



The Regional Municipality of York

2024 CORPORATE ENERGY CONSERVATION AND DEMAND MANAGEMENT PLAN

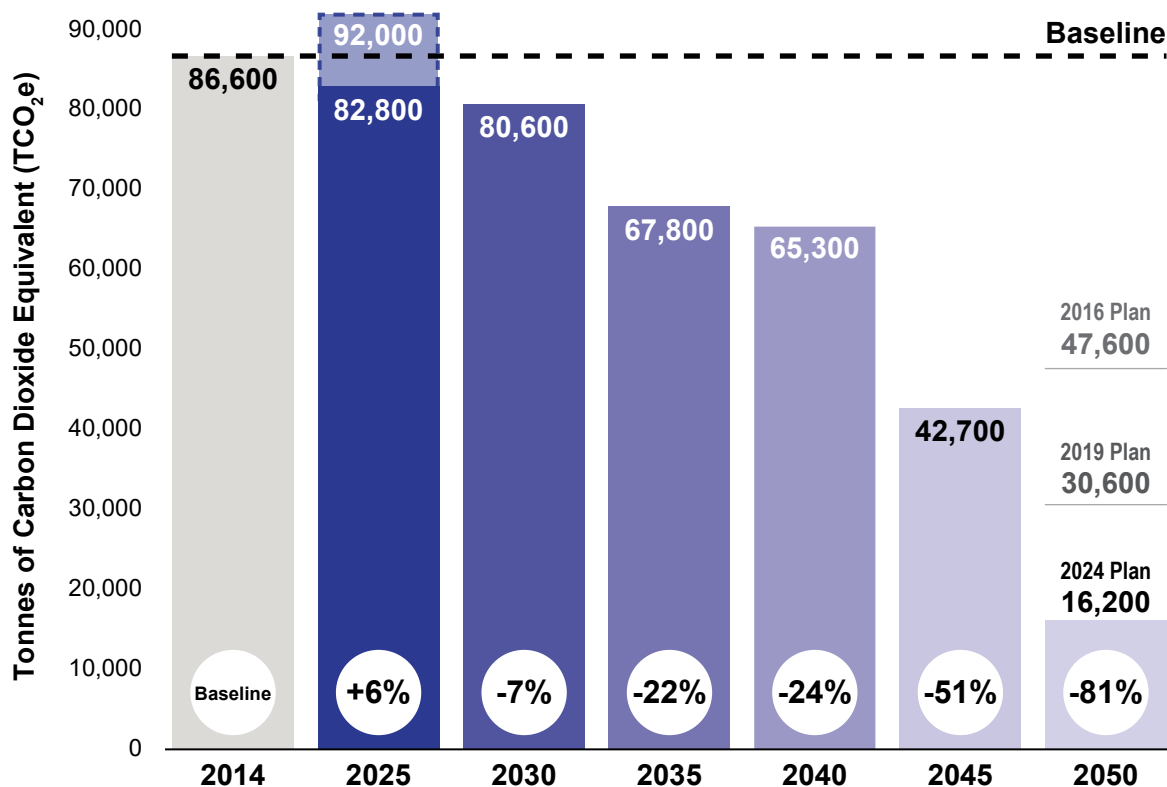
Corporate Emission Targets

This legislated 2024 update (*Ontario Regulation 25/23*) to York Region’s Corporate Energy Conservation and Demand Management Plan moves York Region toward its goal of net-zero carbon emissions by 2050 in a financially responsible manner by leveraging proven technologies, external funding and planned asset replacement cycles. This Plan applies the concept of “conservation first” to achieve mitigation targets. The first step to mitigating greenhouse gas emissions is to minimize energy consumption.

York Region subject matter experts provided initiatives proposed in this Plan. Staff input was augmented with industry best-practices collected from regional and local governments and includes input from industry experts. It is estimated that York Region can reduce its 2050 direct corporate emissions by 81% (Figure 1) compared to its 2014 baseline and avoid a cumulative release of 1.2 million tonnes of greenhouse gas emissions by 2050. Figure 1 shows how each Plan iteration has leveraged available technologies to advance 2050 target emissions closer to net-zero carbon emissions. The pace of emissions reduction will be determined by technology advancements and availability of funding (third-party or internal) for mitigation projects.

Figure 1 also illustrates the risk (almost 10,000 tonnes) associated with potential delays in receiving electric transit buses and utility transformers to the Region’s 2025 emissions target. It is not anticipated that these challenges will extend beyond near-term targets.

Figure 1: Corporate Greenhouse Gas Emissions Targets

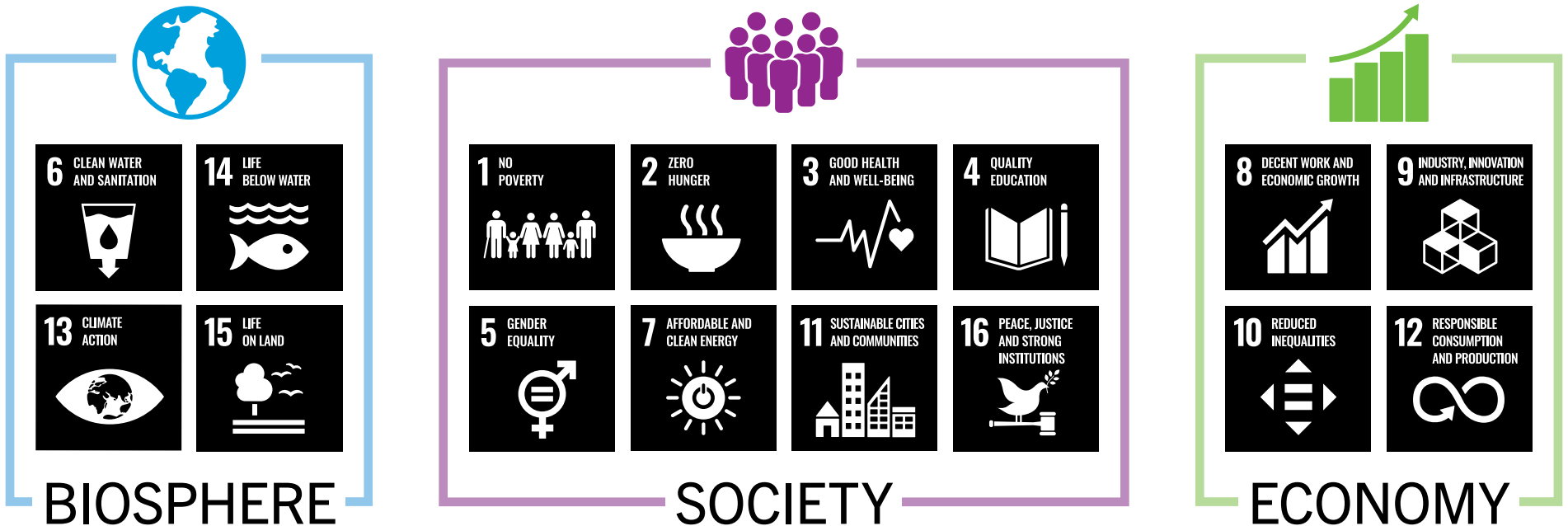


Global Context

Institutions like the United Nations (authority behind the Intergovernmental Panel on Climate Change¹ and Sustainable Development Goals Initiative²) and Stockholm Resiliency Centre³ (authority on the principles of Planetary Boundaries) provide credible analysis, reporting and guidance that focus global efforts on elements associated to climate change requiring immediate attention and sustained efforts. Sustainable Development Goals and Planetary Boundaries were incorporated into the ranking of proposed initiatives (Table 2, page 12) to prioritize mitigation initiatives. Aligning York Region's strategies and plans to these global institutions' guidance ensures that local investments in climate change mitigation are making the greatest impact.

In 2015, United Nations adopted 17 Sustainable Development Goals as a global call to end poverty, protect the planet and promote global peace and prosperity by 2030 (Figure 2). With less than six years remaining, it has never been more important for communities to rally all citizens, civil society, private sector, and other stakeholders to advocate for urgency, ambition and action to realize these goals. This is especially important for those goals that directly contribute to climate change, with the latest United Nations' Intergovernmental Panel on Climate Change (IPCC) report finding that global temperature is already 1.1 degrees Celsius above pre-industrial levels and is likely to reach or surpass 1.5 degrees Celsius by 2035².

Figure 2: United Nations Sustainable Development Goals⁴



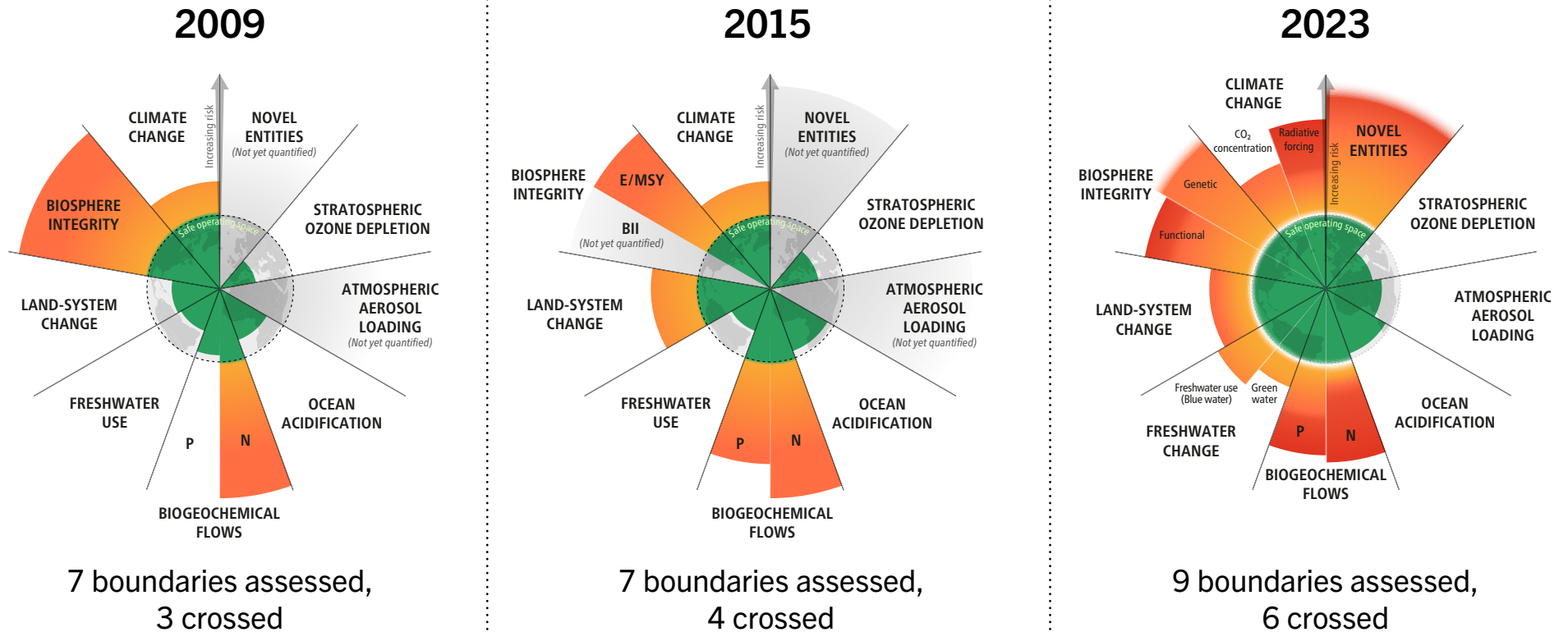
In 2009 the Stockholm Resilience Center proposed the **Planetary Boundaries**³, which offers the following nine quantitative planetary limits that, if exceeded, increase the risk of large-scale abrupt or irreversible environmental impacts.

Figure 3 illustrates the six planetary boundaries that have officially been crossed in 2023 indicating the large-scale societal effort needed to minimize further environmental damage and the associated negative environmental, social and economic impacts.

This update to York Region’s Corporate Energy Conservation and Demand Management Plan proposes initiatives that lower York Region’s impact, through reduced greenhouse gas emissions, on the following planetary boundaries:

- Climate Change (CO₂ concentration)
- Biosphere integrity (biodiversity loss and species extinction)
- Stratospheric ozone depletion (e.g., gaseous halocarbon compounds)
- Ocean acidification
- Biogeochemical flows (phosphorus and nitrogen cycles)
- Land-system change (e.g., deforestation)
- Freshwater use

Figure 3: Stockholm Resilience Centre 2023 Planetary Boundaries



Electrification Strategies

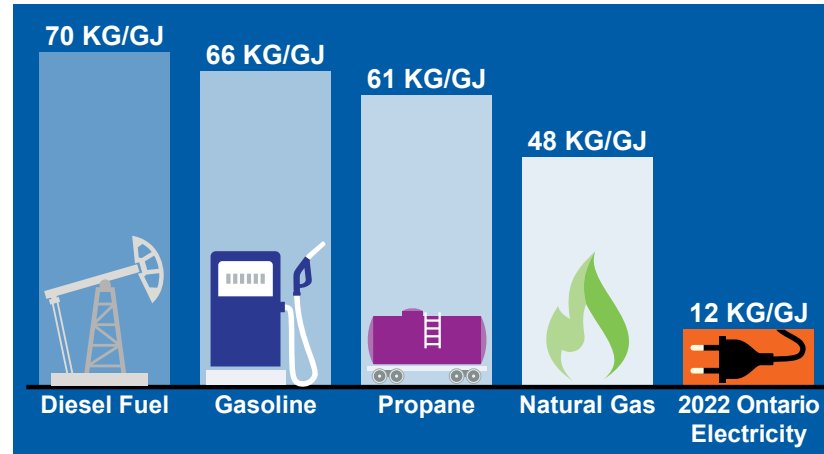
Figure 4 compares the emissions associated with electricity consumption in 2022 to fossil fuels per equivalent unit of energy. **Low-emissions electricity is the dominant strategy for York Region to decarbonize its fleets, buildings and processes.**

The backbone of Ontario's emissions free electricity generation are its nuclear generators. Over the next 15 years these generators will be refurbished. Natural gas generation will replace lower emission nuclear output during these refurbishments which could increase Ontario's electricity associated emissions by as much as 400%⁵. In the long-term, an anticipated zero-emissions electricity grid in Ontario will yield benefits for the Region's early investment to electrify. In the near-term, as illustrated in Figure 5, decarbonization strategies will be offset by increased electricity emission intensities.

Overall, electrification yields lower corporate emissions compared to fossil fuel combustion and provides the most fiscally responsible alternative toward net-zero carbon emissions.

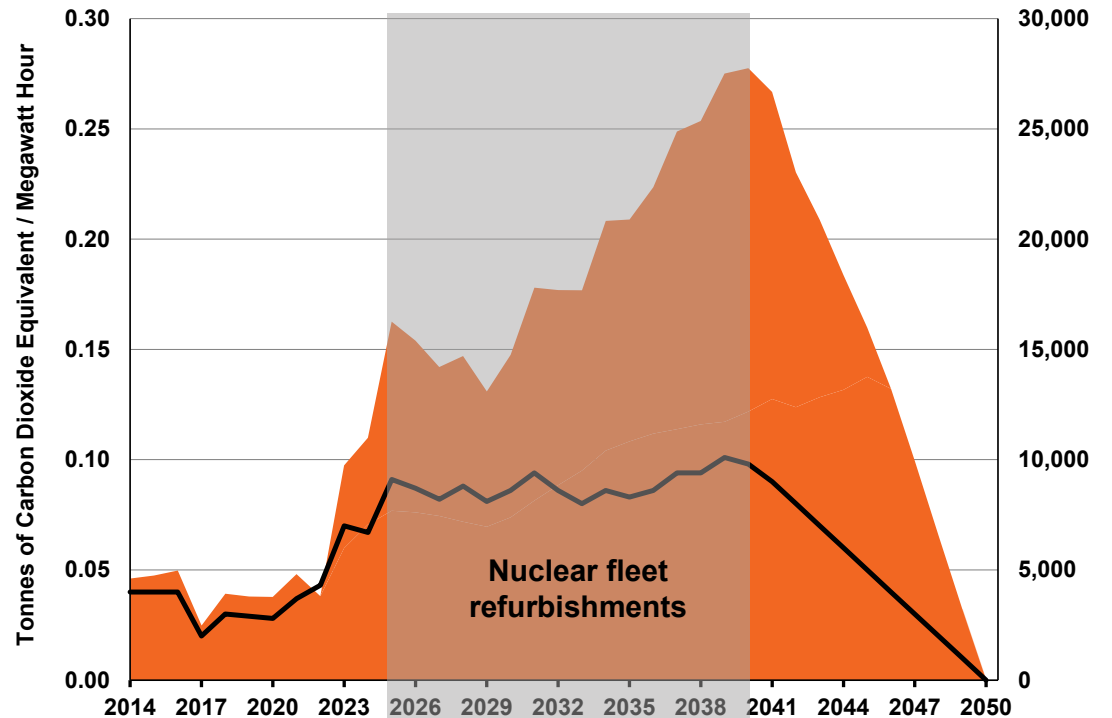
— Ontario's grid-supplied electricity emissions intensity (TCO_{2e} per MWh)
■ York Region electricity emissions

Figure 4: 2022 Greenhouse Gas Intensity by Energy Source



Note: KG/GJ = Kilograms per Gigajoule

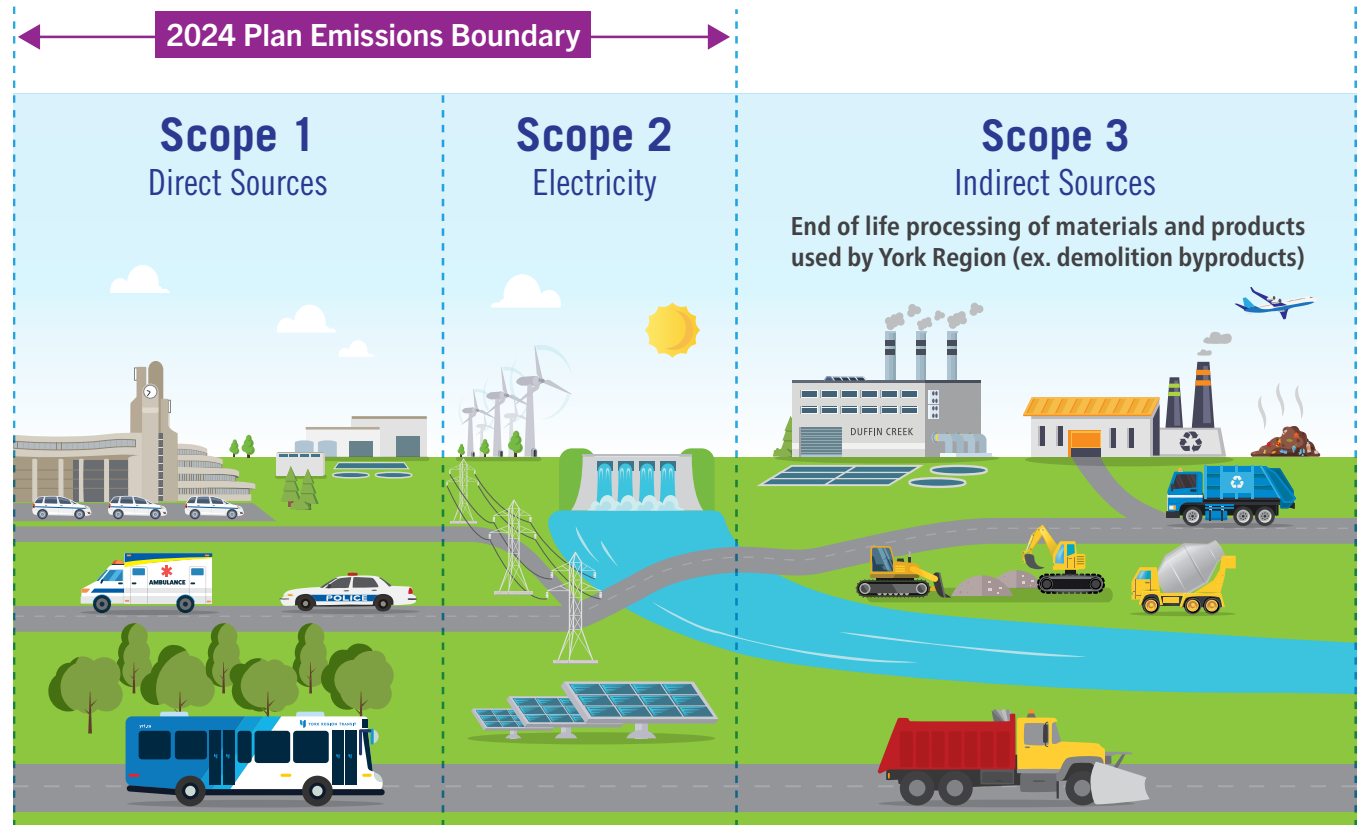
Figure 5: York Region Forecasted Electricity Emissions Versus to Electricity Emission Intensities



Greenhouse Gas Emissions Scopes

Greenhouse gas emissions are classified into three scopes (Scope 1, 2 and 3) based on the degree of control an entity can exert on their release (direct or indirect). Figure 6 illustrates these scopes in the context of services and operation at York Region. The term “Emissions Boundary” defines the extent to which an organization chooses emission sources to include in its emissions account and reporting portfolio.

Figure 6: Overview of Greenhouse Gas Emissions Scopes



Examples of emission source by Scope:

Scope 1:

- Natural gas to heat Region owned buildings
- Fleet vehicle gasoline
- Transit bus diesel fuel

Scope 2 – Electricity to:

- Cool Region-owned buildings
- Operate Region-owned water and wastewater facilities
- Power electric consuming assets including buses, vehicles, lights and computers

Scope 3 – Contracted services including:

- Water and wastewater treatment by peer municipalities
- Infrastructure and maintenance equipment and vehicles
- Energy from waste
- Landfill emissions
- Organics processing

2024 Plan Emissions Boundary

York Region's plans have always exceeded the legislated minimum reporting requirements by including transit bus and fleet fuel, employee business mileage, streetlights and traffic signals, long-term care facilities and waste management sites in its emission boundary. The following is a description of York Region emissions that have evolved to form the basis of Corporate Energy Conservation and Demand Management Plan emissions boundary.

- Transit Fleet** – York Region's transit fleet in 2022 comprised of 91 rapid transit buses, 443 conventional buses and 30 Mobility On-Request buses. Emissions from this category are primarily from diesel fuel combustion.
- Buildings** – York Region's facilities consume electricity and natural gas to heat, cool, ventilate and illuminate buildings and facilities.
- Non-Transit Fleet** – York Region's non-transit fleet vehicles include police, ambulance and light, medium and heavy-duty vehicles. Most non-transit fleet vehicles consume gasoline but a small portion consume diesel fuel or electricity.
- Water and Wastewater** – The distribution, collection and treatment of water and wastewater in York Region is accomplished largely by electrically driven equipment and processes. Diesel fuel used for backup electricity generation and natural gas for conditioned spaces constitute a smaller proportion of greenhouse gas emissions in this category.
- Streetlights, Traffic Signals and Transit Shelters** – In York Region, these assets are all powered exclusively by low-emissions electricity.



Duffin Creek Water Pollution Control Plant

2024 Plan Additions

York Region expanded its emissions in this Plan to include two additional Scope 1 direct emissions: Natural Assets and Wastewater Fugitive Emissions.

Natural Assets – York Region’s natural assets in the form of Region owned forests and street trees are Scope 1 emissions but were excluded from previous Plans. Recent technology has become available to credibly measure the number of trees, forest cover and carbon sequestration potential and include this category in this 2024 Plan.

York Region Wastewater Fugitive Emissions – Wastewater conveyance, processing and treatment result in the release of methane and nitrous oxides into the atmosphere which are potent greenhouse gases.

Table 1 summarizes the relationship between the 2024 Plan emissions boundary and corresponding operational sources of these emissions. Sources in bold are new in this Plan.

Table 1: 2024 Emissions Boundary and Sources – Scopes 1 and 2

Transit / Transportation	Buildings	Non-Transit Fleet	Water and Wastewater	Natural Assets
<ul style="list-style-type: none"> Conventional buses Mobility On-Request buses Rapid transit buses Transit shelters and terminals Street lighting Traffic signals Traffic counters Ev chargers Employee mileage 	<ul style="list-style-type: none"> Waste management facilities Paramedic response stations Police services stations Housing York Inc. Long-term care facilities Transit garages Vehicle storage and maintenance 	<ul style="list-style-type: none"> Light, medium, and heavy-duty vehicles Plug-in hybrid Off-road Tractors and construction Police vehicles Ambulance and medical Police air and marine 	<ul style="list-style-type: none"> Water treatment and pumping Water storage Wastewater treatment and pumping* Odour control Wastewater fugitive emissions* 	<ul style="list-style-type: none"> Urban forests and street trees

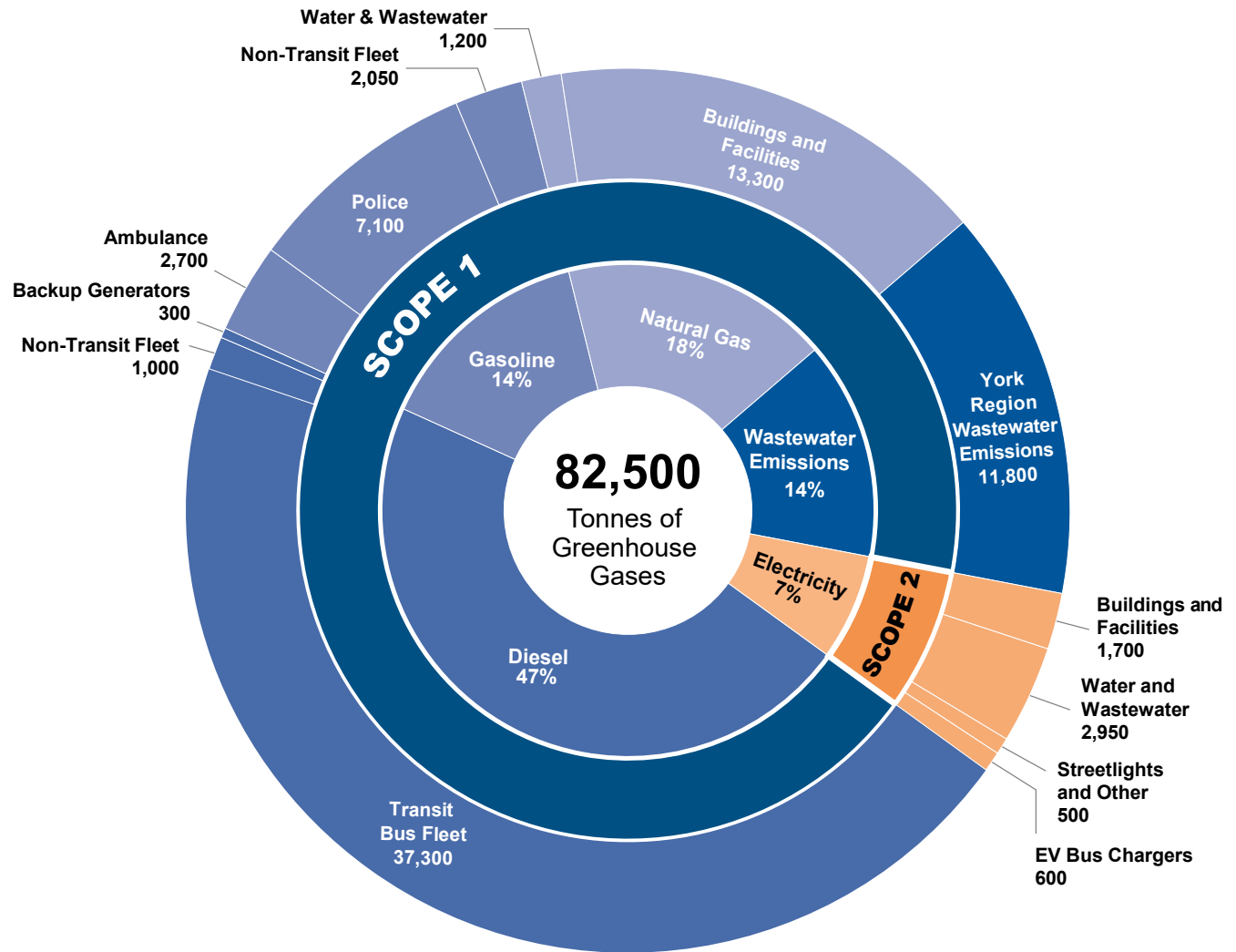
* Up to 90% of York Region’s water treatment and 95% of its wastewater processing are contracted to neighbouring municipalities, are Scope 3 emissions, and do not fall within this boundary. Scope 3 emissions are planned for inclusion in the 2029 Corporate Energy Conservation and Demand Management Plan.

Emissions Breakdown

The expanded 2024 Plan boundary with the inclusion of carbon sequestration from Region owned forests and street trees and wastewater emissions from York Region owned wastewater facilities is illustrated in Figure 7. Wastewater emissions are greenhouse gases such as nitrous oxide and methane that escape into the atmosphere during conveyance and treatment.

With plans to electrify the transit bus fleet, this illustration highlights the importance of buildings and wastewater emissions as the next two highest sources of emissions for staff to continue focusing on. Given the unique nature of buildings, staff have been working on devising long-term plans to align net-zero carbon upgrades with state of good repairs. This will ensure fiscally effective solutions to enable electrification within York Region's building portfolio.

Figure 7: 2022 Corporate Greenhouse Gas Emissions Breakdown





York Region battery electric vehicles

Forecasting the Future

Emissions Scenarios

Three emissions scenarios were explored to examine the magnitude of greenhouse gas reduction opportunities available to York Region, including:

Business-as-Usual

This scenario assumes continued business practices as they are today based on York Region anticipated population growth forecasts. It reflects York Region not actively pursuing energy saving and greenhouse gas emissions reduction initiatives proposed in this Plan.

2024 Corporate Energy Conservation and Demand Management Plan

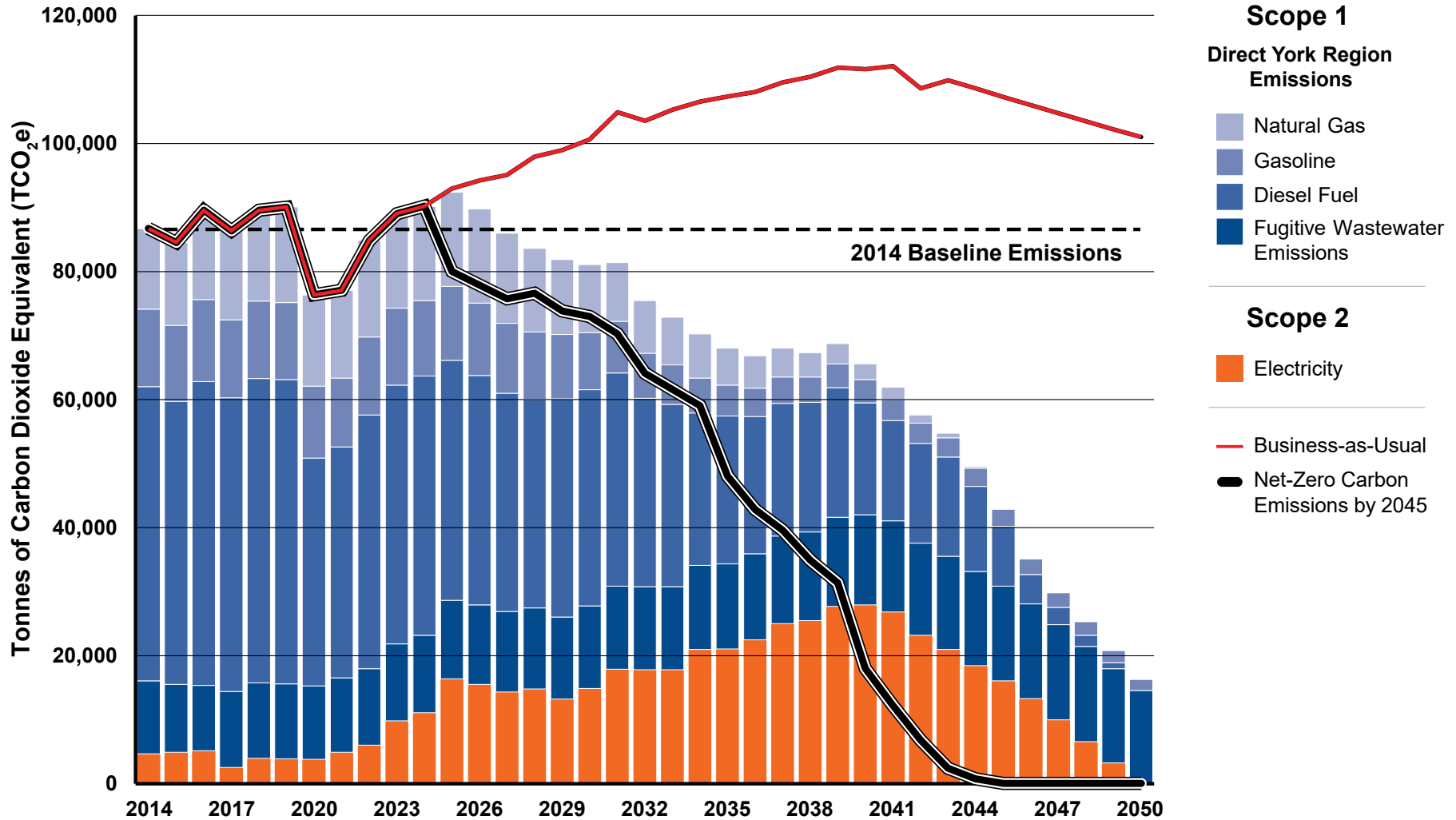
This scenario reflects the concerted implementation of measurable policies and actions identified in this Plan. The 2024 Plan Scenario is guided by numerous York Region policy and strategy documents.

Net-Zero Carbon Emissions by 2045

Many organizations are setting more ambitious plans to achieve the target ahead of 2050. The goal is to provide insurance through a safety factor in case unforeseen variables cause delays in the decades ahead.

The pathway for each scenario is presented in Figure 8.

Figure 8: Forecasted Greenhouse Gas Emissions and Reduction Potential – Scope 1 and 2



A more aggressive path to net-zero carbon emissions by 2045 was investigated and proved to be possible but capital intensive. Net-zero by 2045 also relies on technologies that are not currently mainstream or are still in development, and present significant risk and cost to the Region. In addition, this path requires purchase of carbon credits for the balance of the Region’s remaining corporate emissions to meet the net-zero carbon target and currently forecasted at an annual cost of \$2.8 million. Due to risk and the level of uncertainty, staff do not recommend accelerating emissions reduction at this time, however, opportunities to capitalize on new technology and approaches will continue to be incorporated into the priorities identified in this Plan.

2024 Plan Initiatives Summary

Table 2: 2024 Plan Initiatives

Triple-Bottom Line Rank	Action #	Category	Initiative	Incremental Capital Cost to 2050 (Million)	Greenhouse Gas Emissions Savings (Tonnes Carbon Dioxide Equivalent)		
					2024-2029	2030-2034	2035-2050
6	T-1	Transit	Transit Bus Electrification	\$519.8 M	42,600	77,800	403,200
7	T-2	Transit	Mobility On-Request Fleet Electrification	Operating Cost	-	750	1,630
8	B-2	Buildings	Temperature & Humidity Standards	Staff Time	380	230	190
2	B-3	Buildings	Building/Space/Office Consolidations	Staff Time	6,300	15,800	23,900

Battery-electric propulsion technology is currently the dominant path for the Region because it has the potential to reduce transit fleet emissions by 97% over its diesel bus counterpart.

Transition the current contracted gasoline and diesel-powered fleet to a battery-electric powered fleet.

Develop a policy to establish temperature and humidity standards for all regional buildings.

Optimize existing administrative office space through the use of hybrid-work arrangements and hoteling before adding additional space to heat and cool. Where possible, close poor performing buildings and consolidate staff into high-performing buildings.

Ranking of initiatives is based on a Triple Bottom Line analysis that balances outcomes across financial, environmental and social priorities that are aligned with York Region plans and strategies. Social priorities include United Nations Sustainable Development Goals and Planetary Boundaries that are impacted by climate change in addition to those identified by York Region's own strategies and plans.

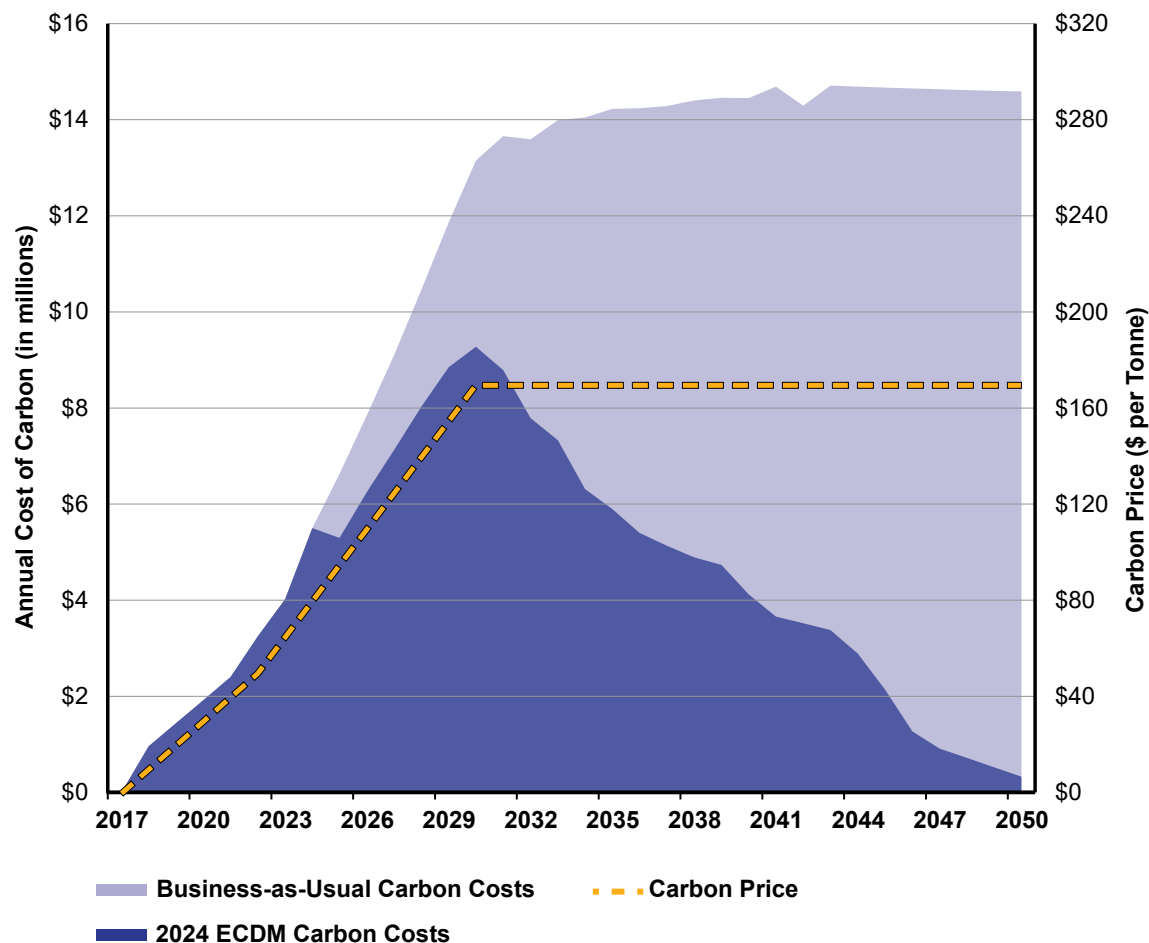
Triple-Bottom Line Rank	Action #	Category	Initiative	Incremental Capital Cost to 2050 (Million)	Greenhouse Gas Emissions Savings (Tonnes Carbon Dioxide Equivalent)		
					2024-2029	2030-2034	2035-2050
1.B	NT-1	Non-Transit Fleet	Electrification of Light-Duty Fleet	\$19.8 M	7,330	13,680	40,390
Replace York Region non-emergency fleet with electric vehicles (including Plug-In Hybrid and hybrid technologies).							
1.A	NT-2	Non-Transit Fleet	Fleet Optimization	Staff Time	170	80	16
Apply the Fleet Optimization Policy to match vehicles to their underlying service need based on life-cycle analysis, operational demands and greenhouse gas emissions reduction.							
4	NT-3	Non-Transit Fleet	Battery Electric Ambulance Pilot	\$32.0 M	1,190	8,300	39,000
Pilot battery electric ambulances.							
9	NT-4	Non-Transit Fleet	Light Duty Equipment Electrification	\$0.1 M	85	85	270
Replace gasoline powered light-duty equipment with battery powered equipment.							
3	W-1	Water and Wastewater	Water Conservation, & Sanitary Sewer Inflow & Infiltration	\$1 M	1,040	2,120	8,750
Reduce daily, and peak water uses and losses from the distribution system through a suite of program components.							
5	W-2	Water and Wastewater	Commissioning and Optimization of Operations	\$30.6 M	2,170	3,175	6,950
Reduce energy consumption through commissioning and optimization of operations.							

Avoided Energy and Carbon Costs

Electricity and natural gas costs are conservatively estimated to increase by about 3% per year for the purposes of this Plan compared to other fuels such as gasoline and diesel which are assumed to increase by about 2% per year. Rising energy prices will negatively impact ongoing operating costs making energy conservation also important to mitigate rising energy costs. Furthermore, the Government of Canada has enacted a carbon price for fossil fuels, which will reach \$170 per tonne of carbon by 2030.

Without a dedicated focus on reducing and conserving energy by 2050, York Region's annual operating costs are estimated to increase by \$14 million in carbon tax and a cumulative \$225 million between 2030 and 2050. This Plan proposes conservation initiatives to avoid these financial impacts by 2050. Figure 9 illustrates the financial cost of carbon pricing related to fossil fuel purchases and the potential this Plan has to mitigate carbon costs in addition to climate change.

Figure 9: Annual Carbon Cost of Greenhouse Gas Emissions



Marginal Abatement Cost Curve

A Marginal Abatement Cost Curve (MACC) compares the normalized cost and greenhouse gas reduction potential of alternative initiatives. Cost intensity in the form of dollars per tonne of greenhouse gas reduction is plotted against the Y-axis with corresponding total greenhouse gas reductions on the x-axis for each initiative over a five-year term.

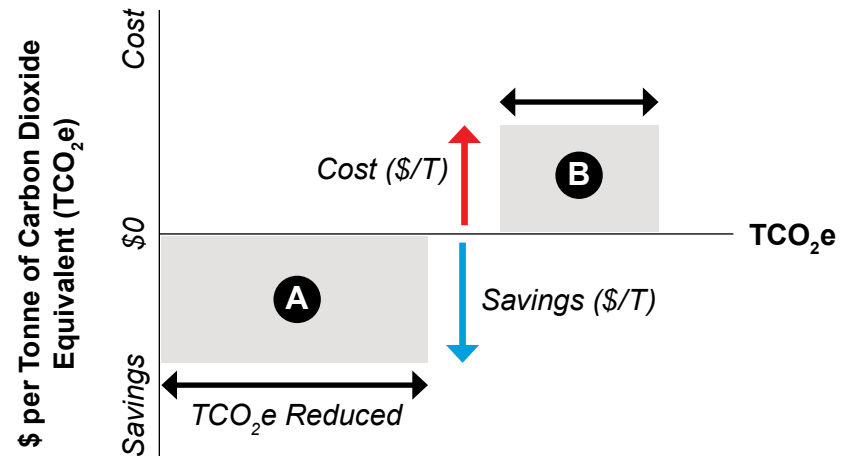
The size and location of each box above and below the axis has the following meaning:

- Initiatives are ordered from highest financial savings on the left to highest financial cost on the right
- Initiatives below the axis represent a net financial savings (Figure 10 blue arrow) whereas initiatives above the axis come at a net cost (Figure 10 red arrow) over their lifecycle
- The taller the box, the greater the net cost or savings
- The width of the box represents the initiative's estimated greenhouse gas emissions reduction potential over 5 years (Figure 10 black arrow)
- The greater the width of the box, the greater the emissions reduction

In the case of Figure 10:

- Box A delivers a net financial savings with the greatest absolute emissions reduction
- Box B delivers less absolute emissions reductions than A and at a net financial cost

Figure 10: Interpreting the MACC

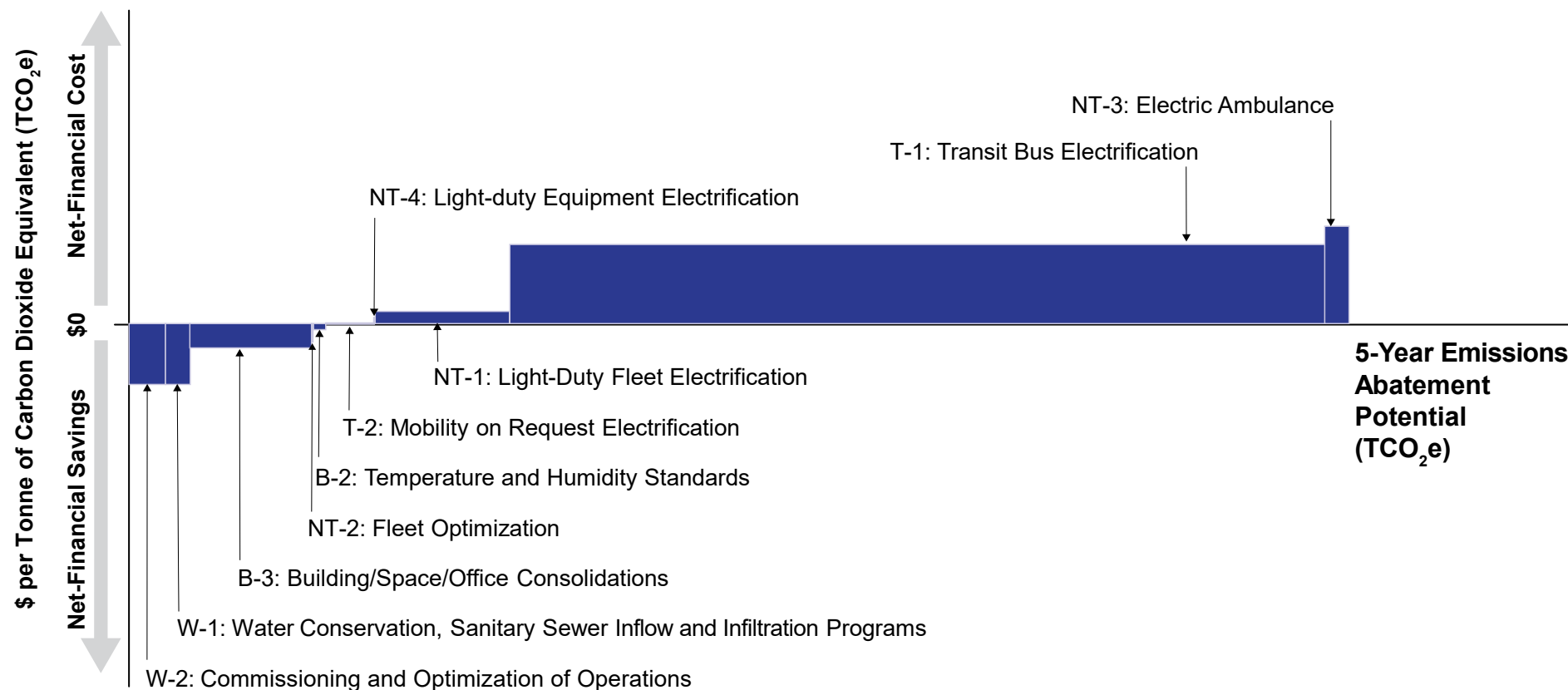


Normalized cost is calculated by deducting operating cost savings from the initial project capital costs. Where operating cost savings are greater than the initial capital cost, a negative cost intensity will result and signify a net financial benefit.

The estimated Marginal Abatement Cost Curve for this 2024 Plan update is illustrated in Figure 11.

While useful to compare the reduction potential and cost across the initiatives presented in this Plan, it should not be used on its own to decide which measures are implemented to achieve York Regions' emission reduction targets (e.g., selecting the cheapest option first and delaying the most expensive options until later). Some of the high cost initiatives have the greatest lifetime emissions reduction potential (i.e., transit bus electrification). Initiatives should be combined as their combined business/emissions cases will provide more attractive scenarios.

Figure 11: Marginal Abatement Cost Curve (MACC) of Proposed Initiatives

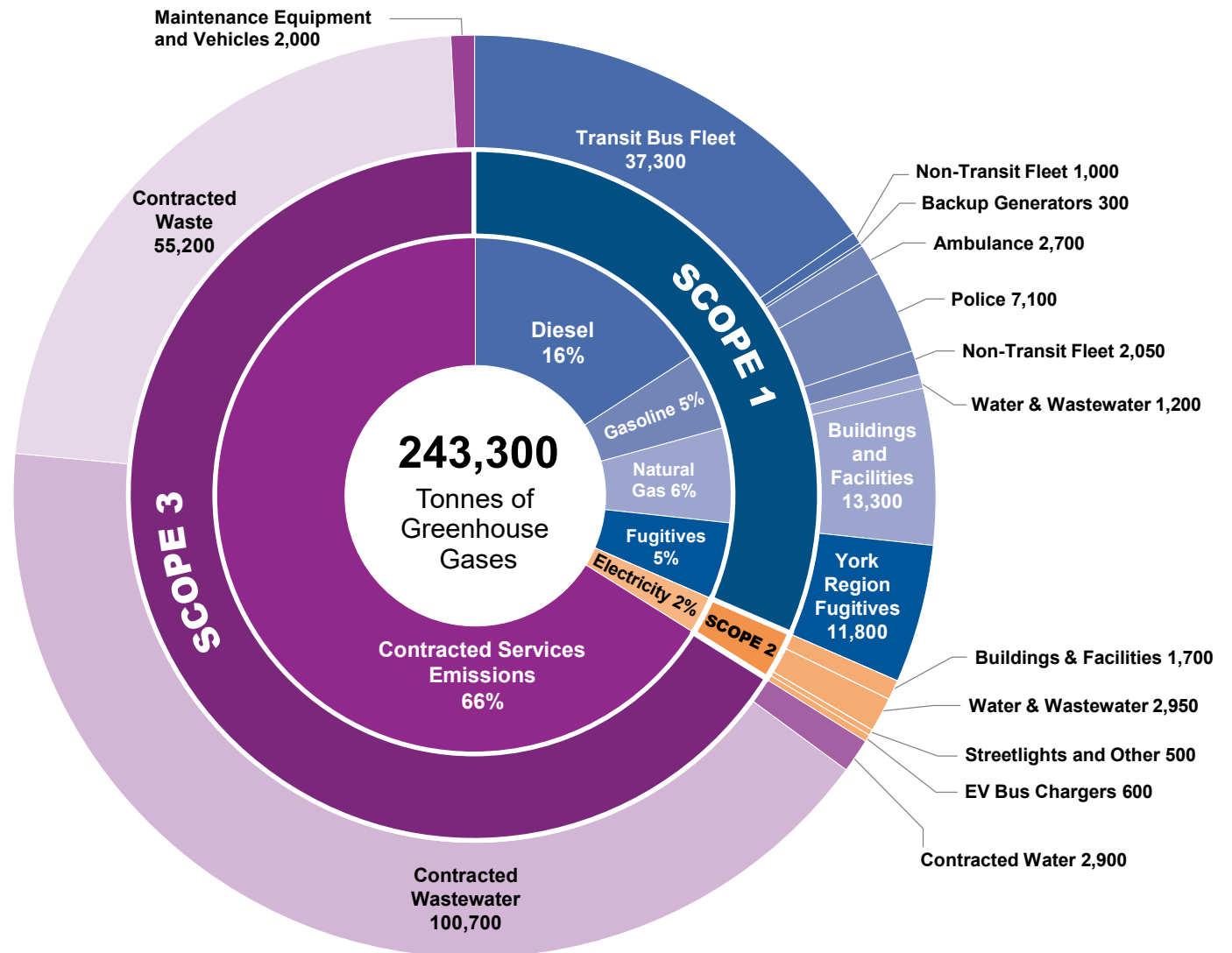


Full Accounting of Greenhouse Gas Emissions

Figure 12: Full Accounting of York Region's 2022 Greenhouse Gas Emissions – Scopes 1, 2 and 3

Scope 3 emissions, the final sources missing from a full accounting of York Region's greenhouse gas emissions profile, are being introduced in this 2024 Plan in preparation for their inclusion in the 2029 Plan. Scope 3 emissions result from activities that are not owned or controlled by York Region but can be influenced through conditions of co-ownership, procurement and permitting.

Figure 12 illustrates the full effect from inclusion of Scope 3 emissions to York Region's accounting of greenhouse gas emissions. In this case, if Scope 3 emissions were applied to York Region's 2022 accounting of greenhouse gas emissions, results would total 243,300 as illustrated in Figure 12.



Endnotes

- ¹ Intergovernmental Panel on Climate Change, 2023. www.ipcc.ch/, accessed November, 2023.
- ² United Nations, 2023. The Sustainable Development Goals Report Special Edition. <https://unstats.un.org/sdgs/report/2023/The-Sustainable-Development-Goals-Report-2023.pdf>, accessed August, 2023.
- ³ Stockholm University, 2023. www.stockholmresilience.org, accessed December, 2023.
- ⁴ United Nations, 2023. Sustainable Development Goals. www.un.org/sustainabledevelopment/, accessed August, 2023.
- ⁵ The Atmospheric Fund, 2021. A Clear View of Ontario's Emissions: Updated electricity emissions factors and guidelines, 2021 Edition. pg 21. www.taf.ca/publications/electricity_emissions_factors/



Durham-York Energy Centre