Niagara Region

Case Study:

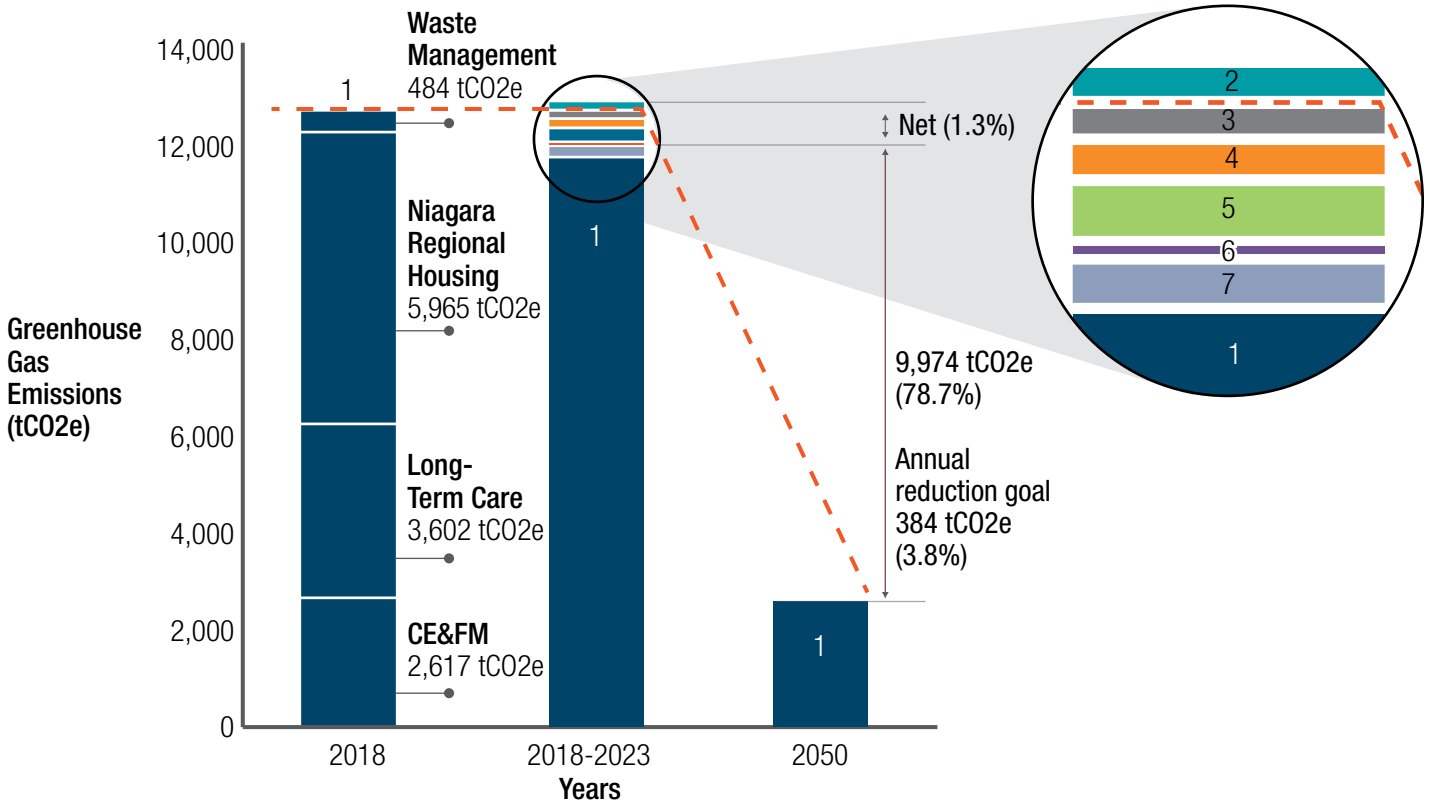
80 Per Cent Greenhouse Gas Reduction by 2050

May 2023 | niagararegion.ca

The following information discusses strategies to achieve an 80 per cent reduction in greenhouse gas emissions by 2050 from the Niagara Region's Building and Water and Wastewater portfolios.

According to the Greenhouse Gas Emissions Inventory, in 2018 the Building portfolio was the largest emitter at 56 per cent, followed by Water and Wastewater at 28 per cent.

Figure 1: Niagara Region Building Portfolio- Greenhouse Gas Emissions



1 **Building Portfolio:**
Construction, Energy and Facilities Management (CE&FM), Long-Term Care, Niagara Regional Housing, Waste Management

Projects/ Initatives

2 Niagara Regional Housing new buildings.....169 tCO2e

3 Decommission 68 Church St Niagara Regional Police Services 1D.....160 tCO2e

4 CE&FM, Long Term Care, Niagara Regional Housing Capital Projects.....160 tCO2e

5 Proposed project – Headquarters Geothermal.....309 tCO2e

6 Proposed project – Headquarters Window Replacement.....47 tCO2e

7 Change in building occupancy during COVID-19.....229 tCO2e

Niagara Region's Greenhouse Gas emissions

Building Portfolio

The graph (Figure 1) on page 2 illustrates the reductions realized since 2018 in the Buildings portfolio as well as possible strategies.

The first bar in Figure 1 displays the Niagara Region's building portfolio, comprising various building types with a total Greenhouse Gas emissions of 12,688 metric tonnes of CO2 equivalent (tCO2e) in 2018. The middle bar presents changes to emissions, including capital projects and proposed initiatives, while the right-hand bar represents the 80 per cent reduction target. Meeting this ambitious goal entails reducing about 384 tCO2e annually, over 26 years (2024-2050). A multi-pronged approach is necessary to achieve this target, such as growth strategies, rightsizing the building portfolio, deep retrofits and strategic building utilization.

Growth Projects- Niagara Regional Housing New Buildings

Since 2018, Niagara Regional Housing has added three energy-efficient buildings with a combined net increase of 107,000 square feet. However, the addition of these buildings have increased Greenhouse Gas emissions by 169 tCO2e annually (item 2), despite their improved building envelope (insulation and windows) and high-efficiency hot water and HVAC systems. If the buildings had been designed according to the minimum energy efficiency requirements specified in the Ontario Building Code, an additional 50 tCO2e would have been added.

To maintain service levels as the region's population grows, new buildings will be necessary, and the adoption of energy-efficient design and building practices should continue to promote sustainable and resilient built environments. Although the Niagara Region currently prioritizes LEED Silver for new construction, achieving the proposed 80 per cent Greenhouse Gas reduction target by 2050 may require a commitment to Net-Zero Greenhouse Gas for all new construction. Without this commitment, new building additions would nullify emission reductions to the existing portfolio (as depicted in Figure 1, items 1 and 2). Moving to Net-Zero has numerous benefits including reducing the carbon footprint of the built environment, lowering energy consumption and costs and enhancing the resilience of new buildings to changing climatic conditions.

Rightsizing - Decommission 68 Church Street

To achieve the 80 per cent Greenhouse Gas reduction target by 2050, the Niagara Region must consider both Net-Zero construction standards and rightsizing the existing building portfolio, as well as applying these standards to future growth projects. Rightsizing the new Niagara Regional Police Services 1 District in St. Catharines (relocated from 68 Church Street to 198 Welland Avenue) and building to LEED Silver standards resulted in a net reduction of 1.6 per cent in Greenhouse Gas emissions (160 tCO2e annually), item 3. Although not statistically significant, the reduction is comparable to the savings generated from all of the energy-related capital projects completed over the past four years. Staff recommends a review of the Niagara Region's building portfolio in order to reduce it where possible as well as exploring opportunities to partner with local area municipalities for shared services.

Deep Retrofits to Existing Building Stock

Item 4 shows a 1.6 per cent reduction in Greenhouse Gas emissions from capital projects in the last four years. Most of the projects focused on end-of-life renewal and energy reduction initiatives linked to Provincial grants/incentives. To date, projects have been focused on reducing the use of electricity and meeting the goals of the Niagara Region's Conservation and Demand Management Plan as per Ontario Regulation 507/18 under the Ontario Electricity Act. Deep retrofits, which involve upgrading multiple building systems, offer a more comprehensive approach, and the proposed items 5 and 6 within Figure 1 could potentially reduce Greenhouse Gas emissions by 356 tCO2e, nearly achieving the annual reduction goal of 384 tCO2e (3.8 per cent). To reach the 80 per cent Greenhouse Gas reduction target, a long-term deep retrofit plan with achievable annual targets is required, taking into account the Niagara Region's Asset Management Plan, building performance, and new technology integration

Building Utilization – Impact of the Pandemic

Figure 1 item 7 presents an unexpected outcome during the pandemic. Due to the remote work policy, the Niagara Region achieved a reduction of 229 tCO2e in the first year of the pandemic despite not closing any facilities and increasing the HVAC requirements in all Long-Term Care facilities. In 2022, with staff returning to the office, Greenhouse Gas emissions returned to pre-COVID-19 levels. This pattern highlights the importance of building utilization and suggests a possible path forward. To decrease the Niagara Region's building portfolio, hybrid workplace policies and alternative service delivery strategies should be considered as part of the Climate Change Action Plan.

Water and Wastewater Portfolio

To meet the Niagara Region's 80 per cent emission reduction target by 2050, the Water and Wastewater division is reviewing potential opportunities to reduce energy consumption, improve efficiency and use renewable sources. It is critical that all measures comply with regulations and maintain water quality, system reliability and meet the increasing demand for treated water.

Achieving emissions reductions within the Water and Wastewater division will consider Table 1.

Overall, meeting the goal of an 80 per cent reduction of emissions in Water and Wastewater operations will require a combination of strategies and continuous efforts to reduce emissions and increase energy efficiency.

Table 1- Emission Reduction Example Opportunities

Category	Theme	Action Items
1- Carbon Footprint Inventory	Identify the sources of greenhouse gas emissions associated with water and wastewater operations.	Identify areas where emissions can be reduced and where renewable energy sources can be implemented.
2- Increase Energy Efficiency	Implementing energy efficiency measures is an essential step toward reducing emissions.	Measures include optimizing aeration blower systems, pumping systems, improving treatment processes and reducing water loss through leaks.
3-Renewable Energy	Renewable energy sources such as solar, wind, and geothermal energy can be used to power water and wastewater treatment plants.	Maximizing the use of digester gas as a fuel source or upgrading the quality of the digester gas to produce renewable natural gas can yield significant emissions benefits.
4-Design & Construction	Design and construction of new facilities to incorporate green/LEED standards.	Use life cycle assessment to evaluate the impacts of the facility design and construction and identify areas where further improvements can be made.

Maximizing Emissions Reduction

Niagara Region operates six water treatment plants, 84 water pumping stations, 10 wastewater treatment plants, 132 wastewater pumping stations and one facility for processing bio-solids. In aggregate, these facilities comprise 28 per cent of the total greenhouse gas emissions for Niagara Region.

A further breakdown of these emissions reveals that Water represents 32 per cent of the emissions and Wastewater operations is 68 per cent. Electricity consumed is 29 per cent of the total emissions and 71 per cent comes from natural gas consumption.

The utilization of these values is pivotal in crafting a comprehensive strategy to optimize emissions reduction by pinpointing key opportunities to achieve an 80 per cent reduction emissions goal. Therefore, in terms of priority of effectiveness for achieving emissions reductions, they rank as seen in Table 3.

Figure 2- Emissions from Water and Wastewater Operation Sources

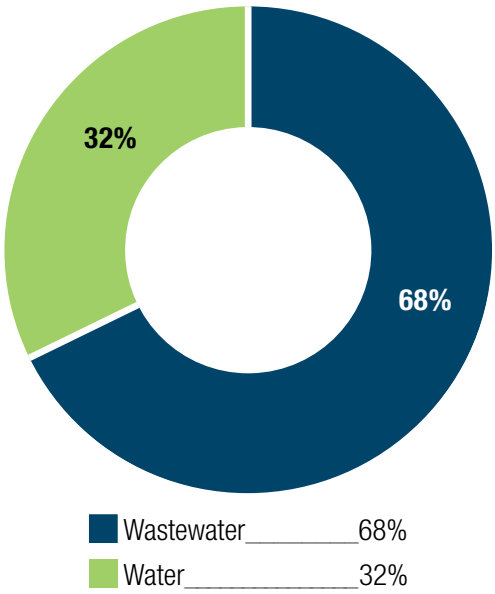


Figure 3- Emissions from Water and Wastewater Fuel Sources

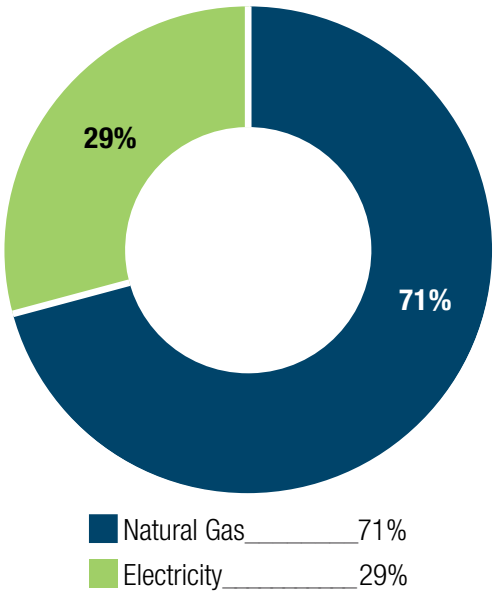


Table 2- Energy Consumption and Emissions- Water and Wastewater Pumping Stations and Treatment Plants

	Pumping Stations				Treatment Plants			
	Electricity Kilowatt-hour (kWh)	Emissions Tonnes (tC02e)	Natural Gas Cubic Metre (m3)	Emissions Tonnes (tC02e)	Electricity Kilowatt-hour (kWh)	Emissions Tonnes (tC02e)	Natural Gas Cubic Metre (m3)	Emissions Tonnes (tC02e)
Wastewater	10,013,534	300	116,821	222	27,539,437	826	1,401,887	2,663
Water	2,909,067	87	16,645	32	16,470,651	494	652,744	1,240

Table 3- Water and Wastewater Emissions Reduction Priorities

Priority	Facility	Type of Gas	Emissions Tonnes (tC02e)
1	**Wastewater Treatment Plant**	Natural Gas	2,663
2	**Water Treatment Plants**	Natural Gas	1,240
3	**Wastewater Treatment Plants**	Electricity	826
4	**Water Treatment Plants**	Electricity	494
5	**Wastewater Pumping Stations**	Electricity	300
6	**Wastewater Pumping Stations**	Natural Gas	222
7	**Water Pumping Stations**	Electricity	87
8	**Water Pumping Stations**	Natural Gas	32

Note: These figures are based on energy consumption for the 2018 base year and exclude non-treatment process related users of energy.

Historically, Water and Wastewater operations has implemented various measures to reduce energy use and their associated emissions and are currently evaluating other measures that will work towards these reduction targets. Example measures are included in Table 4.

Table 4- Water and Wastewater Energy Reduction Measures

Measure	Description
High-Efficiency motors	Motors for all pump and fan systems must be a minimum of 94 per cent efficiency. This is standard for all applications.
Variable Frequency Drives controls	All high-lift and low-lift pumping systems utilize a Variable Frequency Drives to regulate pumping speed to reduce electricity consumption. As per engineering design standards.
High-Efficiency Aeration Blower systems	Technology advances have improved the efficiency of the single largest source of energy consumption in wastewater treatment. Each application is carefully evaluated for efficiency.
LED Lighting	The majority of Water and Wastewater facilities have been converted to LED lighting and in going forward, all new construction projects utilize LED lighting systems. As per engineering design standards.
Digester Gas Use	Use of duel fueled boiler systems at wastewater treatment plants for space heat and process heat. Avoidance of 3,167 tCO2e but replacing consumption of natural gas with digester biogas.
Condensing Boilers	Increase fuel efficiency consumption for process heating and space heating boilers. Four recent boiler upgrades will yield roughly 387 tCO2e reduction.
Renewable Natural Gas	Surplus digester gas can be upgraded to pipeline quality. This initiative is currently being investigated. Potential for revenue generation or to reduce an estimated 4,800 tCO2e of emissions.

In Summary

Achieving an 80 per cent reduction in Greenhouse Gas emissions by 2050 in the Buildings and Water & Wastewater portfolios requires a cohesive and integrated approach. This entails recognizing existing successes and building off them through an integrated and comprehensive plan, including the development of energy-efficient buildings, deep retrofits and including the Water and Wastewater Greenhouse Gas reduction opportunities. Ongoing measures demonstrate the feasibility of the recommended target and highlight the need for continued Niagara Region wide support. Collaborative emissions reduction efforts in both portfolios are necessary for Niagara Region to achieve its ambitious goal.

Case Study:

80 per cent Greenhouse Gas Reduction by 2050

May 2023 | **niagararegion.ca**

Niagara Region