pagepro.mydigitalpublication.com/article/Climate+Chaos+and+Heritage-+Conservation+Values%3A+The+Urgency+for+Action/3762040/673255/article.html.

AUTHOR QUALIFICATIONS

MTBA
ARCHITECTURE • URBANISM • CONSERVATION

MARK THOMPSON BRANDT, SENIOR CONSERVATION ARCHITECT& URBANIST, OAA, RAIC, CAHP, FAPT-RP, LEED AP

Mark is sought after as a leading Heritage Architect/Urbanist in the National Capital Region, having led or co-led over a dozen Parliamentary Precinct heritage projects. Mark is a National Leader in Sustainable Rehabilitation, having co-authored *Building Resilience: Practical Guidelines for the Sustainable Rehabilitation of Buildings in Canada*, the national guidelines document, is currently Co-Chair of the North America-wide Zero Net Carbon Collaboration for Existing and Historic Buildings (ZNCC), and lectures widely on the link between, and the responsibility of, heritage conservation in the effort to reduce carbon emissions. Mark is a sustainability, heritage conservation and existing building specialist with expertise in value assessments, impact assessments and high-value reviews, evaluations for built heritage and cultural landscapes as well as constructing/adapting/intervening in existing structures. He is a stakeholder engagement specialist, with expertise in managing input and gaining consensus through dialogue and project management, including heritage evaluation and intervention reviews, FHBRO presentations and approvals.

EMILY GUY, RESEARCH LEAD & PROJECT COORDINATOR, BA (CANADIAN STUDIES), MA (HISTORY), MED

Emily is a historian with a degree and graduate degrees in Canadian Studies, History and Education. Emily has experience in the private, public, and academic areas and has worked in different jurisdictions in Canada. At MTBA, she leads Research and Development projects, with a specific focus on Historic Places, Heritage Conservation Districts and Cultural Heritage Impact Statements. Emily's Professional Development focusses on Heritage Planning courses, including Cultural Resource Management at the University of Victoria. She is a key Project Manager at MTBA and works closely with the Technical team on a variety of heritage conservation and research projects.

CATHERINE MCBAIN, INTERN ARCHITECT & HERITAGE SPECIALIST, OAA, RAIC, APT

Catherine is an Intern Architect with a speciality in heritage conservation. Her interests include Modern Heritage, concrete conservation, heritage documentation, and designing for social impact. Catherine's graduate thesis explored critical alternatives for the conservation of Canada's former Indian Residential Schools. Her roles in projects include research, design, contributing to cultural heritage impact statements and heritage consideration reports. Catherine is actively part of MTBA research efforts for various projects and is currently working on a second edition of *Building Resilience: Practical Guidelines for the Sustainable Rehabilitation of Buildings in Canada.*

MELISSA LENGIES, RESEARCH INTERN, B.ARCH, LEED GREEN ASSOCIATE

Melissa is an architectural researcher with a specialization in heritage conservation and sustainability. Currently working on her Master of Architecture, she has prior experience in both the public and private sectors providing heritage and design services in the National Capital Region and beyond. As a research intern with MTBA through the NSERC CREATE Heritage Engineering program, Melissa is interested in the impact of climate change on built heritage, as well as the role built heritage plays in climate action in various cultural contexts. She plays an active role in MTBA's research and collaborative initiatives, and is working on the second edition of *Building Resilience: Practical Guidelines for the Sustainable Rehabilitation of Buildings in Canada.*