



McGill

GREENHOUSE GAS INVENTORY

2020 REPORTING YEAR

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Executive Summary

Scope

- **Reporting period:** January 1 – December 31, 2020
- **Consolidation approach:** operational control
- **Operational boundary:** Scope 1, Scope 2 and select Scope 3 emissions; select carbon sequestration; carbon offsets
- **Protocol:** WBCSD/WRI [Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard](#) (2004)

Key Results

- **Gross emissions in 2020 were 45,508 tonnes of CO₂-equivalent (tCO₂e).** This is a decrease of 23% (13,701 tCO₂e) from the 2015 base year and 22% (12,583 tCO₂e) from 2019. Most emissions were Scope 1 (75%), particularly natural gas consumption (67%). An additional 103 tCO₂e was generated from biogenic (biodiesel and renewable natural gas) sources.
- **Net emissions in 2020 were 42,381 tCO₂e.** Net carbon sequestration in the forests at the Gault Nature Reserve and Morgan Arboretum is equal to 2,629 tCO₂e/year (6% total emissions). As of 2020, carbon offsets purchased via the McGill-Bayano Reforestation Project account for 498 tCO₂e sequestered yearly until 2040 (1% total emissions).
- **Disruptions due to the COVID-19 pandemic account for significant decreases in 2020 emissions.** Emissions from university-related travel and commuting fell by 5,549 tCO₂e (69%) and 3,942 tCO₂e (55%), respectively, due to travel restrictions and work-from-home orders from March–December 2020.
- **Scope 1 energy emissions decreased in 2020.** Natural gas consumption (Scope 1) fell by 2,907 tCO₂e (9%) as 2020 was a warmer year on average than 2019, smart energy grids were partially active towards the end of 2020, and there were fewer people on campus as of March 2020 due to the pandemic.
- **Emission increases between 2019 and 2020 were minor** and mostly attributable to refrigerants (increase in Global Warming Potentials), livestock (increase in dairy cows) and Scope 3 natural gas (increase in rented space).
- **Energy-intensity-based key performance indicators for 2019–2020 have improved since 2015.** McGill's emissions from stationary combustion sources per student enrolled were 1.00 tCO₂e/full-time-equivalent student, and emissions per gross area were 0.040 tCO₂e/m², both of which have decreased since 2015 and 2019. Emissions per million dollars endowed (21.78 tCO₂e/\$M) have also decreased since 2015.

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1. Scope of the Inventory

A. Description of the Organization

McGill University, located in Montreal, Quebec, offers over 300 academic programs in 11 faculties and schools. Over 32,000 full-time-equivalent students were enrolled in FY2020, and the University employed more than 13,000 part- and full-time faculty and staff. As of April 30, 2020, the University's endowment was \$1.576 billion¹ and its budget \$1.451 billion.²

McGill owns and operates over 200 buildings on three main campuses: Downtown Campus in downtown Montreal, Macdonald Campus in Sainte-Anne-de-Bellevue and the Gault Nature Reserve in Mont-Saint-Hilaire. The University also owns and operates the Bellairs Research Institute in Barbados, the McGill Arctic Research Station and the McGill Sub-Arctic Research Station.

B. Reporting Period

This report details McGill's greenhouse gas inventory for calendar year 2020.

C. Organizational Boundary

This inventory follows the GHG Protocol's operational control consolidation approach.

We include, within Scope 3, emissions from energy consumption in some buildings over which we do not have operational control. We also include data for several small research stations and facilities whose emissions are relatively immaterial compared to those of our main campus. See Detailed Appendix.

D. Operational Boundary

This inventory includes:

All Scope 1 emissions within the organizational boundaries defined above, except process gases generated by chemicals used for, and by-products generated by, research experiments. See Detailed Appendix.

All Scope 2 emissions within the defined organizational boundaries.

Scope 3 emissions believed to have significant greenhouse gas impacts, that are considered most relevant to the University's mission and for which data are accessible, namely from:

- Electricity and natural gas consumption for select buildings over which we do not have operational control
- Student, faculty and staff commuting
- Directly financed, University-related air travel
- University sports team travel
- The Macdonald Campus shuttle bus

¹ https://www.mcgill.ca/investments/files/investments/report_on_endowment_performance_2019-2020_eng_final.pdf, p. 6 (market value)

² https://www.mcgill.ca/vpadmin/files/vpadmin/english_audited_financial_statements_april2020.pdf, p. 3

- Water supply and treatment
- Power transmission and distribution losses between production sites and McGill facilities.

The following emissions are reported separately as per best practice:

- Emissions from refrigerants not covered by the Kyoto Protocol
- Emissions avoided through waste management and diversion (recycling and composting)
- Emissions from biodiesel in the Macdonald Campus shuttle bus and renewable natural gas purchased to offset a portion of natural gas consumption (biogenic emissions)
- Carbon sequestration from the Gault Nature Reserve and Morgan Arboretum
- Carbon offsets purchased via the McGill-Bayano Reforestation Project.

E. Base Year & Recalculation Policy

Our base year for comparison is 2015. We will recalculate base year emissions should structural changes at the University, changes in calculation methodologies or emissions factors, or significant errors result in a cumulative difference to gross emissions of 10% or more.

F. Method

We invite readers to refer to the Detailed Appendix for methods including data sources, emissions factors, key assumptions and equations.

2. Results

A. Greenhouse Gas Emissions

Gross emissions in 2020 were 45,508 tCO₂e. An additional 103 tCO₂e was generated from biogenic (biodiesel and renewable natural gas) sources. Figure 1 presents the breakdown of emissions by activity.

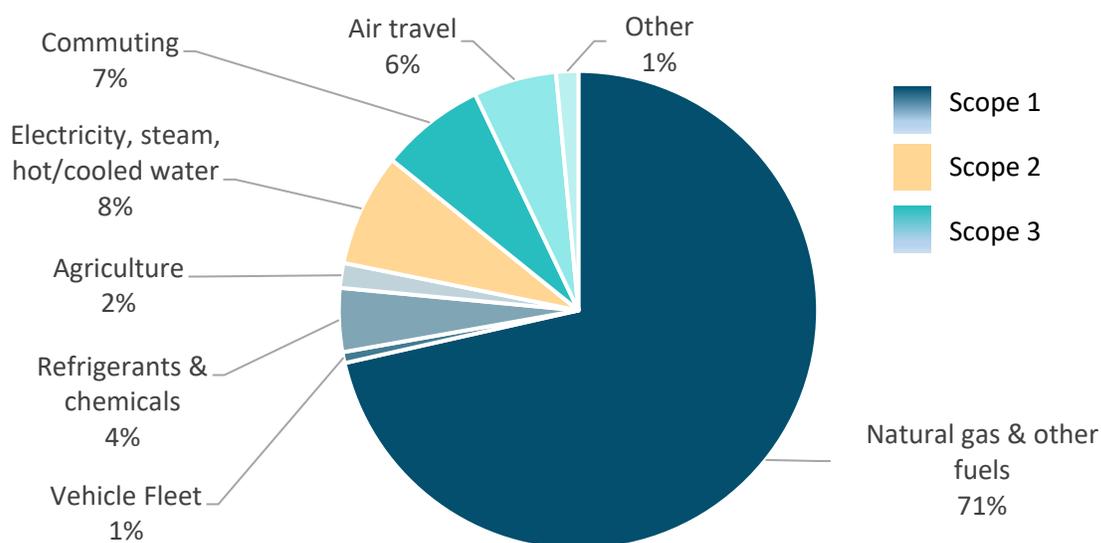


Figure 1. Emissions Breakdown by Activity

Table 1 presents 2020 emissions by greenhouse gas. Table 2 details 2020 emissions by scope and activity.

Table 1. Emissions Breakdown by Greenhouse Gas

Greenhouse Gas	Emissions (tGHG)	Emissions (tCO ₂ e)
Carbon dioxide (CO ₂)	42,532	42,532
Methane (CH ₄)	24	673
Nitrous oxide (N ₂ O)	1.3	344
Refrigerant R134a	0.04	162
Refrigerant R125	1.1	1,715
Refrigerant R32	0.04	33
Sulphur hexafluoride (SF ₆)	0.002	49
Total	N/A	45,508

Note: When emission factors were only available in units of CO₂e, emissions were wholly attributed to CO₂ in the tGHG column

Table 2. 2020 Greenhouse Gas Inventory

CATEGORY	ACTIVITY	ACTIVITY LEVEL	UNIT	EMISSIONS (tCO ₂ e)	% TOTAL
Scope 1 (direct emissions)					
Stationary combustion	Natural gas	15,960,067	m ³	30,286	67%
	Propane	0	L	0	0.0%
	Heating oil	290,019	L	793	1.7%
	Diesel	45,052	L	124	0.3%
McGill-owned vehicle fleet	Diesel vehicles	77,055	L	209	0.5%
	Gasoline vehicles	52,799	L	126	0.3%
	Propane vehicles	0	L	0	0.0%
Refrigerants & chemicals	Refrigerants	1,207	kg	1,910	4.2%
	Insulating gas	1.9	kg	49	0.1%
Agriculture	Livestock	4,965	heads	694	1.5%
	Fertilizers	47,287	kg	67	0.1%
Subtotal				34,257	75%
Scope 2 (indirect energy emissions)					
Purchased energy	Electricity	171,295,088	kWh	249	0.5%
	Steam	290,522	m ³	551	1.2%
	Hot water	1,400,240	m ³	2,657	5.8%
	Chilled water	134,382	kWh	0.2	0.0%
Subtotal				3,458	7.6%
Scope 3 (indirect emissions)					
Stationary combustion	Natural gas	696,418	m ³	1,322	2.9%
	Electricity	11,100,720	kWh	13	0.0%

CATEGORY	ACTIVITY	ACTIVITY LEVEL	UNIT	EMISSIONS (tCO ₂ e)	% TOTAL
Commuting	Faculty, staff	3,606,220	pass-km	1,171	2.6%
	Students	10,961,448	pass-km	2,059	4.5%
Third-party fleet	Macdonald shuttle	71,352	L	212	0.5%
Air travel	Directly financed air travel	26,172,097	pass-km	2,546	6.0%
Sports team travel	Air	408,086	pass-km	33	0.1%
	Bus	21,565	vehicle-km	19	0.0%
	Public transit	0	pass-km	0	0.0%
	Taxi + car	3,276	km	0.6	0.0%
Water	Supply	1,862,713	m ³	137	0.3%
	Treatment	1,129,156	m ³	261	0.6%
Energy losses	Transmission & distribution	14,590,000	kWh	20	0.0%
Subtotal				7,793	17%
Total Gross Emissions				45,508	100%

NON-INVENTORY CATEGORY	ACTIVITY	ACTIVITY LEVEL	UNIT	EMISSIONS (tCO ₂ e)
Avoided emissions from waste management	Solid waste - recycling	480	tonnes	-1,556
	Solid waste - composting	122	tonnes	-57
Total				-1,613
Refrigerants governed by Montreal Protocol	Refrigerants (e.g., R22)	214	kg	319
Total				319
Biogenic emissions	Macdonald shuttle, biodiesel	8,374	L	21
	Renewable natural gas	43,478	m ³	82
Total				103

Scope 1 sources contributed 75% (34,257 tCO₂e) of total emissions. Building natural gas—for heating, cooling and research activities—accounted for most of Scope 1 (88%) and total emissions (67%).

Scope 2 sources—from electricity consumption and other grid-distributed energy such as steam, hot water and chilled water—accounted for 8% (3,458 tCO₂e) of emissions. This is due in part to the low carbon intensity of Quebec’s electricity grid.³

Scope 3 sources made up 17% (7,793 tCO₂e) of emissions, most of which (74%) result from directly financed air travel (6% total emissions) and student, faculty and staff commuting (7% total emissions).

³ Canada Energy Regulator (2021). Canada’s Renewable Power – Canada. <https://www.cer-rec.gc.ca/en/data-analysis/energy-commodities/electricity/report/canadas-renewable-power/canadas-renewable-power/provinces/renewable-power-canada-canada.html> (accessed on Sep 21, 2021)

Table 3 compares energy use across campuses. Energy consumption is highest at the Downtown Campus (32,298 tCO₂e or 90% of total energy emissions) given the higher number of buildings, campus population and proportion of energy-intensive research labs. Macdonald Campus accounts for 10% (3,520 tCO₂e) of total energy emissions, while Bellairs and Gault represent 0.4% (133 tCO₂e).

Table 3. Energy Consumption by Energy Type by McGill Campus

ENERGY CONSUMPTION	ELECTRICITY (kWh)	CHILLED WATER (kWh-e)	STEAM (m ³ NG-e)	HOT WATER (m ³ NG-e)	NATURAL GAS (m ³)	HEATING OIL #2 (L)	PROPANE (L)	DIESEL (L)
Scope 1	0	0	0	0	15,960,067	290,019	0	28,669
Scope 2	171,295,088	134,382	290,522	1,400,240	0	0	0	0
Scope 3	11,100,720	0	0	0	696,418	0	0	0
Total	182,395,808	134,382	290,522	1,400,240	16,656,485	290,019	0	28,669
By Campus								
Downtown	158,326,105	134,382	290,522	1,377,454	15,212,482	0	0	27,158
Macdonald	16,861,438	0	0	22,785	1,422,644	275,259	0	1,511
Gault Reserve	544,080	0	0	0	0	14,759	0	0
Bellairs	55,457	0	0	0	0	0	0	0
Offsite	6,608,727	0	0	0	21,359	0	0	0
Total	182,395,808	134,382	290,522	1,400,240	16,656,485	290,019	0	28,669

B. Gross vs. Net Emissions

Figure 2 compares gross and net emissions without biogenic emissions.

Net carbon sequestration at the Gault Nature Reserve and Morgan Arboretum is estimated at 2,629 tCO₂e/year.⁴

As part of the McGill-Bayano Reforestation project in Panama,⁵ 25,000 trees were planted in 2020. The *ex-ante* estimate of carbon sequestered by these trees is 9,953 tCO₂e over 25 years including estimated mortality.⁶ We account for 498 tCO₂e of carbon offsets per year until 2040, our target year for carbon neutrality.

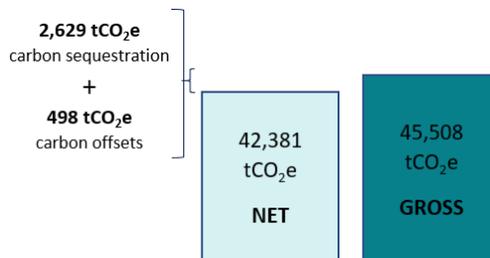


Figure 2. 2020 Gross vs. Net Emissions

⁴ Boushey, I. 2019. "Evaluation of Aboveground Forest Carbon Sequestration for Climate Change Mitigation Targets: A Case Study on McGill University Properties".

⁵ <https://www.mcgill.ca/sustainability/get-involved/offsetting-program/mcgill-carbon-offset-project>

⁶ Marchena, B., and Potvin, C. 2021. Bayano-McGill Carbon Offsetting Project Report 1.

C. Base Year vs. Current Emissions

Total emissions in 2015 were 59,209 tCO₂e. We have achieved near continuous gross emission reductions since, except in 2019. Figure 3 presents the annual gross and net emissions for 1990 and 2015–2020, as well as future targets. See the Detailed Appendix for differences in emissions per activity between 2015 and 2020.

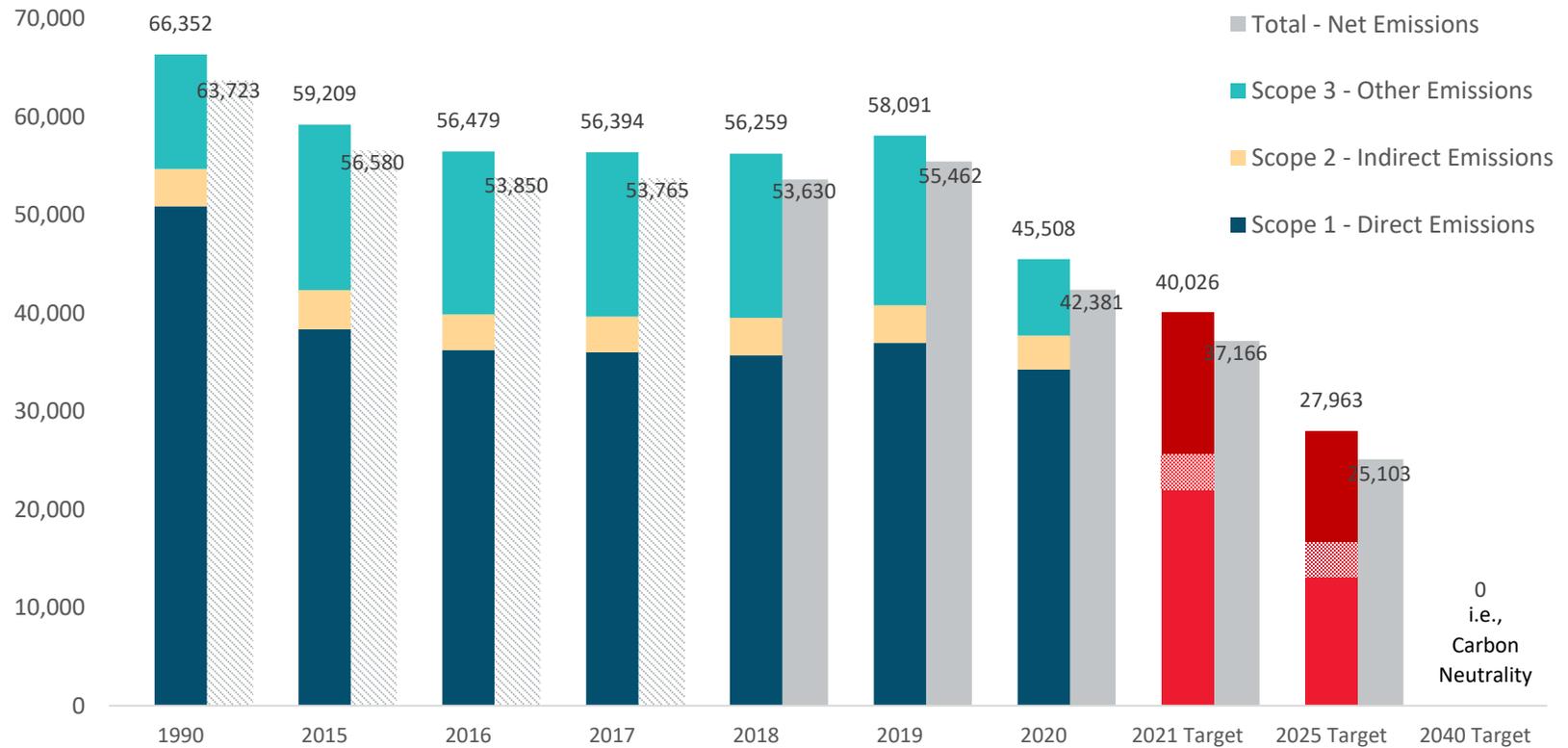


Figure 3. Emissions from 1990 to Present, and Intermediate and Long-Term Reduction Targets

Note: Net emissions account for carbon sequestration on forested McGill properties, including the Gault Nature Reserve and Morgan Arboretum, and carbon offsets purchased via the McGill-Bayano Reforestation Project.

D. Description of Changes in Emissions since 2019

The 2020 results are anomalous given the COVID-19 pandemic, though they move us in the direction of continued emission reductions. Below is a description of the main changes in emissions from 2019–2020:

- Scope 3 directly financed (University-related) air travel emissions dropped by 69% (5,549 tCO₂e) and commuting emissions by 55% (3,942 tCO₂e) due to government-imposed restrictions on traveling outside of Quebec and work-from-home orders from March–December 2020.
- Scope 1 natural gas consumption emissions fell by 9% (2,907 tCO₂e), as: 2020 was warmer on average than 2019, with 10% fewer heating degree days; smart energy grids installed as part of the Energy Management Plan were partially active towards the end of 2020; and the pandemic resulted in operational changes that reduced natural gas consumption—certain HVAC systems are controlled by demand based on occupancy, which was lower as of March 2020.
- Scope 2 steam and hot water fell by 25% (188 tCO₂e) and 7% (199 tCO₂e), respectively, as 2020 was warmer on average than 2019, with 10% fewer heating degree days, and due to less traffic in some buildings because of the pandemic.
- University sports team travel emissions fell by 69% (117 tCO₂e) due to government-imposed restrictions on traveling outside of Quebec from March–December 2020.
- Livestock emissions at the Macdonald Farm increased by 21% (120 tCO₂e), due to cancellation of the FMT Swine & Poultry Course because of the pandemic, combined with an increase in dairy cows to meet the production quota.
- Emissions from refrigerants increased by 18% (287 tCO₂e) due to increased Global Warming Potentials in the IPCC AR6 report released in Aug 2021, though activity levels were unchanged.
- Scope 3 natural gas emissions increased by 11% (127 tCO₂e) due to increased rented space at 550 Sherbrooke, 1010 Sherbrooke and 2001 McGill College.
- Avoided emissions from waste fell by 20% (411 tCO₂e). 2020 saw reduced composting, paper recycling and landfill waste at the Downtown Campus and reduced composting at Macdonald Campus due to the shutdown of cafeterias, certain buildings and residence halls, and various activities and services from March–December 2020 due to the pandemic.

E. Future Emission Reduction Initiatives

The following section lists current and future initiatives that are expected to significantly reduce the University's emissions by 2025:

- Major energy projects at the Powerhouse, which provides steam to most of the Downtown Campus, will generate emission reductions of ~9,000 tCO₂e yearly by 2025. The projects, funded in part by the Government of Canada through the Low Carbon Economy Fund, are expected to complete construction in late 2022:
 - **Conversion of natural gas boilers to electricity:** conversion of one natural gas-fired boiler at the Downtown Powerhouse to electric boilers to be used during off-peak hours;

- **Downtown district steam optimization:** efficiency improvements to the Downtown steam distribution network involving the installation of heat exchangers to recover heat from combustion flue gases at the Powerhouse.
- Other major emission reductions include the completion of projects within the Energy Management Plan, such as heat recovery networks (smart energy grids) deployed in the North-East, South-West and South-East sectors of the Downtown Campus. Now partially operational, these systems are expected to be fully operational in Winter 2021–2022 and reduce Scope 1 emissions by ~1,850 tCO₂e yearly by 2025.
- Other short- to mid-term measures include major renovation and upgrade projects planned across multiple buildings at Macdonald Campus. These will include HVAC and energy efficiency upgrades, such as the implementation of heat recovery networks and lighting improvements, which will impact electricity and natural gas consumption.
- McGill is also implementing efforts to decarbonize its fleet, such as those supported by the Sustainable Alternatives for Vehicle Replacement (SAVR) initiative.⁷
- The McGill-Bayano Reforestation Project, launched in 2020, will help offset McGill community members’ emissions from University-related air travel and commuting.⁸

F. Key Performance Indicators

Table 4 presents three key performance indicators (KPIs) that McGill reports to the Ministry of Education. Note that these include only building-related Scope 1 and 2 energy emissions.

Table 4. 2015 vs. 2020 Emissions KPIs for McGill

	2015–16	2016–17	2017–18	2018–19	2019–20	% Change (2018–19 to 2019–20)	% Change (2015–16 to 2019–20)
Emissions/student enrolment <i>tCO₂e/FTE student</i>	1.12	1.02	1.00	1.02	1.00	-2.0%	-10.7%
Emissions/gross area <i>tCO₂e/m²</i>	0.045	0.038	0.040	0.041	0.041	0.0%	-8.9%
Emissions/endowment <i>tCO₂e/\$M</i>	24.96	22.18	23.79	20.51	21.78	6.2%	-13%

⁷ <https://www.mcgill.ca/sustainability/savr-initiative-sp0212>

⁸ <https://www.mcgill.ca/sustainability/get-involved/offsetting-program/mcgill-carbon-offset-project>