



McGill

GREENHOUSE GAS INVENTORY

2021 REPORTING YEAR

OCTOBER 2022

Prepared by:
Divya Sharma, Climate Officer (Office of Sustainability)
Josh Huizinga, CEM, Energy Manager (Utilities & Energy Management,
Facilities Management & Ancillary Services)

Executive Summary

Scope

- **Reporting period:** January 1 – December 31, 2021
- **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 2021 were 42,097 tonnes of CO₂-equivalent (tCO₂e).** This is a decrease of 29% (17,112 tCO₂e) from the 2015 base year and 8% (3,411 tCO₂e) from 2020. Most emissions were Scope 1 (78%), particularly natural gas consumption (68%). An additional 340 tCO₂e was generated from biogenic (biodiesel and renewable natural gas) sources.
- **Net emissions in 2021 were 38,907 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 2021, carbon offsets purchased via the McGill-Bayano Reforestation Project account for 561 tCO₂e sequestered yearly until 2040 (1% total emissions).
- **Disruptions due to the COVID-19 pandemic continued to account for significant Scope 3 decreases in 2021.** Emissions from university-related air travel and commuting were 7,712 tCO₂e (95%) and 3,968 tCO₂e (55%) lower than 2019 levels (pre-pandemic), respectively, due to pandemic-related travel restrictions and work-from-home orders.
- **Scope 1 energy emissions decreased in 2021.** Natural gas consumption (Scope 1) fell by 1,559 tCO₂e (5%) from 2020 levels, due to milder weather, smart energy grids becoming active, and increased purchases of renewable natural gas. In July 2021, ventilation rates were increased across the University to combat the transmission of COVID-19; this resulted in additional natural gas consumption and an estimated increase of 500–1,500 tCO₂e in Scope 1 emissions in 2021. In other words, had these ventilation measures not been implemented, Scope 1 emissions would have fallen by 2,059–3,059 tCO₂e from 2020 levels.
- **Energy-intensity-based key performance indicators for 2020–2021 have improved since 2015.** McGill's emissions from stationary combustion sources per student enrolled were 0.90 tCO₂e/full-time-equivalent student, and emissions per gross area were 0.038 tCO₂e/m², both of which have decreased since 2015 and 2020. Emissions per million dollars endowed (16.16 tCO₂e/\$M) have also decreased since 2015.

Table of Contents

- Executive Summary 2**
- Table of Contents 3**
- 1. Scope of the Inventory 4**
 - A. Description of the Organization..... 4
 - B. Reporting Period 4
 - C. Organizational Boundary 4
 - D. Operational Boundary..... 4
 - E. Base Year & Recalculation Policy 5
 - F. Method 5
- 2. Results..... 5**
 - A. Greenhouse Gas Emissions 5
 - B. Gross vs. Net Emissions..... 7
 - C. Description of Changes in Emissions since 2020 8
 - D. Key Performance Indicators..... 8
 - E. Base Year vs. Current Emissions 9

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 33,000 full-time-equivalent students were enrolled in FY2021, and the University employed more than 13,000 part- and full-time faculty and staff. As of April 30, 2021, the University's endowment was \$1.892 billion¹ and its budget \$1.447 billion.²

McGill owns and operates over 200 buildings on three main campuses: Downtown Campus in 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 2021.

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
- Water supply and treatment

¹ https://www.mcgill.ca/investments/files/investments/report_on_endowment_performance_2020-2021_-_final_-_en.pdf, p. 5 (market value)

² https://www.mcgill.ca/vpadmin/files/vpadmin/2020-2021_-_english_audited_financial_statements_final.pdf, p. 3

- 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 2021 were 42,097 tCO₂e. An additional 340 tCO₂e was generated from biogenic sources (biodiesel and renewable natural gas). Figure 1 presents the breakdown of emissions by certain key activities.

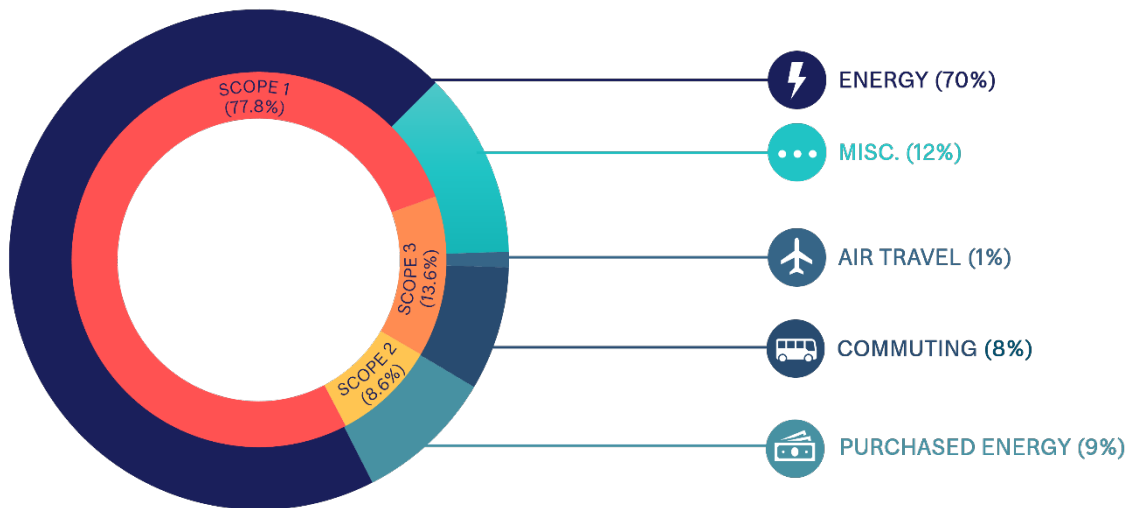


Figure 1. Emissions Breakdown by Key Activity

Table 1 presents 2021 emissions by greenhouse gas. Table 2 details 2021 emissions by scope and activity.

Table 1. Emissions Breakdown by Greenhouse Gas

Greenhouse Gas	Emissions (tGHG)	Emissions (tCO ₂ e)
Carbon dioxide (CO ₂)	39,109	39,109
Methane (CH ₄)	24	673
Nitrous oxide (N ₂ O)	1.2	327
Refrigerant R134a	0.04	148
Refrigerant R125	1.2	1,762
Refrigerant R32	0.04	30
Sulphur hexafluoride (SF ₆)	0.002	49
Total	N/A	42,097

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

Table 2. 2021 Greenhouse Gas Inventory

CATEGORY	ACTIVITY	ACTIVITY LEVEL	UNIT	EMISSIONS (tCO ₂ e)	% TOTAL
Scope 1 (direct emissions)					
Stationary combustion	Natural gas	14,833,849	m ³	28,727	68.2%
	Propane	0	L	0	0%
	Heating oil	290,003	L	793	1.9%
	Diesel	46,896	L	129	0.3%
McGill-owned vehicle fleet	Diesel vehicles	83,912	L	229	0.5%
	Gasoline vehicles	48,002	L	114	0.3%
	Propane vehicles	0	L	0	0%
Refrigerants & chemicals	Refrigerants	1,229	kg	1,939	4.6%
	Insulating gas	1.9	kg	49	0.1%
Agriculture	Livestock	3,965	heads	688	1.6%
	Fertilizers	62,646	kg	80	0.2%
Subtotal				32,747	77.8%
Scope 2 (indirect energy emissions)					
Purchased energy	Electricity	157,482,665	kWh	249	0.6%
	Steam	320,252	m ³	620	1.5%
	Hot water	1,424,925	m ³	2,759	6.6%
	Chilled water	213,162	kWh	0.3	0.0%
Subtotal				3,629	8.6%
Scope 3 (indirect emissions)					
Stationary combustion	Natural gas	755,270	m ³	1,463	3.5%
	Electricity	11,776,973	kWh	18	0.0%

CATEGORY	ACTIVITY	ACTIVITY LEVEL	UNIT	EMISSIONS (tCO ₂ e)	% TOTAL
Commuting	Faculty, staff, students	17,609,910	pass-km	3,204	7.6%
Third-party fleet	Macdonald shuttle	75,863	L	225	0.5%
Air travel	Directly financed air travel	3,968,119	pass-km	383	0.9%
Sports team travel	Air	0	pass-km	0	0%
	Bus	11,207	vehicle-km	10	0.0%
	Public transit	0	pass-km	0	0%
	Taxi + car	0	km	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	13,540,283	kWh	21	0.0%
Subtotal				5,721	13.6%
Total Gross Emissions				42,097	100%

NON-INVENTORY CATEGORY	ACTIVITY	ACTIVITY LEVEL	UNIT	EMISSIONS (tCO ₂ e)
Avoided emissions from waste management	Solid waste - recycling	553	tonnes	-1,800
	Solid waste - composting	164	tonnes	-82
Total				-1,882
Refrigerants governed by Montreal Protocol	Refrigerants (e.g., R22)	214	kg	319
Total				319
Biogenic emissions	Macdonald shuttle, biodiesel	10,441	L	26
	Renewable natural gas	166,320	m ³	314
Total				340

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.³

As part of the McGill-Bayano Reforestation project in Panama,⁴ 3,000 trees were planted in 2021 and 25,000 in 2020. The *ex-ante* estimate of carbon sequestered by the first 25,000 trees is 9,953 tCO₂e over

³ Boushey, I. 2019. "Evaluation of Aboveground Forest Carbon Sequestration for Climate Change Mitigation Targets: A Case Study on McGill University Properties".

⁴ <https://www.mcgill.ca/sustainability/commitments/carbon-neutrality/mcgill-bayano-reforestation>

25 years including estimated mortality.⁵ As of 2021, we account for 561 tCO₂e of carbon offsets per year until 2040, our target year for carbon neutrality.

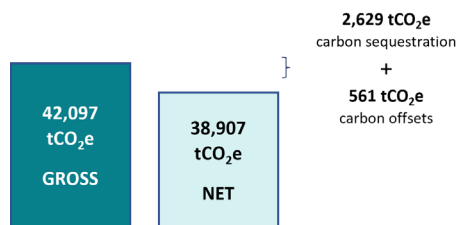


Figure 2. 2021 Gross vs. Net Emissions

C. Description of Changes in Emissions since 2020

As in 2020, emissions in 2021 were anomalous given the COVID-19 pandemic, though we continue to move in the direction of emission reductions. The main changes in emissions in 2021 are the following:

- Scope 3 directly financed (University-related) air travel emissions dropped by 85% (2,163 tCO₂e) from 2020 levels and 7,712 tCO₂e (95%) from 2019 levels (pre-pandemic) due to pandemic-related travel restrictions and work-from-home orders. Scope 3 commuting emissions remained stable in 2021 compared to 2020 levels and dropped by 3,968 tCO₂e (55%) from 2019 levels, due to work-from-home orders from Jan–Sep and in Dec 2021 and a hybrid work model in Oct–Nov 2021.
- Scope 1 natural gas consumption emissions fell by 5% (1,559 tCO₂e), as: weather was milder on average in 2021 than in 2020, with 10% fewer heating degree days; smart energy grids installed under the Energy Management Plan continued to become active; and we increased the purchase of renewable natural gas, which reduced natural gas consumption. Meanwhile, increased ventilation rates across the University in July 2021 to combat COVID-19 transmission led to an increase in natural gas consumption and an estimated additional 500–1,500 tCO₂e of Scope 1 emissions in 2021. Had these ventilation measures not been implemented, Scope 1 emissions would have thus fallen by 2,059–3,059 tCO₂e from 2020 levels.

D. Key Performance Indicators

Table 3 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 3. 2015 vs. 2021 Emissions KPIs for McGill

	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21	% Change (2019–20 to 2020–21)	% Change (2015–16 to 2020–21)
Emissions/student enrolment <i>tCO₂e/FTE student</i>	1.12	1.02	1.00	1.02	1.00	0.90	-10.0%	-19.6%
Emissions/gross area <i>tCO₂e/m²</i>	0.045	0.038	0.040	0.041	0.041	0.038	-7.3%	-15.6%
Emissions/endowment <i>tCO₂e/\$M</i>	24.96	22.18	23.79	20.51	21.78	16.16	-25.8%	-35%

⁵ Marchena, B., and Potvin, C. 2021. Bayano-McGill Carbon Offsetting Project Report 1.

E. Base Year vs. Current Emissions

We have achieved near continuous gross emission reductions since 2015, except in 2019. Figure 3 presents the annual gross and net emissions for 1990 and 2015–2021, as well as future targets. See the Detailed Appendix for differences in emissions per activity between 2015 and 2021.

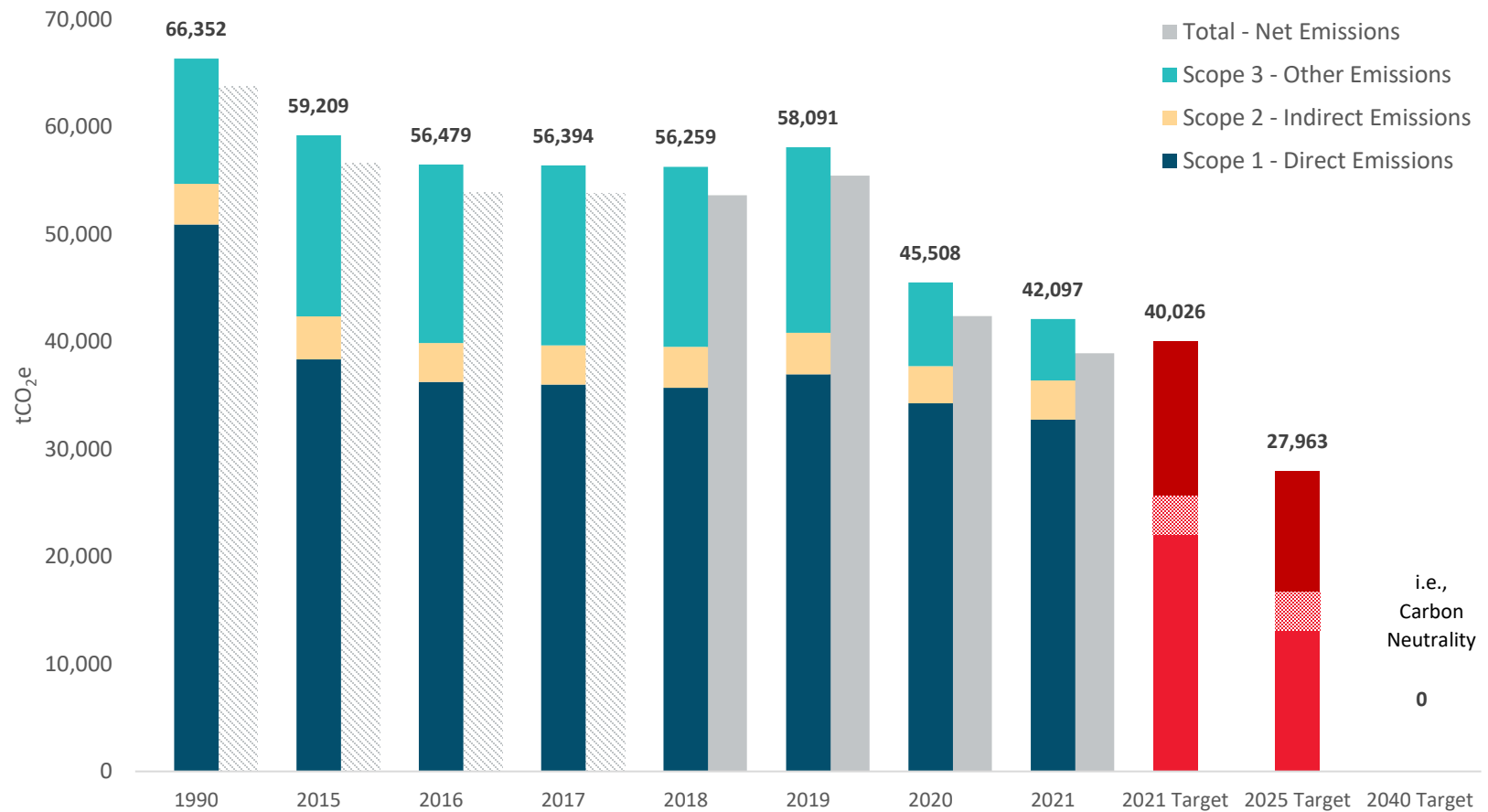


Figure 3. Emissions from 1990 to Present, and Intermediate and Long-Term Reduction Targets

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