ABSTRACT

Building to the Passivhaus Standard for New Construction Institutional buildings

With 47,000 students enrolled annually, BCIT is the largest post-secondary institution in British Columbia. BCIT's vision is to be integral to the economic, social, and environmental prosperity of British Columbia. The School of Construction and the Environment (SoCE) is one of BCIT's six schools. It offers construction trades as well as construction sciences and technology programs. The scientific community has called for a 75% (Factor Four) reduction in global levels of energy and material consumption to achieve ecological sustainability. This target has often been perceived as "unrealistic", and the goal of BCIT SoCE's Factor Four initiative is to explore, with the help of BCIT's community (Students, Faculty and Researchers), how these reductions are possible and whether they can be achieved without compromising service levels.

In 2013, BCIT's Factor Four Team investigated Energy Conservation Measures (ECM) to improve the energy performance of Building NE1, a 20,000 m^2 mix-use educational building within the Factor Four area located at the Burnaby main campus. ECMs were identified that would reduce total energy consumption to reach the set intensity target, while improving air quality and thermal comfort; however, based on surveys done to evaluate seismic risk and deferred maintenance value, reports showed that demolishing and rebuilding Building NE1 as a new construction was more economical than proceeding with a major renovation. Further, Sandra Rohler of RPHD (Rohler Passivhaus Design) was contracted and released a preliminary building analysis report on Building NE1. This work defined a set of recommendations that included researching and understanding the implications of rebuilding NE1 to the meet the Passivhaus Standard while also achieving LEED Gold Certification, as a means to reach the energy intensity target set for NE1 in the Factor Four energy plan.

The objectives of this study are to build upon the recommendation of RPHD and assess the Passivhaus standard as it relates to new construction of Commercial and Institutional (C&I) buildings at BCIT, while studying the differences in building science, design and construction with LEED, and identify priority actions and recommendations to further develop the business case for the Passivhaus standard. Specifically, the following research questions will be investigated:

- What is a Passivhaus building and why pursue the standard?
- What are the implications of committing to building a Passivhaus building at BCIT while meeting the LEED Gold requirement for all new construction and major renovation projects at BCIT?
- Are there real-world examples that can be used for comparison and evaluation?

The study was conducted through primary and secondary research. The approach taken to ensure currency of the information was to conduct in-person and electronic interviews with industry stakeholders and utilize the results of a 3rd party general survey to synthesize appropriate recommendations and priority actions. This report will therefore present an overview of the LEED rating system and a focused review on the Passivhaus Standard for C&I buildings. Findings will be considered to inform BCIT stakeholders of the critical considerations to meet the Passivhaus standard for new construction development. The report is presented in the following sections:

ABSTRACT

Section 1: Introduction
Section 2: Canadian Construction Industry: A Primer
Section 3: Leadership in Energy and Environmental Design (LEED)
Section 4: Passivhaus Standard
Section 5: Analysis and Assessment
Section 6: Recommendations & Priority Actions

Results of the study indicate that the Passivhaus standard is achievable in not only residential but commercial and institutional buildings, as evidenced by the 17 certified and registered Passivhaus institutional buildings throughout the world. Although there are currently no certified Passivhaus institutional buildings in Canada, the principles of the standard remain the same; however, design criteria needs to be adapted for the specific climatic conditions in order to better meet the standard. The commercial availability of Passivhaus-quality components and materials are difficult to procure in North America; however, locally sourced components/materials are available and could most likely meet the stringent requirements of the standard. The LEED rating system and the Passivhaus Standard cannot be compared like for like as each has a different focus, e.g., the primary focus of Passivhaus is on energy efficiency whereas LEED focuses on broader sustainable development categories. In terms of energy performance, the Passivhaus's energy performance requirement can award most of the points (35%) available in the Energy and Atmosphere category to help achieve LEED Gold certification.

The overall conclusion is that LEED and Passivhaus are complementary. If the stringent energy performance requirement of the Passivhaus standard is met in the building design, this achievement would help reach LEED Gold Certification or higher, while the broad categories of LEED would allow a continued pursuit of other sustainable development and design. A Passivhaus building at BCIT would be the first of its kind in Canada and would demonstrate a continual commitment to the Factor Four Initiative by promoting a stringent energy efficiency construction standard with its undoubted benefits that has been demonstrated for the last 20 years.