EXECUTIVE SUMMARY

Policy Assessment of Carbon-Focused Life Cycle Assessment in Green Building Design and Performance at the University of British Columbia

Prepared by: G. MacKenzie Walker, UBC Sustainability Scholar, 2019
Prepared for: Diana Lopez, Research Coordinator, UBC Sustainability Initiative, University of British Columbia

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Disclaimer

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Executive Summary

The University of British Columbia (UBC) approved the Green Building Action Plan (GBAP) in 2018, which prioritized the reporting and reduction of embodied carbon in building projects through tools such as whole-building life cycle assessment (WBLCA). The research outlined within this report is intended to provide a concise summary of what this mandate means, what is already being done and opportunities and challenges to meet the vision as outlined within the GBAP. By consolidating this information in one report, it strives to establish a common understanding of embodied carbon and WBLCA concepts and serve as a reference for a UBC staff audience and external partners.

The research within the report is divided into the following three sections:

1. Overview of life cycle assessment (LCA) concepts, how LCA can be used to assess environmental impacts, which include embodied carbon, and a review of the prominent software tools that are available to assist in conducting these assessments;
2. Summary of a literature review of the numerous standards and green building certification programs which exist to provide uniformity and incentivize the use to LCA to reduce embodied carbon in building construction. This section also includes the discussion of the existing policies and regulations which are implemented or under development globally, at a national level in Canada, at the regional level in the lower mainland and then lastly at UBC Vancouver Campus; and
3. A discussion of opportunities and challenges in successful application of LCA analysis and policy implementation, specifically focused on UBC. This discussion was informed through interviews and the literature review conducted in the two previous sections.

Life cycle assessment (LCA) of buildings is both a science and a framework to quantify potential environmental impacts of buildings and their components throughout the different life cycle stages, including resource extraction, manufacturing and prefabrication, transportation, onsite construction, operation, maintenance, demolition and disposal. There are several ways to utilize LCAs, which all strive towards reducing the environmental impacts of buildings now and in the future. In general, LCAs can be used:

- To inform the building design process and modify the building design to reduce its environmental impacts;
- As a post-construction assessment of building performance; and
- To set environmental impact benchmarks and targets for building typologies.

WBLCA is a type of LCA in which the entire building is assessed comprehensively, as opposed to only an individual component (e.g. comparing only the environmental impacts of material choices for the structural system of a building). The holistic assessment approach of WBLCA allows for improved opportunity to reduce negative environmental impacts, which is generally preferred both at UBC and the wider construction industry to measure the reduction in embodied carbon and other environmental impacts.

Embodied carbon refers to numerous greenhouse gases which, when emitted to the atmosphere—in this case as a result of the construction of a building—are able to retain thermal energy, leading to an increase in the average temperature of the Earth. This process of trapping thermal energy is referred to as global warming. Embodied carbon is a way to understand and quantify the greenhouse gases that are emitted by the building materials and construction methods, which includes all of the life cycle stages of a building with the exception of operational uses.

Factors such as the rapid growth of the UBC Vancouver Campus student population and the need for on-campus housing drives demand for construction of new buildings, extensions, renovations, and new infrastructure. These activities require the use of materials which result in the release of significant and immediate carbon emissions into the environment. Embodied carbon emissions are notably different than operational energy carbon emissions since the later accrues over time and could be significantly reduced with operational efficiencies and construction methods (e.g. passive house) and energy supply decarbonization, which in the case of the UBC campus is already underway. Both embodied and operational emissions are important if any climate action targets are to be achieved, including UBC's target of reducing 100% of campus GHG emissions by 2050 relative to 2007 levels, as stated in the UBC Climate Action Plan.

Embodied carbon is specifically addressed in the UBC GBAP within the materials and resources component area with the following identified actions:

- For institutional buildings, implement policies for reduced embodied carbon in buildings, starting with a requirement to report embodied carbon, followed by incremental reductions.
- For residential buildings, create an integrated policy for building materials that considers reduced environmental impact, healthy material requirements, and life cycle analysis.

Based on the interviews and literature review completed for this report, the following opportunities for were identified for consideration by UBC in order to improve their policies and reduce embodied carbon emissions as part of building construction:

1. UBC should consider collecting LCAs from consultants to be able to gain insights into the environmental performance of their buildings and understand fundamental assumptions of the assessments. This information may be useful in validation of whole-building performance to meet UBC targets of net zero for both buildings by 2035 and the entire campus by 2050. Furthermore, it could also be useful to start a building a database and inform future policy targets and benchmarks.

2. Create a new requirement that a submittal be required for all new buildings (including those in the market-based development areas), which includes the BoM of the major building components and the carbon intensity of those materials, which would act as a starting point for better comparability between projects. This information would also support the creation of the database that can inform future policy target setting and benchmarking

3. Revise UBC LEED Implementation Guide to clarify the Building LCI Reduction credit, Optional 4 – Pathway 3 under LEED v4.1 be obtained by the design team as a minimum requirement.

4. Monitor forthcoming policy by the City of Vancouver, including the target of 40% reduction in embodied carbon emissions by 2030, and look for alignment opportunities. Alignment with City of Vancouver policies is likely to improve the results of any program as developers, designers and constructors operating in the region will gain familiarity with the City's processes due to the volume of development undertaken within the City in comparison to the UBC campus.

5. Actively monitor LCA tools and databases, industry capacity (i.e. designer and consultant knowledge and skills) and manufacture transparency (i.e. LCIs & EPDs) developments to identify opportunities for improvement in existing embodied carbon analysis, as well as leadership opportunities to improve these areas.

6. Support governmental initiatives for standardization of assessment methods and inputs, such as Environmental Product Declarations (EPDs), to improve benchmarks for data gathered by other municipalities and institutions.

7. Consider internalizing LCA assessment and/or implement a review processes with the consultants conducting the LCA, to improve consistency, institutional understanding and transparency; this may be a long term consideration depending on the rate of development on campus and integration of LCA into the sustainability framework for new buildings.