SETTING THE STANDARD:
evolv1 First New Build to Achieve Zero Carbon Standard for Design

The Cora Group’s evolv1 is a three-story building located in the University of Waterloo’s David Johnston Research and Technology Park in Waterloo, Ontario. It was purpose-built to attract a millennial, tech-savvy workforce. The amenities and creative collaboration spaces reflect the group’s focus on sustainability. From project conception, Stantec used an integrated design process to achieve the goal of a carbon-neutral building. In April 2018, evolv1 became the first building to achieve the Zero Carbon Building (ZCB) – Design certification under the Canada Green Building Council’s Zero Carbon Building Standard.

KEY INFORMATION

Project Owner & Developer: The Cora Group
Sustainability Consultant: Stantec
Architect and Landscape Architect: Stantec
Civil, Electrical, Energy and Mechanical Engineer: Stantec
Commissioning Authority: CFMS-West Consulting
Contractor: Melloul-Blamey Construction
Electrical Systems – Design Assistance: Stecho Electric
Mechanical Systems – Design Assistance: Conestogo Mechanical
Site Size: 19,397 m² (208,788 ft²)
Type: Multi-tenant class - A office building
EUI: 81 kWh/m²/year
TEDE: 24 kWh/m²/year
Peak Demand: 389 kW
PV Array Size: 619.4kW AC/ 767.9kW DC photovoltaic (825,014 kWh/year)
Embodied Carbon Intensity: 260 kg CO₂ eq/m²
Other Renewables: Solar Wall Ventilation Preheat System (500GJ/year)
Climate Zone: Zone 6

coragroup.com/project/evolv1
cagbc.org/evolv1

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VISION

Making a Case for Zero Carbon Buildings with evolv1

Guiding the evolv1 project was one vision: To create a functional building with little to no impact on the environment. Encouraged by Sustainable Waterloo Region, it was the express wish of evolv1 owners, The Cora Group Inc., that the building serve to inspire others to build regenerative buildings. To create that type of groundswell support, The Cora Group knew that evolv1 couldn’t just be a great sustainable building—it also had to be an economically viable solution that works within the challenges of the real estate market. Participating in the CaGBC’s Zero Carbon Building Pilot Program as one of 16 pilot projects gave evolv1 a platform to reach others with that inspiration.

Developers and owners often benefit from the lessons learned from similar projects. As a pilot project, there were few examples to act as a guide. With no established roadmap, the developers turned to an experienced and reliable team that shared The Cora Group’s vision.

This exceptional team included experts from many fields: geo-exchange, solar, building envelope, and even trade experts including general contractors, mechanical, electrical, and fenestration. This approach helped The Cora Group to achieve their goal: A Zero-Carbon Building through concept and development of our latest building, Canada’s First Design Certified Zero Carbon Building: evolv1. Setting a new building standard for the development industry was a challenge we accepted and accomplished. As a developer and property manager our priorities are quality buildings and our tenants. evolv1 is a step above in quality, sustainable A-Grade space and our tenants love it.”

Adrian Conrad, COO, The Cora Group

THE PROCESS

One Team, One Focus

Stantec led evolv1’s design from start to finish. The firm acted as the architect, engineers, and sustainability consultant, with most disciplines working out of the same office. The project employed an integrated design process (IDP) with all disciplines at the table for initial project discussions.

Controlling so many design elements and having the team in one space ensured that project communication was fluid and seamless. All critical design decisions were continuously fed back to the energy modeler throughout the design process. By continuously verifying the impact on the building’s energy consumption, Stantec was able to ensure targets and other systems were not compromised. On a standard project, the energy model is developed at critical milestones to verify the design, but with evolv1, it was a constant work in progress.

An example of this approach was the design of evolv1’s solar wall. During the design process, it became evident that the wall’s colour had a significant impact on the system’s efficiency. The energy modelling team, mechanical design team, sustainability team, and the architectural team all had input into the final design decision.

A sufficiently dark color was chosen to both achieve the architect’s vision for the building aesthetic and simultaneously achieve the engineering team’s goal in regard to solar heat gain and the total energy budget. The positioning and integration of the wall into the façade was done to illustrate how the technology could be integrated seamlessly while adding some subtle visual cues to allow identification of the wall as part of the education aspect of the building.

The glazing selection was another example of the design team interacting to achieve a greater benefit. The architects were looking for optimal visible light transmittance and a view to the exterior, while the mechanical engineers were looking to reduce solar heat gain. Options were modeled to optimize a solution benefiting both these needs effectively.

Both these examples showcase how the team’s approach brought together many disciplines with different viewpoints, some with a high-level, holistic understanding of building design, and others with a narrower focus. Through collaboration and sharing of expertise, together they were able to make the best decisions for evolv1’s design.
THE DESIGN
Integrated & Informed

To achieve a zero-carbon balance, the design team implemented passive measures in the building design. For example, evolv1 was placed on the north edge of the site to maximize the unobstructed, south-facing surface area of the solar photovoltaic panels in the parking lot. The building was also oriented along the east-west axis to maximize control over solar heat gain. Even the shape of the floor plate was chosen to maximize access to daylight and views in an open office layout.

Data modeling was integral to many evolv1 design decisions. Parametric modeling was used to fully understand the implications of each design decision as well as the associated costs. Modelling allowed the team to carefully analyze the different green building strategies and choose the most effective path to meet their goals. The project team was able to deliver on a design with only a modest capital cost premium—easily justified based on operating returns.

“When we began to envision what would be needed to complete a zero-carbon building, we were joined by others who shared the same vision. evolv1 was imagined collaboratively—giving the foundational start needed to set a course of action. We knew the value of bringing together the right people right from the start.”

Adrian Conrad, COO, The Cora Group

BUILDING ENVELOPE
High Impact, High Appeal

The building envelope has a significant impact on the marketability of office space, as today’s tenants are looking for standout buildings. To improve efficiency, as well as the tenant experience, evolv1’s design maximizes access to daylight and views. The window-to-wall ratio was designed at a generous 36.6 per cent, with visible light transmittance at 0.53. Continuous glazing placed strategically in the vision zone allows for flexibility during tenant fitout and will help facilitate future layout changes.

An R-value of R-30 (R-12 effective) was achieved for the walls while an R-value of R-40 was achieved for the roof. Together with triple-pane glazed units with U 0.20 W/m² K and Solar Heat Gain Co-Efficient (SHGC) of 0.32, the resulting Thermal Energy Demand Intensity (TEDI) of the building was 24 kWh/m²/year.

To further take advantage of the building’s position, external horizontal shading devices were installed on the southern side to allow the winter sun in, while reducing unwanted summer heat. Vertical solar fins were installed on the east and west exposures to block the unwanted heat gains as the sun moves around the building at different times of the day.

For visual interest, an architectural feature was added to the second and third floor’s east and west-facing exposures. The vertical solar shading fins, integrated with the curtainwall system, were given different colours and hues on the north and south sides. This provides a varying dynamic appearance from the adjacent LRT trains, and the commuters, depending on whether they are travelling to or from the city centre.

VENTILATION SYSTEM
Controlling Air Quality

Building ventilation is handled with a dedicated outdoor air system (DOAS). For consistently high air quality, carbon dioxide (CO₂) sensors are located throughout the building, monitoring CO₂ levels, and controlling the quantity of ventilation air coming from the central make-up air unit. To maintain CO₂ levels at required setpoints and reduce the amount of outdoor air required, the supply fan speed of the make-up air unit modulates according to CO₂ readings inside the space (demand-control ventilation). The make-up air unit also includes an enthalpy wheel with an efficiency of 81 per cent, which recovers sensible and latent heat from building exhaust year-round.

Another ventilation strategy adopted in evolv1 includes the use of a passive solar collector integrated into the building façade (the solar wall) to pre-heat ventilation air that is then distributed by the central DOAS to the entire building. The advanced mechanical system can automatically determine when thermal energy from the solar wall is needed to heat the building during the heating season by continually measuring both indoor and outdoor temperatures. This mechanism ensures that the solar wall is bypassed during the cooling season.
HEATING AND COOLING SYSTEM

Efficiency in Motion

Comfort is a priority for tenants, so the heating and cooling system is critical to ensure a consistent temperature throughout the space. evolv1 is heated and cooled with water-cooled variable refrigerant flow (VRF) heat pumps, featuring a coefficient of performance (COP) of 3.1. The system has individual condensing units with cooling capacities that range between 18-24 tons.

evolv1 also features an open-loop geo-exchange system. It draws water from an aquifer located 160 meters below ground, which provides water at a constant 10°C throughout the year. The water is pumped from the aquifer, filtered, and then passed through a double-walled, stainless steel, potable water-grade heat exchanger which injects or rejects heat from the ground into the condenser loop.

The efficiency of the VRF system comes from its ability to move energy around, taking heat from one side of the building and moving it to the other side when required.

In addition, there is a backup 211kW electric boiler. The boiler run time is expected to be minimal during normal operation--for example, it may run during morning warmup during the coldest days of the year.

ELECTRICAL SYSTEM

Meeting Variable Demand

Electricity demand varies with the time of day and the season. With evolv1, pumps and motors equipped with Variable Frequency Drives (VFDs) allow for precise modulation and control. By managing their operation this way, evolv1 can respond to varying loads, helping minimize energy use. The peak electricity demand occurs in the winter with the building requiring a total of 386.0 kW (an equivalent code-compliant design would likely peak at over 600 kW).

Lighting is an important consideration for ensuring tenant comfort. evolv1’s lighting system is LED and consists of a programmable lighting controller and occupancy and light sensors for daylight harvesting and continuous dimming.

The building features an ultra-low average lighting power density of 4.75 W/m².

RENEWABLE ENERGY

Making Evolv1 Green & Sustainable

The ZCB-Design certification requires that at least five per cent of a building’s total energy consumption be met by onsite renewable energy. evolv1 boasts a 619.4kW AC/ 767.9kW DC photovoltaic system comprised of a 219.8kW AC/ 263.9kW DC roof-mounted array and 399.6kW AC/ 504kW DC ground mount array. The PV system was designed to generate about 825,014 kWh in the first year of operation and was designed to produce approximately 105 per cent of the building total energy use.

Generating onsite renewable energy helps to improve building resilience in the face of power outages, reduces overall demand from the electrical grid, minimizes environmental impacts from power generation facilities, and helps prepare for a distributed energy future.

“We at Sustainable Waterloo Region are so proud and excited for the completion of the Cora Group’s evolv1. Right from the moment that the community challenged us to take this project on, in 2013, we have committed resources to make this vision a reality. The partners that we worked with, including the Cora Group, the David Johnston R+T Park, and EY Canada, among many more, shared the passion for the vision, the commitment to the impact of this building, and the high-performance standard of the building. Now, we are excited to be tenants in Canada’s first Zero Carbon Building, multi-tenant office building, right here in Waterloo Region.”

Tova Davidson, Executive Director – Sustainable Waterloo Region
**LIVING GREEN WALL**

Within evolv1’s atrium space is a three-story green wall roughly 5.7 m wide. The green wall is made up of close to 4,500 individual plants from 12 different tropical varieties. A dedicated atrium HVAC system enables air to be recirculated back from the top of the atrium, mixed with ventilation air, and then supplied back at lower level to distribute throughout the atrium. The process improves indoor air quality by capturing the humidity released by the green wall during the winter months and lowering the burden on the active humidification systems. As a result, the energy consumed by the humidification process is reduced. The wall is irrigated every 15 days for 30 minutes using drip irrigation with water drawn from rainwater cisterns.

**WATER USE MANAGEMENT**

In addition to using rainwater for the green wall, the cistern water is also used in water closets and urinals. Paired with ultra low-flow plumbing fixtures, evolv1 was designed to reduce potable water consumption by over 69 per cent relative to a traditionally designed building.

While not a water management measure but an energy savings one, the project also includes instantaneous electric water heaters that heat the domestic water used in the building, and provide hot water on demand.

**SUMMARY**

When The Cora Group Inc. embarked on this project with Sustainable Waterloo Region, the David Johnston R+T Park, Stantec, and the project team, they did so with something to prove. They wanted other developers and owners to know that Zero Carbon Building was possible, economically sound, and marketable. By creating a space that shows that you can raise the bar on sustainability while still providing a superior tenant experience, evolv1 is helping a broader audience realize what is possible through great design.

With the building measures put in place, the team is confident that zero-carbon will be achieved in operation. The project will be able to demonstrate carbon-neutral operation as early as 12 months after full occupancy through annual Zero Carbon Building – Performance certification.

“The thing that makes this building so incredible is that it is a no compromise solution. Not only is it an incredible space - a class A office building - it is also a comfortable space to work. The team is able to be more productive and is happier at work with the exceptional lighting levels in the building, which balance natural light with lighting systems, as well as the high level of comfort. Even on the coldest days, we are comfortable thanks to the high levels of insulation, triple-glazed windows, and innovative HVAC system.”

Tova Davidson, Executive Director – Sustainable Waterloo Region