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By Keith Loria

FIRST CO2-BASED FACILITY FOR CONGEBEC

SINA partners with Canadian cold storage company to maximize energy efficiency and sustainability.

In September 2024, Congebec opened its first CO2-based refrigeration warehouse in Mascouche, Quebec, Canada.

Working hand in hand with developers Rosefellow and Skyline, SINA was brought in to build what would become the largest warehouse in Congebec's portfolio.

From the outset, Congebec had a very specific idea of what it wanted.

"Congebec had a vision to build a state-of-the-art facility that could adapt to the needs of the food industry," says Mahmoud El-Koury, Partner at Québec-based SINA Construction. "The selection of CO2 as the refrigerant is a less toxic refrigerant than ammonia, which was heavily used by operators in the past. This eliminates evacuations and production downtime whenever there is a leak. An integral part of this design choice was Zero-C which has a very innovative approach with CO2 systems."

SINA worked with architect GKC to design Congebec's facility.

"It was a very streamlined design process, and we didn't have to do two steps forward, one step back," El-Koury says. "It's fun to work with a team like Congebec that knows exactly where they're going, and once we made a collective decision, we kept adding to the design."

The new Congebec facility is equipped with a loading dock providing access to 30 doors; three refrigeration plants; two adiabatic coolers on the roof with variable speed fans and stainless steel coils; two electric boilers that serve as an auxiliary heat source in the event of a shutdown of the refrigeration systems; 46 evaporators for cooling and heating different rooms; 13,000 linear feet of piping; more than 500 valves; and more than 400 probes and sensors that are part of the refrigeration system. An automated central control system manages all climate maintenance in addition to the refrigeration system.

SINA was brought in to build what would become the largest warehouse in Congebec's portfolio. (Photo courtesy of KODA)

"The building design is compliant with the latest codes and regulations in Quebec and has innovative technology installed that makes the building very energy efficient," El-Koury says.

Congebec was very involved in the build, overseeing such aspects as refrigeration, equipment, racking, plant security, office fit-up and IT infrastructure and networking needs.

"SINA has been a valuable partner and truly made Congebec's vision come to life to create an innovative and sustainable building with a firm engagement toward an autonomous food supply chain," says Jean-François Vallée, Senior VP, Engineering for Congebec. "SINA was key to delivering this technical success and was very collaborative with our energy-conscious approach to implement state-of-the-art energy efficiency solutions within the build."

Left: The new Congebec facility is equipped with a loading dock providing access to 30 doors. (Photo courtesy of KODA)
Right: The freezers are equipped with efficient and well-insulated Rytec high speed, bi-parting doors that have a good R-value to prevent heat loss. (Photo courtesy of KODA)

Sustainable Mindset

There were several sustainability considerations that went into the design of the Congebec warehouse. El-Koury explains the team leveraged knowledge and expertise from internal and external partners to find the best combination possible for a most efficient building.

To ensure the warehouse is Congebec's most energy efficient building to date, the decision was made to use CO2 for the refrigeration system with a combination high-tech building management system and adiabatic sub-cooling on the roof.

"This is a more energy-efficient refrigeration design as proven by the lower energy consumption compared to a similar-sized building," El-Koury says. "In addition, this building is also the first in Congebec's portfolio to have no natural gas HVAC heating in the warehouse. All heating is provided by recovering the waste heat from the compressors and using it with a glycol loop to provide hot air for offices, dock, mechanical room, inspection and repacking rooms."

The recovered heat is also used to defrost the evaporators and provide underfloor radiant heating across the warehouse freezers and coolers. Plus, the freezers make use of efficient and well-insulated Rytec high speed bi-parting doors that have a good R-value to prevent heat loss.

"The 30 dock doors are well insulated and regularly checked to make sure no cool air is escaping around the openings," El-Koury says. "The freezers also have destratification fans installed to better circulate the cool air, which leads to more efficient cooling."

Other sustainable choices were utilizing LED lighting both indoors and outdoors, installing two electric vehicle chargers in the parking lot and planting trees around the building to positively impact the local community.

Congebec has also started an initiative in collaboration with Banques Alimentaires du Québec to reduce food waste. By offering freezer space in its multi-temperature facilities, the company helps provide a streamlined alternative track for food that can't reach market by channeling 500,000 kg of food from its customers to those in food insecurity situations every month.

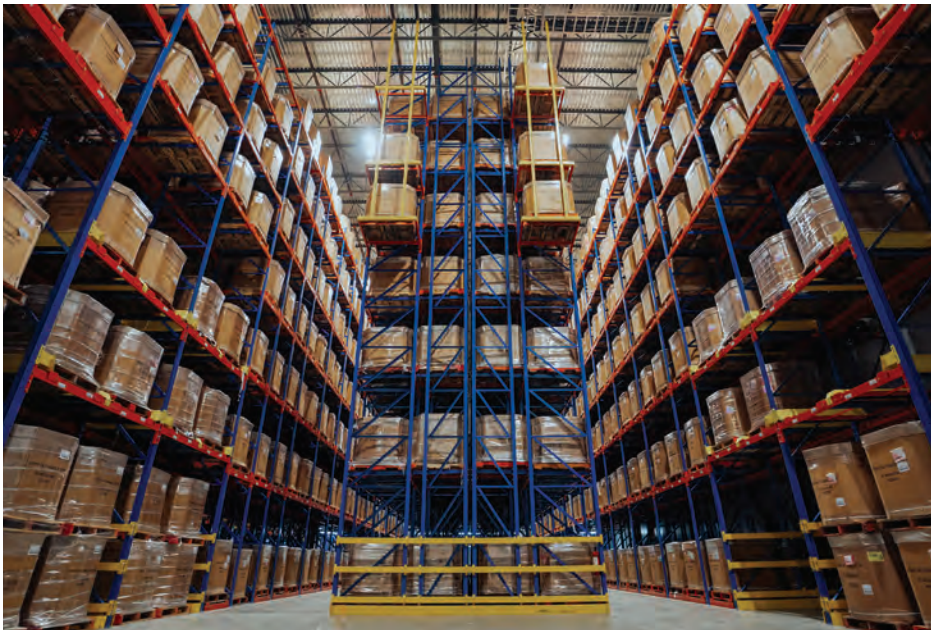
Innovation Abounds

El-Koury points to the heat recuperation on the CO2 system as something the team leaned into heavily for the project.

"We use it for the HVAC system for the offices as well, and that's something we see translate into energy efficiency and minimal maintenance costs later on," he says.

Additionally, from a design aspect, there are a lot of new elements for this project like the swing room, which is one of the warehouse rooms that can either be operated at 4 degrees Celsius or -18 degrees Celsius.

"You have to account for that transition when you're thinking about the envelope and



Congebec was very involved in the build, overseeing such aspects as refrigeration, equipment and racking, (Photo courtesy of KODA)

Attention to detail aligned to Canadian Food Inspection Agency (CFIA) standards resulted in one of the highest grades given by the CFIA on a Congebec new build. (Photo courtesy of Archimed Studios)

the humidity level that you introduce into the building once you go from -18 C to 4 C without losing the integrity of your envelope and your roof system," El-Koury says.

The sophisticated system incorporates liquid sub-cooling devices, frequency inverters on compressor and gas cooler motors, and a comprehensive heat recovery system using a hot glycol loop. This loop efficiently reclaims waste heat from the refrigeration process, providing energy for heating the building, defrosting evaporators and warming the loading dock, reducing reliance on traditional, energy-intensive methods like natural gas.

Beyond refrigeration, innovation extends to the site's material handling equipment. The project utilizes Very Narrow Aisle (VNA) trucks, optimized for warehouse space efficiency. These trucks incorporate regenerative braking, a cutting-edge feature that captures and reuses energy during braking. This regenerative technology not only increases battery life and extends shift duration but also minimizes downtime and associated costs.

"Coupled with a proactive project management approach that emphasized meticulous tracking of project deliverables and deadlines, these innovative strategies propelled the project to successful and timely completion," El-Koury says.

Overcoming Challenges

The warehouse is CFIA (Canadian Food Inspection Agency) certified, but it didn't come without some roadblocks.

The project involved more than 40 suppliers and vendors and the cooperation of every single department within Congebec. In addition, the project required more than 400 deliverables executed by the project team as well as department representatives.

"As a team, together with the developer and the architect, we worked hand-in-hand with the city of Mascouche to present a design that was aesthetic, but also followed the city permitting guidelines without integrating design aspects that would put the building integrity at risk during its intended use," El-Koury says. "As usual, it is of great importance to work diligently to make sure all the preparation work for the electric entry is to Hydro-Quebec standards in order to get the electric entry hooked up on time."

El-Koury notes this attention to detail, aligned to CFIA standards, resulted in one of the highest grades given by the CFIA on a Congebec new build. That is something SINA and the whole team is very proud of.

Supply chain issues also proved challenging. The project was started in an economic climate of uncertainties on material prices and delivery dates – from steel structures to electrical components. Cost increases were minimized by collecting materials upfront and keeping them in the warehouses pre-construction.

Another big challenge involved the sprinkler system.

"It's a system that has a lot of specific requirements and a lot of restraints, such as the time of response for each sprinkler head (about 20 seconds), so the design aspect had to be very specific," El-Koury says. "It required a lot of gallon support, and the city didn't have that much water to give us, so we devised a water reserve in prefabricated tanks on the lot. We had about 320,000 gallons outside the building under the loading area. It was a challenge to have that system function, and it required one of the biggest fire protection pumps to make it work."

A Job Well Done

The site preparation started in March 2022, and 18 months later the project was complete.

"The strength of the project was the team," El-Koury says. "There were many people around the table who were experienced in cold storage. We all delved into our experience to be creative and conceive the best building possible. It was a challenging but fun project. We are proud to be part of this important building in Congebec's history."

KEITH LORIA is an award-winning journalist who has been writing for major newspapers and magazines for close to 20 years, on topics as diverse as sports, business and technology.

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