Sprout Building
Green Design Today

PROJECT SUMMARY

Office Building

101-111 Gerrard Street East

U.S. DEPARTMENT OF ENERGY
SOLAR DECATHLON

Ryerson University

Project Summary

101-111 Gerrard Street East, in the heart of downtown Toronto, provides a unique opportunity to design and build an innovative net-zero building on the outskirts of the Ryerson University campus. Toronto, Canada's largest city, with a population of 2.9 million, must play a role in guiding the country into a cleaner future.

Sprout Building aims to create a refreshing and creative net-zero office building, under the ownership of Ryerson University, with a focus on biophilic design and renewable energy. There is an intent to inspire other developments to follow suit and take a more environmental approach to Toronto building. The strategies are a collaborative effort to create a one-of-a-kind and effective building, with special consideration given to occupant health and well-being, utilizing skills from the team members' diverse backgrounds.

Design Strategy

The cornerstone of this project is to design a space that performs well while also providing a pleasing aesthetic experience for the occupants. To accomplish this, attention will be given to solar energy, geothermal heating/cooling systems, Passive House standard envelope design, and architectural perspective.

One of the goals of this design is to address embodied and operational carbon while maintaining a high-performance structure and meeting stakeholders' needs. Sprout Building will accomplish this by utilizing natural materials such as mass timber and wood cladding, as well as optimizing passive shading in the summer and solar heat gain in the winter.

Project Site

Location: 101-111 Gerrard Street East, Toronto, ON
Site owner: Ryerson University
Climate Zone: ASHRAE 5A
Lot size: 13251.94 ft^2 (1231 m^2)
Building Size: 70,683 ft^2 (6566.67 m^2)
Occupancy: 320 people (220 ft^2 per person)
Baseline EUI: 58.96 kBtu/ft^2*yr
Proposed Building EUI: 25.67 kBtu/ft^2*yr

Technical Specifications

Walls: R-38 (RSI 6.71)
Below Grade Wall: R-40 (RSI 7.01)
Below Grade Floor Slab: R-40 (RSI 7.01)
Green Roof: R-53 (RSI 9.35)
Low Slope Roof: R-52 (RSI 9.2)
Glazing Units: R-44 (RSI 7.69)
Projected Costs: $380.66 CAD/$ft^2$ ($304.86 USD/$ft^2$)

Important Aspects

Energy Performance

The EUI target for office buildings for this Design Challenge is 80 kBtu/ft^2*yr. After the floorplan had been drawn, a baseline EUI has been taken so that renewable energy strategies can be explored. The modeled EUI of the building with a basic HVAC system is 58.96 kBtu/ft^2*yr. The proposed model EUI decreased to 25.67 kBtu/ft^2*yr. One strategy that was used to decrease the building's cooling and heating loads was including a Dedicated Outdoor Air System (DOAS) with a high-efficiency Energy Recovery Ventilator (ERV). Renewable energy sources such as geothermal and solar energy were also utilized to cover the building's energy demand. Photovoltaic (PV) panels are positioned on the subject building's roof, as well as the adjacent Ryerson-owned Pitman Hall rooftop. The use of this adjacent building's rooftop for additional PV panels was necessary to ensure that adequate power generation was provided during peak hours of consumption.

Architecture

A detail-oriented approach to architectural design is vital to achieving a holistic design. Therefore, the architectural team has assessed all aspects of interior planning to create an environment that offers an optimal indoor experience to occupants. Aspects such as indoor space size, office locations and lighting, meditation spaces, retail and green roof have all been integrated into the interior environment to maximize occupant comfort and promote mental health and productivity.

Engineering

Sprout Building is focused on designing an efficient structure while including materials to reduce the embodied carbon of the building. As a result, mass timber was selected as the primary structural element of the building. A high-performance building enclosure was designed which achieved passive house standards in addition to the net-zero requirement of the project. High-efficiency HVAC systems were utilized to aid in achieving the net-zero energy consumption of the building.

Market Analysis

The aim of this project was to design a building that is applicable to the local market with optimal efficiency, comfort, and environmental performance. One of the team's objectives in this project was to balance the financial cost and long-term benefits of the building. The projected cost for this build is $380.66/ft^2, which falls within the appropriate range of $290-425 /ft^2 provided by the 2022 Canadian Cost Guide for 5-30 storey (class A) office buildings.

Durability & Resilience

The building enclosure has been designed following the Perfect Wall design strategy in order to maintain the building's integrity and durability. This system contains all elements required for building science best practices in cold climates. The design team carried out careful consideration and evaluation of the support, control, and finish layers.

Embodied Environmental Impact

Following the building enclosure preliminary design, including material selection and thicknesses, a Life Cycle Assessment (LCA) was conducted in an early stage of the design process. This gave the project team the opportunity to alter the design in order to decrease the environmental impacts of the new building. Aspects such as green certification were prioritized in selecting alternative materials whenever possible. The circularity of the used materials was also an important consideration.

Integrated Performance

The project architect, engineer, and energy modeler worked collaboratively and simultaneously produced the preliminary design of the building. This included taking into account relations of architectural aspects such as space size and window and door placement to systems performance such as HVAC systems. The interior design elements were considered in terms of associated energy and water consumption aspects. The atrium space, for example, has been assessed based on occupant indoor experience and its integration with the CLT building. Other disciplines such as environmental management were also integrated into the planning and design process.

Occupant Experience

Occupant experience was one of Sprout Building's primary focuses from the first stage of project planning. Occupant experience has been the focus of the team's architectural and building design through the integration of biophilic design, areas for socialization and relaxation, lighting and optimal window-to-wall ratio, as well as the incorporation of green space. Occupant health is also promoted through a central staircase, bike storage room, and shower rooms to encourage physical activity and sustainable methods of travel.

Comfort & Environmental Quality

Comfort and indoor environmental quality are important in buildings, especially workspaces as occupants could spend an average of 35-40 hours per week indoors. Therefore, it is essential to ensure the building is providing a healthy indoor environment through the design of systems such as HVAC and lighting. The project team designed an optimal indoor system, taking into consideration the number of occupants as well as the location of the building and outdoor air pollution level. This was done using the energy modeling software, EnergyPlus.