



STOUFFVILLE SUSTAINABILITY

## INTRODUCTION

Inspired by our founders, Longo's purpose is to fuel happier and healthier lives, while being the most trusted and relied-upon food partner. Our goal is to create remarkable food experiences by putting family standards at the heart of everything we do. This model comes to life through our 31 traditional format stores, five smaller urban format stores (known as The Market by Longo's) and our online grocery delivery service, Longo's delivered by Grocery Gateway.

Longo's is governed by a sustainability strategy made up of three pillars: Environmental Stewardship; Responsible Sourcing; and Healthy, Happy People. Since grocery stores are one of the most energy-intensive retail businesses, Longo's has long been focused on building and running more efficient stores with reduced greenhouse gas emissions and operating costs. We are committed to supporting the communities we operate in, and reducing the environmental impact of our stores is one of the ways we demonstrate this.

Showcased in the design, construction and operation of the Longo's Stouffville store – the first of its kind in Canada and one that sets a new standard for sustainable grocery stores.

"Longo's is committed to the communities where our stores are located and to doing our part for the environment," says Anthony Longo, President and CEO. "We have a long-standing commitment to supporting energy-reduction initiatives, and our Guests expect it."

Championed and led by Longo's senior leadership, the project team for the Stouffville store is an integrated team of trusted, experienced partners, particularly contractors with expertise in CO<sub>2</sub> refrigeration and energy efficiency. Longo's partnered with Neelands Group Limited and S2E Technologies Inc. to design, install and maintain the cooling, heating and control systems in the Stouffville store. The partnership between Neelands Group and Longo's is long-standing and anchored by their shared vision for a sustainable future. Neelands Group is an Ontario-based commercial refrigeration and HVAC company that specializes in turnkey energy, procurement and construction work.

"Longo's has been and continues to be a market leader in new innovative technologies," says Noel Neelands, President of Neelands Group. "Neelands Group is proud to partner with Longo's Stouffville, Canada's first near net-zero energy store. Building supermarkets that are financially viable and environmentally responsible ensures that the near net-zero store will be the standard for future generations."



## PROJECT OBJECTIVES

Before Longo's Stouffville, there was a knowledge gap in the supermarket industry around successfully integrating high-efficiency technologies in large commercial buildings to save energy, reduce costs and create positive environmental impacts. One of the key objectives of the Stouffville store project was to narrow that gap by designing, building and operating a sustainable supermarket with a goal of near net-zero energy and reduced greenhouse gas (GHG) emissions.

The vision was to be the first near net-zero energy supermarket in Canada. The project would demonstrate that the supermarket sector in Canada has the ability to achieve clean and efficient energy consumption and could set a new benchmark for the performance of future supermarkets.

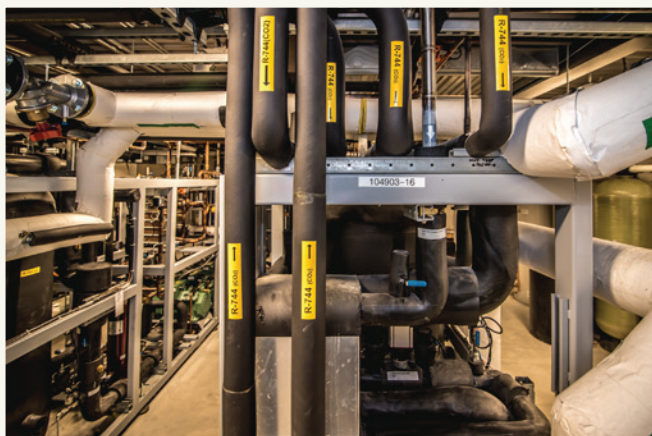
With this vision in mind, Natural Resources Canada's (NRCAN) Energy Innovation Program stepped in as an invaluable partner with a grant (CEI-BLD-850). Once funding was secured, the 40,000 square foot Stouffville store aimed to reduce electricity consumption by 35% and have the remaining 65% generated onsite via solar photovoltaics (PV) and combined cooling, heating and power (CCHP) to effectively make it a near net-zero energy facility. Initial modelling showed that the efficient use of CCHP waste heat would reduce natural gas-driven space heating and hot water heating by 50%. The store would also substantially reduce the impact of refrigeration GHG emissions by using CO<sub>2</sub> as the refrigerant, rather than hydrofluorocarbon (HFC) refrigerants, which have much higher GHG impacts.



## STORE FEATURES

Together, the team implemented a set of key features and best practices to develop a near net-zero energy store. The key elements of the store are:

- **Combined Cooling, Heating and Power System:** Longo's Stouffville is the first grocery store in Canada to have a CCHP system that allows for concurrent production of electricity and thermal energy from a single energy source. CCHP generation provides lower cost electricity and the added benefit of the hot water loop for heating/dehydration in the winter and cooling/load reduction of the refrigeration racks via an absorption chiller in the summer. This system allows the store to generate approximately 60% of its own energy.
- **CO<sub>2</sub> Refrigeration:** Refrigerant leaks are one of the most significant sources of GHG emissions for grocery retailers. Conventional systems use HFC refrigerants such as R507 & R404, whereas the system at Stouffville uses CO<sub>2</sub> as its refrigerant. The global warming potential (GWP) of conventional refrigerants compared to CO<sub>2</sub> is significant, with R507 & R404 having a GWP of 3985 and 3922, respectively, compared to CO<sub>2</sub>, which has a GWP of 1. The impact of this is seen when refrigerant leaks, which are inevitable, occur. One kilogram of leaked R507 results in the release of 3985 kg of CO<sub>2</sub>e, whereas 1 kg of leaked CO<sub>2</sub> results in the release of 1 kg of CO<sub>2</sub>.
- **Solar PV:** There are solar PV panels in three areas – the rooftop, the building façade and on top of a parking canopy in the parking lot – which enabled the store to generate approximately 130,000 kWh of solar energy in 2020.
- **Monitoring and Performance Analytics:** Measurement is an important aspect of the project, and Longo's uses a software called Kalder. Developed and run by Neelands Group, Kalder monitors energy consumption and equipment performance, allowing the store to make adjustments in real-time and ensure the systems are running efficiently. The software system also modulates temperature set points to take advantage of times when more energy is available than can be stored.



## RESULTS

Since the Stouffville store opened in 2018, there have been positive results in terms of reduced energy consumption and operational costs.

By utilizing a natural, climate-friendly CO<sub>2</sub> refrigeration system, the Stouffville store has been able to reduce its GHG emissions from refrigerant leaks in comparison to traditional stores. The transcritical system installed by Neelands Group is integrated with the store's CCHP, solar and waste heat, resulting in reduced energy consumption compared to a typical grocery store.

"Whereas a typical CO<sub>2</sub> system might enter transcritical mode about 15% of the time in the Northern climate, resulting in higher energy consumption, the Stouffville store's CO<sub>2</sub> system enters transcritical mode far less. As a result, it uses 65% less power in the summer months," says Tom Quaglia, Vice President, Construction of Neelands Group.

Regarding electricity, the store consumes 10% less than a typical supermarket and reduces reliance on the electrical grid by 70% through onsite power generation. This has helped cut demand response charges at the Stouffville store by at least 40%.

"We set our goals high because the stakes are high. Longo's could not have done this without a partner like Neelands Group, who have a shared vision of a sustainable future, and have guided us from the spark of this idea to the development of the store. Not only is it the right thing to do, but also it positively impacts our operational bottom line," says Dave Mastroieni, Vice President of Central Procurement & Facility Management at Longo's.

By combining electricity and gas, the Stouffville store has seen a reduction in energy consumption by about 20%, resulting in a net cost savings after all expenses of 40%, or more than \$130,000 annually, compared to an average grocery store. It's expected that these savings will result in a return on investment of premium design and build costs in just over six years.



## CHALLENGES

The main challenge has been designing a curtailment solution for CCHP and solar PV. The efficiency measures, including higher efficiency equipment and thermal designs for the store envelope, have demonstrated significant impacts on overall store loads. The amount of onsite generation was designed to offset the store's needs; however, due to the regulations of the Ontario Energy Board, export from CCHP (as load displacement generation) to the grid is not allowed. This has prevented excess PV generation capacity from being net metered, thus requiring curtailment of PV production since commissioning to avoid triggering automatic shut down by the electrical protection system. As a result, significant PV production has been sacrificed.

"The project was designed to be near net-zero, but due to regulations that prohibit exporting solar energy, it was determined that there was a need for a battery storage system. Neelands' Kalder software system is used to monitor and control the overall system, ensuring optimized results," says Ady Vyas, Vice President, Energy & Digital Services at Neelands Group. The installation of a battery storage system allows energy that would have been lost due to curtailment to be stored for future use. With the addition of a battery and PV curtailment management system, the focus now is on balancing loads with generation.

Considerable effort will be taken to fine-tune the algorithms for maximizing PV production. While economics dictate the size of the battery storage, the idea is to prove that some of the lost solar production can be recouped. In the future, as storage pricing becomes more cost-effective, all of the installed solar capacity can be used.

"The challenge comes from regulatory barriers as well as a change-averse retail mindset that prefers maintaining the status quo and eschews paying 20% more than usual for energy-saving systems. Most retailers insist that their business is groceries, not energy. But everybody's business is energy," notes Vyas, "so let us show you how to save operational costs while doing the right thing for the environment."



## PROJECT BENEFITS & RESULTS

Data on the store's electrical consumption indicates success with reducing the energy footprint. Higher efficiency rooftop hardware has resulted in significant reductions in energy consumption due to more efficient motors and airflows. CO<sub>2</sub> refrigeration as a replacement for HFC refrigerants has led to significant reductions in GHG emissions.

## NEXT STEPS

A white paper will be created at the end of 2022 to detail the results of the battery storage and curtailment strategy and to analyze load data to quantify the impact that the use of the absorption chiller has had on refrigeration rack loads. The report will assess the business case for the addition of generation and efficiency measures.

With the battery in place and commissioned, we will fine-tune a curtailment strategy in 2022 that couples battery storage with PV production. Expectations are that annual PV production can be doubled with this approach, still not utilizing all the installed capacity due to the limitations of battery capacity.

The Stouffville project is only the beginning. Since the completion of construction, Longo's and Neelands Group have continued to retrofit existing Longo's stores by replacing older refrigerant racks with CO<sub>2</sub> and adding microturbines for onsite generation. Data will continue to be collected at the Stouffville store and others with the objective of demonstrating real-life results that help the supermarket industry meet its bottom line as well as supporting a sustainable future.

