Developing an Inventory of Large Buildings in the Metro Vancouver Region to Reduce Emissions

Disclaimer

This report was produced as part of the UBC Sustainability Scholars Program, a partnership between the University of British Columbia and various local governments and organizations to provide graduate students with opportunities to do applied research on projects that advance sustainability and climate action across the region.

This project was conducted under the mentorship of Metro Vancouver staff. The opinions and recommendations in this report and any errors are those of the author and do not necessarily reflect the views of Metro Vancouver or the University of British Columbia.

Reproduced with permission of Metro Vancouver, with all rights reserved.

Acknowledgements

The author acknowledges that the work for this project took place on the unceded ancestral lands of the xwməθkwəy̓əm (Musqueam), Skwxwú7mesh (Squamish), Stó:lō and Səĺílwətaʔ/Selilwitulh (Tsleil- Waututh) Nations.

The author would like to thank the Sustainability Scholars Program for this opportunity to work on this project and Karen Taylor for providing guidance and support. The author would also like to thank Claire Ewing for being a supportive mentor and for her insights and contribution.

Introduction

In the dynamic landscape of Metro Vancouver, buildings have emerged as a formidable contributor, accounting for approximately 25% of the region's greenhouse gas emissions[1]. A substantial portion of these emissions arises from using natural gas for space and water heating—a practice with enduring implications. This long-lasting impact is underscored by the fact that choices made a century ago continue to resonate through our emission levels today. This intergenerational link between past decisions and present consequences emphasizes the gravity of today's decisions. At this juncture, the imperative of securing a carbon-neutral future becomes starkly evident.

In alignment with this ethos, Metro Vancouver and its member municipalities have embarked on a resolute journey marked by ambitious targets and committed leadership in response to the climate crisis. Acknowledging that the decisions and investments made today shape the trajectory of emissions for generations to come, this plan carries the torch of global collaboration, urging us to unite, envision boldly, and take decisive action in the present moment. In navigating this pivotal juncture, developing a comprehensive inventory of the region's buildings emerges as a linchpin, enabling data-driven strategies to usher in an era of sustainable progress and resilient urban development.

Background

Buildings wield substantial influence as emissions sources in Metro Vancouver. Aiming to address this, Metro Vancouver's Clean Air Plan [2](2021) and Climate 2050 Buildings Roadmap target emissions reductions through strategic actions, particularly within existing buildings. A comprehensive inventory of regional buildings is imperative to enable these efforts, facilitating the tailored deployment of regulations and programs. While a single-family home inventory initiative is underway, the focus now extends to "large" buildings, surpassing 25,000 square feet. These structures, despite their minority in number, account for a disproportionately high amount of emissions, warranting targeted reduction measures. Metro Vancouver's pursuit of a precise large building inventory underscores its commitment to effective emissions management for lasting impact.

Research Approach

The research methodology systematically integrates several datasets containing key building characteristics, such as occupancy type, gross floor area, vintage, and others. With a filtering criterion of a minimum

---

[1] Metro Vancouver. (2021). *CLIMATE 2050 Roadmap Buildings A Pathway to Zero Emissions and Resilient Buildings*.

[2] Metro Vancouver. (2021). *Clean Air Plan*

building gross floor area (GFA) of 25,000 sq. ft, data was aggregated and standardized using the Google Maps API and Python programming. Rigorous data quality assurance ensued, entailing the removal of duplications and identification of missing essential attributes, such as GFA, construction year, and occupancy type. The research culminated in implementing an open-source Python framework, UBID[3], facilitating the unique identification of each building by encoding geographical coordinates and a corresponding plus code[4], thus enhancing the precision and integrity of the dataset.

Summary

In alignment with Metro Vancouver's strategic objectives aimed at mitigating greenhouse gas emissions from large buildings through targeted retrofits and regulatory measures, this project culminates in a comprehensive inventory of buildings 25,000sqf in size or larger. This inventory is a repository of essential building attributes, including gross floor area (GFA), construction vintage, occupancy classifications, and heating/cooling specifications. A Python codebase has also been developed, featuring functions designed to harmonize address datasets, identify and eliminate duplications, and rectify absent or erroneous entries within critical building features. This code streamlines data integration from various sources and is a testament to its operational efficacy.

Quantifiably, the inventory catalogues approximately 9,000 distinct buildings characterized by 261 comprehensive variables. An exploration of this dataset reveals a notable cluster of ~1,400 structures constructed between 1990 and 2000, while approximately 60% of buildings occupy the 25,000-50,000 sq. ft range. Building vintage and GFA trends reveal a discernible pattern: an ascending average GFA across successive decades, reflecting the architectural shift towards taller and more expansive structures. This amalgamation of data compilation and analysis substantiates the project's significance, positioned as a cornerstone in Metro Vancouver's persistent pursuit of a sustainable urban landscape.

---

[3] Pacific Northwest National Laboratory. (2023). Unique Building Identifier (UBID). Energy.gov. https://www.energy.gov/eere/buildings/unique-building-identifier-ubid

[4] Google maps. (2023). Learn. Plus Codes. https://maps.google.com/pluscodes/learn/