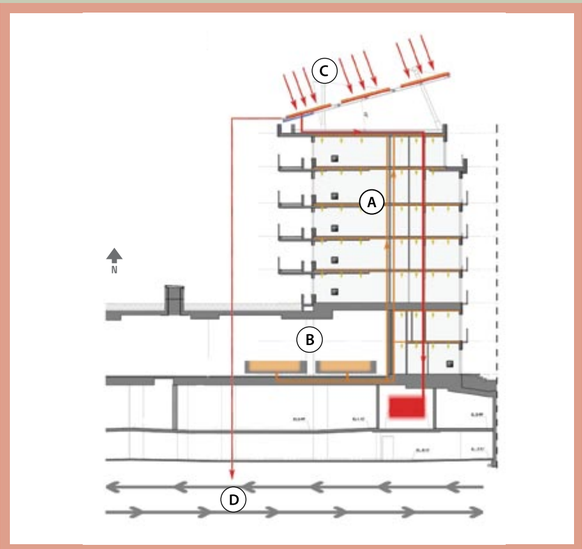

A. DESIGN & OCCUPANT ENGAGEMENT Energy consumption is reduced through efficient building design and occupant engagement.

B. HEAT RECOVERY Heat recovered from the grocery store's refrigeration system provides space heating for the building

C. SOLAR HOT WATER ARRAY Arrays on two buildings provide the remainder of energy to meet the net zero balance. The solar installations provide hot water to the building and excess heat is sold to the Neighbourhood Energy Utility (NEU) **(D)** and used in adjacent buildings.

Energy Savings Before the addition of renewable energy, the Net Zero building's annual energy savings compared to a conventional building is 68%. With the energy production from the solar hot water system as well as the heat recovery from the grocery store refrigeration system, the building achieves Net Zero energy. Including the renewable energy contribution, the predicted annual GHG savings for the building compared to a baseline model is equal to roughly 280 tonnes of carbon dioxide equivalent.

Thermal Net-Metering

On long, sunny summer days, the solar thermal arrays will produce an abundance of heat energy – an amount that far exceeds the building's demand. During the winter, when the sun is often obscured by clouds and the days are shorter, the rooftop solar arrays will be less efficient. To address these seasonal fluctuations in solar heat production, the City of Vancouver and the Neighbourhood Energy Utility (NEU) devised a "thermal net metering" system. Through this agreement, excess hot water produced by the solar thermal system that is not used by the building is transferred to the NEU and distributed for use in other buildings on the SEFC site. Conversely, on low-production winter days, the Net Zero building will derive the balance of its heat energy from the NEU.

"The building is successful because of its context," says Ramslie. "It would not achieve its energy goals if it were not connected to the Neighbourhood Energy Utility network and therefore able to export heat energy." Similarly, the building was only able to meet its energy production goals because it was able to use the rooftop of a neighbouring building for solar panels, and draw waste energy from the adjoining supermarket.

The interrelationships between the buildings provide a useful lesson, a model that is transferable to future projects across Canada and beyond. According to the 2006 census, four out of five Canadians (more than 25 million people) live in urban areas. As the urban population continues to rise, it is crucial for Canadians to explore ways of applying and integrating clean energy technologies in an urban context. Implementing renewable technologies in a dense urban environment presents challenges that include shading from neighbouring buildings, limited site area and managing stakeholder relationships.

The approach taken at SEFC turned the challenge of a restrictive urban environment into an opportunity to establish relationships between the buildings and the various energy systems. "This process ended up delivering a high-performing building relying mostly on passive design, and proving that such projects are business models of urban collaboration towards collective targets, rather than isolated design exercises," says Undurraga.

LESSONS LEARNED

Performance Indicators

Although the design team went to great lengths to estimate the building's annual energy balance, it's not enough to design a Net Zero building and assume that it will meet its projected performance objectives. Once the building is occupied, it is key to monitor the building's systems and track its actual performance. The building has a monitoring system in place that will record its performance over time to measure the success of the chosen technologies, and offer lessons for future applications. "Monitoring is fundamental. If we don't have feedback and reporting, we don't have Net Zero," says Ostojic.

Education and Engagement

Behaviour change – the human factor – is an element that is often overlooked in discussion of sustainable design. When trying to meet the Net Zero goal, the design team had to consider how the occupants would use the building. Part of the occupant agreement for the building is that the occupants must be made aware of the building's objectives and their role in helping to meet them. "You know you've achieved a successful green building not when you get the plaque, but when occupants are engaged," says Ramslie.

Collaboration

The strategy to meet the Net Zero objective emerged from a dedicated integrated design team, with each member bringing individual expertise and a commitment to out-of-the box thinking. With a shared vision, the diverse team of professionals met regularly to assess their progress. "I learned that good buildings are a collective effort of design that involves clients, city officials, users, a cohesive design team, and a well-crafted set of objectives and road map. Learning from the best in doing so changed forever my understanding of architecture," says Undurraga.

Transferability

"This project was a great opportunity: it was Vancouver's first trial at a Net Zero multi-unit residential building. As we designed the building, we thought about how transferable this would be to other sites in Vancouver, how it could inform future development. This building, the shape and footprint is similar to a typical Vancouver 120-foot deep site. Theoretically, the lessons that we learned here can be applied to sites around the city," says Lyon.

"Monitoring is fundamental. If we don't have feedback and reporting, we don't have Net Zero."

Goran Ostojic, Principal, Cobalt Engineering.

CHALLENGE For local governments to make it easier to transfer energy across property lines, in order to boost efficiency, share resources and create opportunities for turning waste into fuel.

PROFILE

Albert Bicol

PEng
Partner, Cobalt Engineering

Albert Bicol was involved early on in the master planning for the Olympic Village site. Later, he played a key role as mechanical consultant on the design of the Net Zero building. Bicol contributed his expertise in passive design to the process of lowering the energy demand for the building.

"It's important to be open-minded. Don't think about boundaries. Use things twice," says Bicol, citing examples of the Net Zero building's use of 'waste' heat from the grocery store, and the building's outdoor corridors having a dual function as both hallways and shading devices.

Bicol's passion for passive design is counterintuitive for a mechanical engineering professional. He delivers presentations around the world on the topic. "We're putting ourselves out of business," he jokes, by advocating an approach to energy-efficient building design that reduces reliance on mechanical systems.

"The Net Zero building was a bold statement, and a step toward regenerative buildings. Telling the story of this building will encourage others, and inform future projects. There's a huge learning curve for everyone, but the more we get educated, the more we will achieve."