Greenhouse Gas Inventory
University City Campus
For Fiscal Year FY2020
December 31, 2020

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Section Number and Title Page No.

I. Executive Summary

A Greenhouse Gas Inventory ("Inventory") has been prepared by Drexel University for fiscal year 2020. The Inventory is the University's impact on the environment as measured in greenhouse gases emitted in units of equivalent tons of carbon dioxide and is often referred to as an institution's "Carbon Footprint". The purpose of this Inventory is to benchmark the University's greenhouse gas emissions and to provide a consistent methodology for inventorying the emissions on an annual (or other periodic) basis.

The Greenhouse Gas Inventory was prepared in accordance with T*he Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard* ("*GHG Protocol*") published jointly by the World Business Council for Sustainable Development and the World Resources Institute.

An initial Inventory was performed in 2008 and again in 2011. The 2011 report built off the 2008 by including the addition of emissions from commuting, corporate air travel and landfilled waste. A new Inventory was created for 2020 which incorporated Scopes 1 and 2 and as much of Scope 3 as possible due to the COVID-19 pandemic, which is explained further in the section "VI. Disclaimer". This will also be the same for fiscal year FY2021. However, the FY2022 Inventory will be the new base year for future comparisons, due to numerous changes at the University and fluctuations in business due to COVID-19.

Using this methodology, the total net greenhouse gas emissions for Drexel University City owned buildings for fiscal year 2020 are as follows:

- **34,558.96 Metric Tons of Equivalent Carbon Dioxide for the University City campus.**
- 1.012 Metric tons of Equivalent Carbon Dioxide ("eMT CO_2") per full time equivalent student primarily enrolled at the University City Main Campus.
- 8.5 Metric tons of Equivalent Carbon Dioxide per 1,000 square feet.

Table A and Figure 1 summarize the University's greenhouse gas emissions by source.

Source	Quantity Used in Year	Units	Total GHG Emissions eMT CO2
Natural Gas	437,990	100 cubic feet	2,386.94
Fleet Fuel			
Gasoline	1,437	gallons	12.84
Diesel	0	gallons	0.00
Biodiesel	38,728	gallons	307.65
Leased Vehicles Mileage	0	miles	
Refrigeration Losses	0	ounces	
Purchased Electricity	67,267,287	kWh	23,182.77
Renewable Energy Purchase Offset Credit	36,000	kWh	(12.41)
Steam	87,220	1,000 lbs	6,914.78
Corporate Rail Travel	7,134	miles	37.31
Corporate Air Travel	8,302,614	dollars	1,379.33
Commuting			
Personal Car	0	miles	0.00
Subway & Trolley	0	miles	0.00
Commuter Rail	0	miles	0.00
Landfill Waste	2,003	tons	349.75
2020 Annual Totals			**34,558.96**

Table A: Greenhouse Gas Emission Contribution by Source

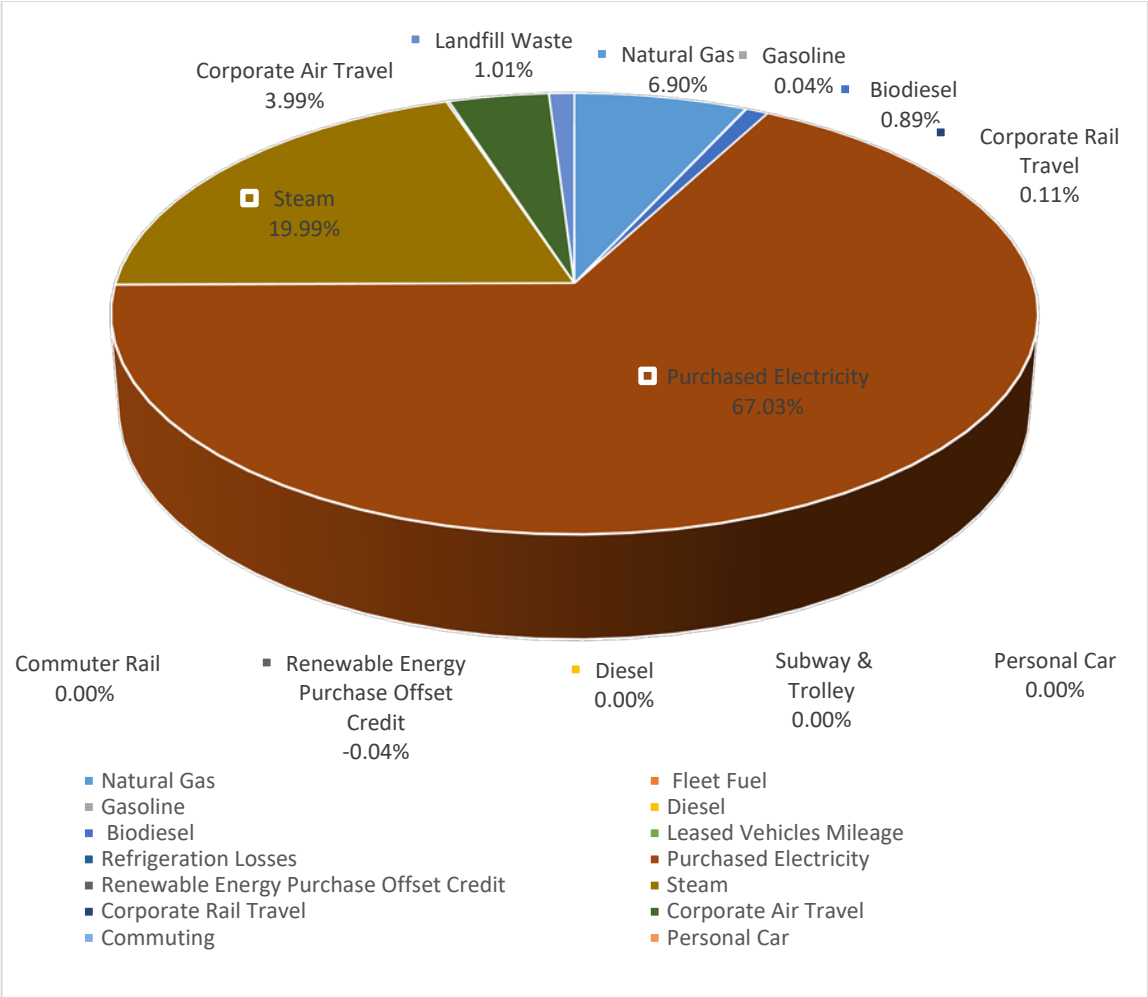


Figure 1: Total GHG Emissions eMT CO2

The GHG Protocol separates Greenhouse Gas emissions into three scopes.

1. Scope 1 – Direct emissions from sources that are owned and or/controlled by the University. These include emissions from combustion of fossil fuels in boilers, cogeneration facilities and/or vehicles and emissions from refrigeration leaks in chillers.
2. Scope 2 – Indirect emissions from sources that are not owned or operated by the University but whose energy products are directly used by the University. These include purchased electricity and steam.
3. Scope 3 – Other indirect emissions from activities such as commuting, corporate travel and waste disposal.

The University's inventory was calculated based on data provided by multiple departments and guidelines provided in 40 CFR part 98. The Inventory is the University's impact on the environment as measured in greenhouse gases emitted in units of equivalent tons of carbon dioxide and is often referred to as an institution's "Carbon Footprint". The purpose of this report is to provide a consistent methodology for inventorying the emissions on an annual basis.

Greenhouse gas emissions are based on information gathered from the following sources:

- Facilities Department – Electricity, Steam, Natural Gas, and Landfill Waste.
- Facilities and Accounting Departments – Corporate Air Travel.
- Planning, Design and Construction Department – Building Data.

Greenhouse Gas Reporting began surfacing around in 2008 due to the potential global warming carbon dioxide emissions causes. In 2011, the U.S. Environmental Protection Agency (EPA) finalized the seven subparts under the Greenhouse Gas Reporting Rule (40 CFR part 98). Drexel University participated in the Greenhouse Gas Inventory Reporting in 2008 and 2011. More recently, the City of Philadelphia has been focusing on energy efficiency and currently implementing more energy conservation requirements. Drexel University's Real Estate and Facilities Department has resumed with our Inventory reporting to find ways to improve our carbon emissions output and follow the EPA guidelines.

II. Greenhouse Gas Inventory Introduction

A. Drexel Climate and Sustainability Initiative

The Drexel Green Initiative at Drexel University was created in 2008 by students, faculty, and staff dedicated to transforming Drexel's campus into a sustainability leader[8]. This initiative was officially changed in 2020 to the Climate and Sustainability. The initiative covers aspects of operations, building construction/renovation, academics, student life, and developing a strategic plan to further sustainable practices and policies. The initiative is overseen by the Office of Climate and Sustainability who share information about products, services, policies, and procedures that will advance the University's mission of being a better environmental citizen.

As part of this initiative, the University elected to perform a Greenhouse Gas Inventory ("Inventory"). The Inventory is the University's impact on the environment as measured in greenhouse gases emitted in units of equivalent tons of carbon dioxide and is often referred to as an institution's "Carbon Footprint". The purpose of this Inventory is to benchmark the University's greenhouse gas emissions and to provide a consistent methodology for inventorying the emissions on an annual (or other periodic) basis. An initial Inventory was performed in 2008 and again in 2011. The 2011 report built off the 2008 by including the addition of emissions from commuting, corporate air travel and landfilled waste. A new Inventory was created for 2020 which incorporated Scopes 1 and 2 and as much of Scope 3 as possible due to the COVID-19 pandemic, which is explained further in the section "VI. Disclaimer". Fiscal year FY2020 (July 1, 2019 to June 30, 2020) Inventory will be for reporting purposes only, as will the FY2021. FY2022 will be selected as the new base year for future comparisons, due to numerous changes at the University and fluctuations in business due to COVID-19.

Greenhouse gas reporting provides means of tracking emissions that will assist the University in energy management planning. Possible measures available for further reducing the greenhouse gas usage by the University includes:

- Building Energy Efficiency including lighting, HVAC, BAS, receptacle loads and envelope.
- Energy Conservation programs including changes in consumption habits.
- Alternative Energy projects including micro-turbines and combined heat and power.
- Renewable Energy including solar, wind, and/or geothermal.
- Purchase of renewable energy.
- Alternative Fuels including biodiesel, hybrid, and electric vehicles.
- Air Travel Policies.
- Commuting strategies.
- Waste Minimization strategies.
- Carbon Offset products purchased, and Carbon Offset projects financed.

The measures listed above are to improve Drexel's Carbon footprint and good practices for the University. To implement these measures and make them successful, appropriate funding must be allotted and maintained.

B. Greenhouse Gas Protocol

The Greenhouse Gas Protocol Initiative is a partnership between the World Business Council for Sustainable Development and the World Resources Institute. The Corporate Accounting and Reporting Standard, used for this inventory, is the basis for most other Greenhouse Gas Standards including those developed by the International Standards Organization (ISO 14064), the United States Environmental Protection Agency Climate Leaders Program and the Clean Air.

C. Greenhouse Gases

Greenhouse gas ("GHG") emission inventories are focused on the following greenhouse gases.

- CO_2 – Carbon Dioxide.
- CH_4 – Methane.
- N_2O – Nitrous Oxide.
- PFC – Perfluorocarbons (e.g. Perfluoromethane from aluminum smelting).
- HFC – Hydrofluorocarbons (e.g. HFC-134a from refrigerant losses).
- SF_6 – Sulfur Hexaflouride (e.g. in high voltage electrical equipment).

Each of the above GHGs contributes to global warming; however, the magnitude of the contribution of these gases to global warming varies, as a result of the chemical and physical properties of the gases. In order to determine the cumulative impact of the GHG emissions in a manner that can be compared to the impact of other institutions or to the GHG impact from past years, GHG emissions are often expressed in terms of carbon dioxide equivalents, or eCO^2, by multiplying the emissions of each GHG by a global warming potential. The Global Warming Potential ("GWP") is defined as the ability of each greenhouse gas to trap heat in the atmosphere, referenced to carbon dioxide (GWP of 1). From Table B below, it can be seen that 1 metric ton of Nitrous Oxide is as destructive as 298 metric tons of Carbon Dioxide.

The table below lists the GWPs utilized to calculate carbon dioxide equivalents for common GHGs. The GWP factors were obtained from data provided by the Intergovernmental Panel on Climate Change ("IPCC")[6].

Greenhouse Gas	Formula	Atmospheric Lifetime (years)	Global Warming Potential
Carbon Dioxide	CO_2	50-200	1
Methane	CH_4	12	25
Nitrous Oxide	N_2O	114	298
PFC-14	CF_4	50,000	7390
HFC-23	CHF_3	270	14,800
HFC-134a	$C_2H_2F_4$	14	1,430
Sulfur Hexaflouride	SF_6	3,200	22,800

Table B: Types of Greenhouse Gases

D. Greenhouse Gas Inventory

A Greenhouse Gas Inventory is the University's impact on the environment as measured in greenhouse gases emitted in units of equivalent tons of carbon dioxide and is often referred to as an institution's "Carbon Footprint". The purpose of the Inventory is to benchmark a University's greenhouse gas emissions and to provide a consistent methodology, as described in detail in the Inventory Management Plan, for inventorying emissions on an annual (or other periodic) basis. An inventory is the starting point for understanding a University's greenhouse gas emissions and what steps will be necessary to reduce the institution's carbon footprint.

E. Greenhouse Gas Inventory Calculation

The followings section explains the methodology for determining each type and ultimately the total sum of CO2 emissions. Not all Scopes are included in FY2020 GHG Report due to insufficient information, which is explained in the section VI. Disclaimer.

1) **Natural Gas:** Emissions from facility heating via natural gas were quantified by compiling consumption data for each building from invoices and delivery bills, converting the quantities of fuel consumed into heat content expressed in million British thermal units (mmbtus), and applying the above emission factor for natural gas.
2) **Transportation:** Emissions from the combustion of gasoline, diesel and biofuel by owned or leased mobile sources were quantified by compiling consumption data in gallons from fleet fuel purchase records tracked by the University and applying the above emissions factors, respectively. Where fuel records were not available, annual miles driven for the vehicle were divided by the mileage to obtain gallons per year used and then added to the fuel purchase records.
3) **Purchased Electricity:** Emissions from purchased electricity were quantified by compiling electric bills from PECO Energy for each building and applying emissions factors associated with the electric grid sub-region defined by eGRID. Units used were kilowatt hours (kWh) or megawatt hours (MWh).
4) **Purchased Steam:** Emissions from purchased steam were quantified by compiling steam bills from the Veolia/Vicinity Energy Corporation for each building that receives steam heat and applying emissions factors. Units used were in thousand pounds per hour (mlbs).
5) **Corporate Travel:** Emissions from corporate air travel were estimated from compiling the total dollars spent on air travel from accounting reports and applying the industry standard cost per passenger mile factor and the above emissions factors associated with corporate air travel. These values were also compared to the emissions values provide by World Travel a company used by Drexel for our Corporate travel. The method with the higher emissions was used for reporting purposes.
6) **Landfill Waste:** Emissions from landfilled waste were quantified by compiling total tonnage from reports generated by the contracted hauler and applying the above emissions factors associated with landfilled waste with methane (CH_4) recovery and electric generation.
7) **Commuting:** Emissions from commuting were not recorded or quantified this reporting. This will be discussed in future reporting.

F. Renewable Energy Purchases

1) The University purchased 36 MWH of the electricity from solar generation. The renewable energy certificates from this production were used to offset the emissions from the purchased electricity.

G. Carbon Offsets

Projects that reduce the production or release of carbon dioxide or other greenhouse gases below levels that would normally occur in a typical project can produce carbon offsets that are available for purchase by other entities looking to reduce their carbon footprint. For example, solar electrical generation projects can produce carbon offsets in the form of renewable energy credits (“REC”) that are available to be purchased and used by other organizations. The solar projects are compared to the typical greenhouse gas produced by the other electricity generating assets (coal, natural gas, oil, nuclear) in the area and the net difference is the carbon offset. Qualifying projects must be verified that they are actually producing carbon offsets and that they pass the “additionality” criteria. Projects are assumed to not be “additional” if they are only put in place to produce carbon offsets. To pass the additionality criteria, a project must be considered business as usual. Appropriate funding must be allotted to projects that are able to produce renewable energy credits for the University.

III. Drexel Greenhouse Gas Inventory Boundaries

Using the GHG Protocol as the basis for preparing the Inventory, it was necessary to make decisions and assumptions regarding the organizational and operational boundary conditions that best suited the needs of Drexel University and the goal of carbon reduction.

There is some uncertainty in the estimation of greenhouse gas emissions, particularly where data is not available at this date or measurement of a particular parameter is impossible. The effort is best spent on identifying methods to improve data capture, identifying particular parameters to focus on, and taking a closer look at reporting intervals to identify trending. The improvements made in these areas will improve the ability to identify and control the greenhouse gas emissions on an ongoing basis.

A. Organizational Boundary

The GHG Protocol establishes the standardized approaches and principles for determining the organizational boundary of the inventory.

The organizational boundary of an organization can be determined under the GHG Protocol by using either the equity share approach or the control approach. For the purposes of this report, we have elected the operational control approach to define the organizational boundary, considering all facilities/entities that are under operational control and/or significant influence of the University. In many situations, as in the case of the University's University City campus, the organizational boundary is defined best by operational control. Operational control is defined as any buildings or facilities where the University has the complete ability to implement and introduce its operating policies. This approach best fit the University profile, accounting for Greenhouse Gases in locations where the University had the ability to control the emissions profile.

The University owns or controls real estate on the University City, Center City, Queen Lane, and other locations. The 2020 Greenhouse Gas Inventory concentrated on the University City campus only. Future inventories may include the other operations as deemed appropriate. The major exclusions from this organizational boundary were the Center City and Queen Lane campuses and other remote locations. These campuses have different operating characteristics, and a greenhouse gas inventory could be developed for these locations.

The University City campus map was used to define the physical boundaries of the Inventory. Drexel University will use the Operational Control Approach applied to the physical boundaries of the University City campus. Under this approach, the University will account for 100 percent of the GHG emissions from operations over which it has control. Emissions from operations over which the University does not have operational control will not be included in the Inventory. Operational Control means that the University has the full authority to introduce and implement its operating policies within the operational unit. Under this Operational Control Approach, we have included the buildings on the campus map that are owned, operated, and occupied by the University. We have excluded the following types of buildings from the campus map.

- Portions of owned and operated buildings that are leased to commercial or retail ventures.
- Owned by others such as fraternities and sororities.

A University City Campus Map with a complete listing of all buildings is attached as Appendix A.

B. Operational Boundary Conditions

The GHG Protocol separates Greenhouse Gas emissions into three individual scopes, as they are defined by the GHG Protocol:

1) Scope 1: Direct emissions from sources that are owned and or/controlled by the University. These include emissions from combustion of fossil fuels in boilers, cogeneration facilities and/or vehicles and emissions from refrigeration leaks in chillers.
2) Scope 2: Indirect emissions from sources that are not owned or operated by the University but whose energy products are directly used by the University. These include purchased electricity and steam.
3) Scope 3: Other indirect emissions from activities such as commuting, corporate travel and waste disposal.

Table C below describes the different Scope's and sources of emission as well as the types of GHG's that are emitted by each function.

Emission Type	Source of Emissions	GHGs Emitted
Scope 1 – Direct Emissions		
Facility Heating—Natural Gas	Stationary Furnaces, Boilers, Water Heaters, HVAC	CO2, CH4, N2O
Onsite Electricity Generation—Natural	Emergency Generators	CO2, CH4, N2O
Refrigerants	HVAC	CO2, CH4, N2O, CHF3, C2H2F4
Transportation—Gasoline, Diesel, Biofuel	Owned or Leased Vehicles	CO2, CH4, N2O
Scope 2 – Indirect Emissions		
Purchased Electricity	Electricity purchased from PECO & 3rd Party Generator	PECO: CO2, CH4, N2O 3rd Party Generator: No Emissions
Purchased Steam	Steam generation by Vicinity Energy (formally Veolia Steam) for facility heating	CO2, CH4, N2O
Scope 3 - Indirect Emissions		
Commuting	Personal Car, Subway/Trolley, Commuter	CO2, CH4, N2O
Corporate Travel	Airline Travel	CO2, CH4, N2O
Landfill Waste	Waste taken to landfill	CO2, CH4, N2O

Table C: Greenhouse Gas Emission Type and Sources

The following items that could be part of a greenhouse gas inventory were not included. Data collection methodology may be implemented to track these for future greenhouse gas inventories.

1) Scope 1 Emissions for Agriculture Fertilizer were not included as the University campus is primarily an urban area and fertilizer usage is considered insignificant compared to other Scope items. Future inventories may be structured to include these emission sources.
2) Scope 3 Emissions for Wastewater emissions are considered optional. Preliminary calculations based on water usage indicated these emissions to be insignificant compared to the total greenhouse gas inventory. Future inventories may be structured to include these emission sources.
3) Scope 3 Emissions for Paper usage are considered optional. Accounting changes will need to be implemented to track the paper usage for the University. Future inventories may be structured to include these emission sources.

C. Base Year Concept

1) The GHG Protocol establishes that a meaningful and consistent comparison of emissions over time necessitates the selection of a performance datum with which institutions can compare current emissions; this performance datum is referred to as the "Base Year." It is

also necessary to have a base year emissions recalculation policy, which will include the basis and context for any recalculations.

D. Base Year

1) The University's Planning, Design and Construction (PD&C) Department within the Real Estate and Facilities Department previously hired Pennoni Engineering, Inc. to complete the Drexel University Greenhouse Gas Inventory for fiscal years FY2008 and FY2011. Based on the 2011 report, dated 12-6-2011, the PD&C Department was able to reproduce a similar report for Fiscal Year 2020 and future use.

IV. Data Collection

Usage Data was collected for all significant scope items. Data was obtained from the facilities, accounting, and planning departments for the following items:

- Scope 1 – Natural Gas Usage.
- Scope 1 – Oil Usage.
- Scope 1 – Transportation Fuel for University Fleet including corporate vehicles.
- Scope 2 – Electricity Usage.
- Scope 2 – Steam Usage.
- Scope 3 – Air Travel for corporate use.
- Scope 3 – Landfilled Waste.
- Scope 3 – Transmission and Distribution Losses from Purchased Electricity.

Templates have been prepared to ensure consistent data collection efforts in the future. They are included in Appendix B, to the Inventory Management Plan, included separately.

A. Inventory Management Plan

ISO 14064 and the EPA Climate Partners require an Inventory Management Plan to be completed and maintained. The Inventory Management Plan institutionalizes the process for collecting, calculating, and maintaining the greenhouse gas data. The following are the major sections of an Inventory Management Plan:

- University Information – Organizational, Legal and Contact Information.
- Boundary Conditions – Definitions, Exclusions and Facility List.
- Emission Quantification – Methodology, Emission Factors and Global Warming Potential.
- Data Management – Data Location, Collection, Normalization Factors, Quality Assurance, Security and Responsible Parties.
- Base Year – Significance Threshold, Structural Change Adjustments, Methodology Change Adjustments.
- Management Tools – Roles & Responsibilities, Training, Documentation Retention and Control.
- Auditing & Verification – Internal & External Auditing, Management Review and Corrective Action.

The University will use the Inventory Management Plan to consistently produce our Greenhouse Gas Inventory on an annual basis.

V. Greenhouse Gas Inventory Calculations

A. Emissions Qualifications

Emissions quantification involves the calculation of emissions of GHGs from emission sources identified within the organizational and operational boundaries selected. The Emissions Factors and Global Warming Potentials were obtained from either actual fuel usage or from reference sources. The reference sources are listed on the relevant individual worksheets attached in Appendix B. The following factors were used in the calculation[7].

Source of Emissions	CO_2	CH_4	N_20
Natural Gas[7]	52.76 kg/mmbtu	0.005275 kg/mmbtu	0.000106 kg/mmbtu
Biofuel[7]	7.853 kg/gal	0.000567 kg/gal	0.000257 kg/gal
Diesel Fuel[7]	9.987 kg/gal	0.000567 kg/gal	0.000257 kg/gal
Gasoline[7]	8.71 kg/gal	0.001742 kg/gal	0.000599 kg/gal
PECO Electricity	0.4805 kg/kWh	0.000005 kg/kWh	0.000009 kg/kWh
Commuting – Personal Car[7]	0.377 kg/mile	0.000075 kg/mile	0.000026 kg/mile
Commuting – Commuter Rail[7]	0.1604 kg/mile	0.00000501 kg/mile	0.00000320 kg/mile
Commuting – Subway/Trolley[7]	0.1429 kg/mile	0.0000129 kg/mile	0.0000223 kg/mile
Corporate Air Travel	0.774 kg/mile	0.0000076 kg/mile	0.0000088 kg/mile
Landfill Waste[7]	0 kg/ton	6.984 kg/ton	0 kg/ton
Steam[7]	66.33 kg/mmbtu	0.00125 kg/mmbtu	0.000125 kg/mmbtu

Table D: Greenhouse Gas Unit Conversions

The factors for the Veolia/Vicinity Energy Steam Usage were based on a 90% natural gas and 10% distillate oil mix. See the individual inventory sheets in Appendix B for more detail on the emission factors.

In general, emissions are quantified by relating an activity to a standard emissions factor using the following equation: E = A x EF, where:

E = emissions;
A = activity rate, i.e. gallons of diesel fuel or mmbtus of diesel fuel consumed per year.
EF = emission factor, i.e. kilograms of CO_2 emitted per gallon of diesel fuel consumed or kilograms of CO_2 emitted per mmbtu of diesel fuel consumed.

B. Specific Methods

The following specific methods will be used to quantify GHG emissions from the various sources at Drexel University Main Campus:

1) Emissions from facility heating via natural gas were quantified by compiling consumption data for each building from invoices and delivery bills, converting the quantities of fuel consumed into heat content expressed as mmbtus, and applying the above emission factor for natural gas.
2) Emissions from the combustion of gasoline, diesel, and biofuel by owned or leased mobile sources were quantified by compiling consumption data in gallons from fleet fuel purchase records tracked by the University and applying the above emissions factors, respectively.
3) Emissions from purchased electricity were quantified by compiling electric bills from PECO Energy for each building and applying the above emissions factors associated with the electric grid sub-region defined by eGRID.
4) Emissions from purchased steam were quantified by compiling steam bills from the Veolia Energy Corporation for each building that receives steam heat and applying the above emissions factors.
5) Emissions from corporate air travel were quantified from World Travel Agency through Drexel's Procurement department. These emissions are calculated per miles traveled for short and long distances.
6) Emissions from landfilled waste were quantified by compiling total tonnage from reports generated by the contracted hauler and applying the above emissions factors associated with landfilled waste with methane (CH4) recovery and electric generation.
7) Emissions from commuting will be quantified in the future reporting by calculating the total miles traveled by mode (personal car, commuter rail, subway/trolley) and applying the applicable emission factor.

After calculating all the data and performing calculations of the above. Table E details the University City campus Greenhouse Gas Emissions in Metric Tons of CO_2.

Source	Quantity Used in Year	Units	CO2 Emissions	CH4 Emissions	N2O Emissions	Total GHG Emissions eMT CO_2
Scope 1 Emissions						
Natural Gas	437,990.00	100 cubic feet	2,384.40	1.12	1.42	2,386.94
Fleet Fuel - Gasoline	1,437.00	gallons	12.52	0.06	0.26	12.84
Fleet Fuel - Diesel	0.00	gallons	0.00	0.00	0.00	0.00
Fleet Fuel - Biodiesel	38,728.30	gallons	304.13	0.55	2.97	307.65
Leased Vehicles Mileage		miles				
Refrigeration Losses		ounces				
Scope 1 Emissions Totals			**2,701.05**	**1.73**	**4.64**	**2,707.42**
Scope 2 Emissions						
Purchased Electricity	67,267,287.00	kWh	23,182.75	0.01	0.00	23,182.77
Steam	87,220.00	1,000 lbs	6,907.65	3.25	3.88	6,914.78
Scope 2 Totals before Renewable Energy Offset Renewable Energy Offset	36,000.00	kWh				12.41
Renewable Energy Offset Renewable Energy Offset (from Scope 3)						
Scope 2 Emissions Totals			**30,090.40**	**3.27**	**3.88**	**30,085.14**
Scope 3 Emissions						
Corporate Air Travel	8,302,614.00	miles	1,364.48	0.89	13.96	1,379.33
Corporate Rail Travel	67,839.99	miles	37.31			37.31
Corporate Car Travel		miles				
Commuting (faculty, staff & students)						
Personal Car		miles				
Subway & Trolley		miles				
Commuter Rail		miles				
Transmission & Distribution Losses		of steam/electricity				
Landfill Waste	2,003.10	tons		349.75	0.00	349.75
Scope 3 Carbon Offsets (Reductions)*						
Renewable Energy Purchase Offset Credit		kWh				
Scope 3 Emissions Totals			**1,401.79**	**350.64**	**13.96**	**1,766.39**
2020 Annual Totals			**34,193.24**	**355.64**	**22.49**	**34,558.96**

Table E: Total Greenhouse Gas Emissions for FY2020

1) The total amount of CO2 Metric tonnes emitted by the University's University City campus is shown in Table E above. This amount will be used as for Reporting purposes. The Base Year for comparison to future fiscal years will be based off FY2020. The University will implement reduction measures and set goals for future GHG Reporting in the future.

VI. Disclaimer

A. Conditions, Limitations, and Disclaimers

1) This Greenhouse Gas Inventory was created using current engineering and utility data that was obtained through various departments within the University at the time that services were initiated. There is some uncertainty in the estimation of greenhouse gas emissions, particularly where data was not available at this date or measurement of a particular

parameter is impossible. The Inventory that was generated is to be used to help guide the University toward decisions regarding the implementation of the greenhouse gas reduction measures. The report must be read in its entirety. Do not rely solely on the Executive Summary and do not read selected elements only.

B. Omitted Greenhouse Gases from FY2020 Reporting

1) The University has decided to return to reporting Greenhouse Gases in FY2020. Not all sources and types of greenhouse gas emissions data recording methods were in place within the various departments across the University. Therefore, some sources and types had to be omitted from the FY2020 Inventory, such as Commuting Students, Staff and Faculty, transmission, distribution, and refrigerant loses. These sources and types of Greenhouse gas emissions will be included in FY2022 Inventory.

C. COVID-19 Pandemic

1) Due to the COVID-19 pandemic the data used for the FY2020 report is somewhat skewed, as will the FY2021 data. This is because of the stay home order by the government, which impacted travel to and from campus and the building utility usage, as energy saving measures were implemented at the beginning of the pandemic and released as government agencies provided guidelines. However, moving forward the PD&C staff know which staff members have been identified, in the various University Departments, to obtain the data and have ongoing conversations about what will be required.

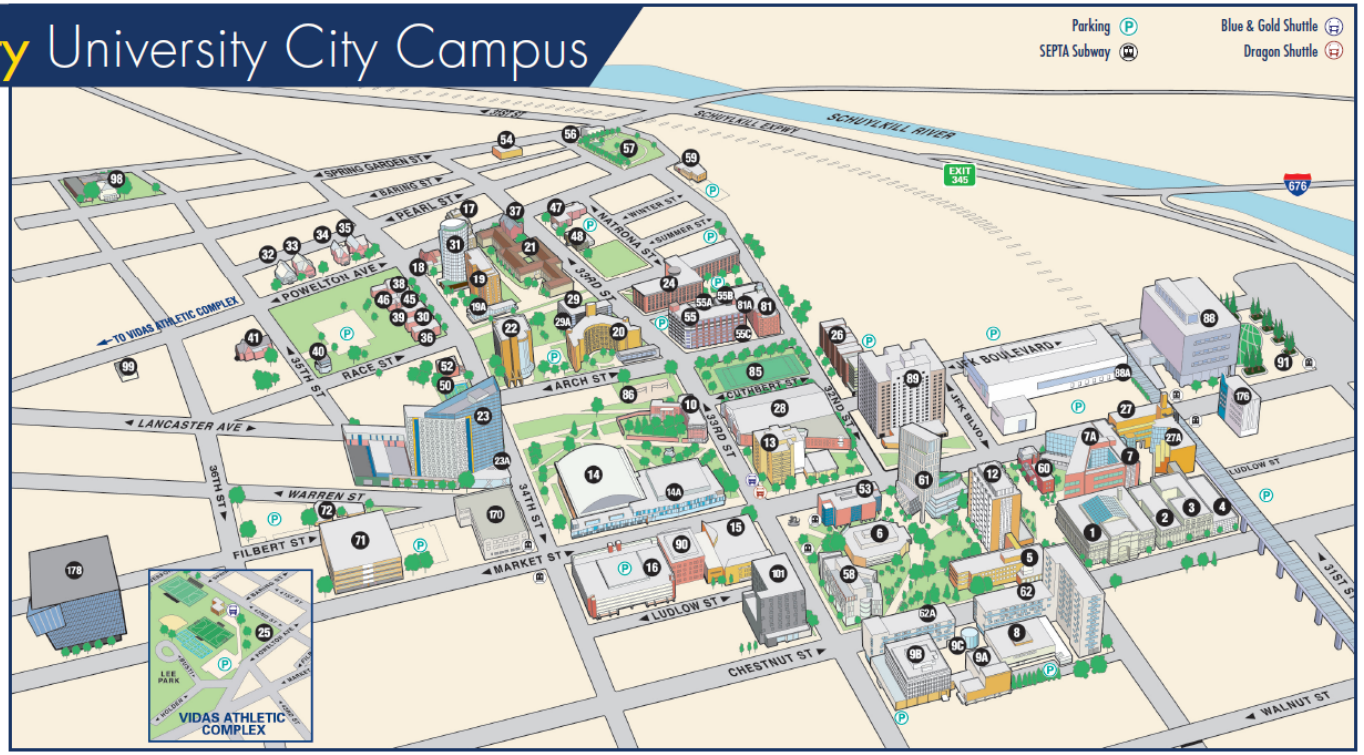
VII. References

1. Drexel University Greenhouse Gas Inventory - For Fiscal Year 2011, produced by Pennoni Associates, Inc. Energy & Sustainability
2. Greenhouse Gas Protocol – http://www.ghgprotocol.org/standards/corporate-standard
3. http://www.presidentsclimatecommitment.org/
4. ISO Focus, Innovations Moving Transport Forward – http://www.iso.org/iso/home.html
5. EPA Center for Corporate Climate Leadership – http://www.epa.gov/climateleaders/reporting/index.html
6. Changes in Atmospheric Constituents and in Radiative Forcing – http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html
7. https://www.epa.gov/sites/production/files/2020-04/documents/ghg-emission-factors-hub.pdf
8. Drexel University Office of Climate & Sustainability - https://drexel.edu/sustainability/

VIII. Table of Tables

IX. Appendix A – University City Campus Map

Drexel University University City Campus



Academic Building 55
Alumni Engineering Labs 4
Armory (Buckley Courts) 28
Bossone Research Enterprise Center . . . . . 7&7A
School of Biomedical Engineering, Science and Health Systems
Buckley Green 86
Buckley Recreational Field 85
Buckley Tennis Courts 50
Center for Automation Technology 27A
Chestnut Square . . . . . 62&62A
Creese Student Center 8
Curtis Hall 3
Daskalakis Athletic Center 14
Design Arts Annex 55A
Disque Hall 12
Dornsife Center for Neighborhood Partnerships . 98
Drexel Park 57
Drexel Square 91
Drexel Police Station 55C
Drexel Recreation Center 14A
Drexel Smart House 40
Fraternity Houses
Alpha Chi Rho 30
Alpha Epsilon Pi 30
Alpha Pi Lambda 37
Delta Sigma Phi 45
Lambda Chi Alpha 35
Pi Kappa Alpha 39
Pi Kappa Phi 34
Sigma Phi Epsilon 36
Tau Kappa Epsilon 32
Theta Chi 38
General Services Building 16
Hagerty Library 15
Handschumacher Dining Center 9C
Kline Law Building and Library 90
Kline School of Law
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Language and Communication Center 48
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Goodwin College of Professional Studies
LeBow College of Business
Library Learning Terrace 29A
Lincoln Plaza 176
MacAlister Hall 9B
College of Arts and Sciences
Pennoni Honors College

Main Building 1
Mandell Theater 9A
Nesbitt Hall 13
Dornsife School of Public Health
Northside Dining Terrace 19A
Papadakis Integrated Sciences Building 58
Parking Garage 16
Pearlstein Business Learning Center 53
Close School of Entrepreneurship
Peck Alumni Center 60
Perelman Center for Jewish Life 52
PSA Building 47
Randell Hall 2
Residence Halls
Bentley Hall 20
Caneris Hall 26
Kelly Hall 19
Millennium Hall 31
Myers Hall 21
North Hall 24
Race Hall 29
Towers Hall 22
Van Rensselaer Hall 17

Ross Commons 18
Rush Building 10
Sorority Houses
Alpha Sigma Alpha 39
Delta Phi Epsilon 46
Delta Zeta 36
Phi Mu 33
Phi Sigma Sigma 33
Stratton Hall 5
The Study at University City (Hotel) 101
The Summit 23
University Crossings 89
Urban Eatery 23A
URBN Center 71
Westphal College of Media Arts & Design
URBN Center Annex 72
Vidas Athletic Complex 25
208 N. 35th Street 41
225 N. 32nd Street 59
400 N. 31st Street 56
3025 Market Street 88
3101 Market Street 88A
3201 Arch Street 81

3201 Arch Annex 81A
3210 Cherry Street 55B
3210 Spring Garden Street 54
3401 Market Street 170
School of Education
3608 Powelton Avenue 99
3675 Market Street 178
College of Computing & Informatics

3141 Chestnut Street
Philadelphia, PA 19104
DREXEL.EDU

UNIVERITY COMMUNICATIONS 2/20

X. Appendix B – Greenhouse Gas Inventory Workbook

Drexel University Greenhouse Gas Inventory for Fiscal Year 2020

Scope Type: **One**
Source: **Purchased Natural Gas**
Time Period: **July 1, 2019 to June 30,2020**

Month	Purchased Natural Gas (ccf)	Purchased Natural Gas (mmBtus)	CO2 Emissions (eMT CO2)	CH4 Emissions (eMT CO2)	N2O Emissions (eMT CO2)	Total GHG Emissions (eMT CO2)
July	14,650.00	1,503.09	79.75	0.04	0.05	79.84
August	15,600.00	1,600.56	84.93	0.04	0.05	85.02
September	17,240.00	1,768.82	93.85	0.04	0.06	93.95
October	29,610.00	3,037.99	161.20	0.08	0.10	161.37
November	56,740.00	5,821.52	308.89	0.15	0.18	309.22
December	77,520.00	7,953.55	422.02	0.20	0.25	422.47
January	74,140.00	7,606.76	403.61	0.19	0.24	404.05
February	66,860.00	6,859.84	363.98	0.17	0.22	364.37
March	47,760.00	4,900.18	260.00	0.12	0.15	260.28
April	19,610.00	2,011.99	106.76	0.05	0.06	106.87
May	10,110.00	1,037.29	55.04	0.03	0.03	55.10
June	8,150.00	836.19	44.37	0.02	0.03	44.42
Annual Totals	**437,990**	**44,937.77**	**2,384.40**	**1.12**	**1.42**	**2,386.94**

Calculation Method Information
CO2 Emissions = Natural Gas (ccf) x Energy Conversion (mmbtus/ccf) x Emission Factor (kg CO2/mmbtu) / 1000
N2O Emissions = Natural Gas (ccf) x Energy Conversion (mmbtus/ccf) x Emission Factor (kg N2O / mmbtu) x GWPF (tonnes CO2/tonnes N2O) / 1000
CH4 Emissions = Natural Gas (ccf) x Energy Conversion (mmbtus/ccf) x Emission Factor (kg CH4/mmbtu) x GWPF (tonnes CO2/tonnes CH4) / 1000

Energy Conversion Data
Natural Gas ccf to mmbtus = 0.1026
CO2 Emission Factors for Natural Gas = 53.06 (kg/mmbtu)
CH4 Emission Factors for Natural Gas = 0.001 (kg/mmbtu)
N2O Emission Factors for Natural Gas = 0.000106 (kg/mmbtu)

Drexel University Greenhouse Gas Inventory for Fiscal Year 2020

Scope Type: **One**
Source: **Gasoline Purchased**
Time Period: **July 1, 2019 to June 30,2020**

Month	Gasoline (gallons)	CO2 Emissions (eMT CO2)	CH4 Emissions (eMT CO2)	N2O Emissions (eMT CO2)	Total GHG Emissions (eMT CO2)
July	600	5.2	0.0	0.1	5.4
August	0	0.0	0.0	0.0	0.0
September	0	0.0	0.0	0.0	0.0
October	0	0.0	0.0	0.0	0.0
November	0	0.0	0.0	0.0	0.0
December	837	7.3	0.0	0.1	7.5
January	0	0.0	0.0	0.0	0.0
February	0	0.0	0.0	0.0	0.0
March	0	0.0	0.0	0.0	0.0
April	0	0.0	0.0	0.0	0.0
May	0	0.0	0.0	0.0	0.0
June	0	0.0	0.0	0.0	0.0
Annual Totals	**1,437**	**12.5**	**0.1**	**0.3**	**12.8**

Calculation Method Information
CO2 Emissions = Fuel Used (gallons) x Emission Factor (kg CO2/gal) / 1000
N2O Emissions = Fuel Used (gallons) x Emission Factor (kg N2O/gal) x GWPF (tonnes CO2/tonnes N2O) /1000 CH4 Emissions = Fuel Used (gallons) x Emission Factor (kg CH4/gal) x GWPF (tonnes CO2/tonnes CH4) / 1000

Fuel Usage Data (Gallons) Obtained from Drexel University fuel records.
Emission Factors
CO2 Gasoline = 8.71 (kg CO2/gal) Obtained from IPCC, 1999, Vol. 2, Section 2
CH4 Gasoline = 0.001742 (kg CH4/gal) Obtained from Draft Inventory of U.S. Greenhouse Gas Emissions
N2O Gasoline = 0.000599 (kg N2O/gal) Obtained from Draft Inventory of U.S. Greenhouse Gas Emissions

Drexel University Greenhouse Gas Inventory for Fiscal Year 2020

Scope Type: **One**
Source: **Biodiesal Purchased**
Time Period: **July 1, 2019 to June 30,2020**

Month	BioDiesel (B20) (gallons)	CO2 Emissions (eMT CO2)	CH4 Emissions (eMT CO2)	N2O Emissions (eMT CO2)	Total GHG Emissions (eMT CO2)
July	5,958	46.8	0.1	0.5	47.3
August	4,464	35.1	0.1	0.3	35.5
September	5,505	43.2	0.1	0.4	43.7
October	5,448	42.8	0.1	0.4	43.3
November	4,585	36.0	0.1	0.4	36.4
December	3,652	28.7	0.1	0.3	29.0
January	4,458	35.0	0.1	0.3	35.4
February	3,344	26.3	0.0	0.3	26.6
March	1,314	10.3	0.0	0.1	10.4
April	0	0.0	0.0	0.0	0.0
May	0	0.0	0.0	0.0	0.0
June	0	0.0	0.0	0.0	0.0
Annual Totals	**38,728.3**	**304.1**	**0.5**	**3.0**	**307.6**

Calculation Method Information
Calculations are the same as Gasoline above

Emission Factors for Low Sulfur Diesel
CO_2 = 9.987 (kg CO2/gal) Obtained from IPCC, 1999, Vol. 2, Section 2
CH_4 = 0.000567 (kg CH4/gal) Obtained from Draft Inventory of U.S. Greenhouse Gas Emissions
N_2O = 0.000257 (kg N2O/gal) Obtained from Draft Inventory of U.S. Greenhouse Gas Emissions

Drexel University Greenhouse Gas Inventory for Fiscal Year 2020

Scope Type: **One**
Source: **Low Sulfur Diesel Purchased**
Time Period: **July 1, 2019 to June 30,2020**

Month	Low Sulfur Diesel (gallons)	CO2 Emissions (eMT CO2)	CH4 Emissions (eMT CO2)	N2O Emissions (eMT CO2)	Total GHG Emissions (eMT CO2)
July	0	0.0	0.0	0.0	0.0
August	0	0.0	0.0	0.0	0.0
September	0	0.0	0.0	0.0	0.0
October	0	0.0	0.0	0.0	0.0
November	0	0.0	0.0	0.0	0.0
December	0	0.0	0.0	0.0	0.0
January	0	0.0	0.0	0.0	0.0
February	0	0.0	0.0	0.0	0.0
March	0	0.0	0.0	0.0	0.0
April	0	0.0	0.0	0.0	0.0
May	0	0.0	0.0	0.0	0.0
June	0	0.0	0.0	0.0	0.0
Annual Totals	**0**	**0.0**	**0.0**	**0.0**	**0.0**

Calculation Method Information
Calculations are the same as Gasoline above

Emission Factors for Low Sulfur Diesel
CO_2 = 9.987 (kg CO2/gal) Obtained from IPCC, 1999, Vol. 2, Section 2
CH_4 = 0.000567 (kg CH4/gal) Obtained from Draft Inventory of U.S. Greenhouse Gas Emissions
N_2O = 0.000257 (kg N2O/gal) Obtained from Draft Inventory of U.S. Greenhouse Gas Emissions

Drexel University Greenhouse Gas Inventory for Fiscal Year 2020

Scope Type: **One**
Source: **Electricity Purchased**
Time Period: **July 1, 2019 to June 30,2020**

Month	Purchased Electricity (kWh)	CO2 Emissions (eMT CO2)	CH4 Emissions (eMT CO2)	N2O Emissions (eMT CO2)	Renewable Energy Purchase Offsets (kWh)	CO2 Emissions offset (eMT CO2)	Total GHG Emissions (eMT CO2)
July	7,198,901	2,481.003	0.001	1.719E-09	6,000.000	2.068	2,478.937
August	6,806,498	2,345.767	0.001	1.625E-09	6,000.000	2.068	2,343.700
September	6,177,058	2,128.839	0.001	1.475E-09	6,000.000	2.068	2,126.772
October	5,492,128	1,892.787	0.001	1.311E-09	6,000.000	2.068	1,890.720
November	4,698,086	1,619.131	0.001	1.122E-09	6,000.000	2.068	1,617.064
December	5,000,215	1,723.256	0.001	1.194E-09	6,000.000	2.068	1,721.189
January	5,244,224	1,807.350	0.001	1.252E-09	0.000	0.000	1,807.351
February	4,835,585	1,666.518	0.001	1.154E-09	0.000	0.000	1,666.519
March	5,046,068	1,739.059	0.001	1.205E-09	0.000	0.000	1,739.060
April	4,693,562	1,617.572	0.001	1.12E-09	0.000	0.000	1,617.573
May	5,887,248	2,028.960	0.001	1.405E-09	0.000	0.000	2,028.961
June	6,187,714	2,132.511	0.001	1.477E-09	0.000	0.000	2,132.512
Annual Totals	**67,267,287**	**23,182.753**	**0.013**	**1.61E-08**	**36,000.000**	**12.407**	**23,170.359**

Calculation Method Information
CO_2 Emissions = Purchased electricity(kwh) x Emission Factor (kg CO2/kwh) / 1000
N_2O Emissions = Purchased electricity(kwh) x Emission Factor (kg N2O/kwh) x GWPF(tonnes CO2/tonnes N_2O)/1000
CH4 Emissions = Purchased electricity(kwh) x Emission Factor (kg CH4/kwh) x GWPF(tonnes CO2/tonnes CH4)/1000

CO2 Emission Factors (kg/kwh)		
Purchased Electricity - PA	0.34	Obtained from US EPA Office of Atmospheric Programs
CH4 Emission Factors (kg/kwh)		
Purchased Electricity - PA	2.27273E-05	Obtained from US EPA Office of Atmospheric Programs
N2O Emission Factors (kg/kwh)		
Purchased Electricity - PA	4.09091E-06	Obtained from US EPA Office of Atmospheric Programs

Drexel University Greenhouse Gas Inventory for Fiscal Year 2020

Scope Type: **One**
Source: **Steam Purchased**
Time Period: **July 1, 2019 to June 30,2020**

Month	Purchased Steam (mlbs)	Purchased Steam (mmbtus)	CO2 Emissions (eMT CO2)	CH4 Emissions (eMT CO2)	N2O Emissions (eMT CO2)	Total GHG Emissions (eMT CO2)
July	3,222	3,847.07	255.18	0.12	0.14	255.44
August	3,426	4,090.64	271.33	0.13	0.15	271.61
September	3,225	3,850.65	255.41	0.12	0.14	255.68
October	4,571	5,457.77	362.01	0.17	0.20	362.39
November	11,375	13,581.75	900.88	0.42	0.51	901.81
December	14,568	17,394.19	1,153.76	0.54	0.65	1,154.95
January	14,617	17,452.70	1,157.64	0.55	0.65	1,158.83
February	12,217	14,587.10	967.56	0.46	0.54	968.56
March	9,381	11,200.91	742.96	0.35	0.42	743.72
April	6,770	8,083.38	536.17	0.25	0.30	536.72
May	2,983	3,561.70	236.25	0.11	0.13	236.49
June	865	1,032.81	68.51	0.03	0.04	68.58
Annual Totals	87,220	104,140.68	6,907.65	3.25	3.88	6,914.78

Calculation Method Information
CO2 Emissions = Fuel Used (gallons) x Emission Factor (kg CO2/gal) / 1000
N2O Emissions = Fuel Used (gallons) x Emission Factor (kg N2O/gal) x GWPF (tonnes CO2/tonnes N2O) /1000 CH4 Emissions = Fuel Used (gallons) x Emission Factor (kg CH4/gal) x GWPF (tonnes CO2/tonnes CH4) / 1000

Fuel Usage Data (Gallons) Obtained from Drexel University fuel records.
Emission Factors
CO2 Gasoline = 8.71 (kg CO2/gal) Obtained from IPCC, 1999, Vol. 2, Section 2
CH4 Gasoline = 0.001742 (kg CH4/gal) Obtained from Draft Inventory of U.S. Greenhouse Gas Emissions
N2O Gasoline = 0.000599 (kg N2O/gal) Obtained from Draft Inventory of U.S. Greenhouse Gas Emissions

Drexel University Greenhouse Gas Inventory for Fiscal Year 2020

Scope Type: **Two**
Source: **Corporate Travel – Air Travel**
Time Period: **July 1, 2019 to June 30,2020**

Month	Short Haul				Mid Haul				Long Haul				Total GHG Emissions
	Mileage	CO2 Emissions	CH4 Emissions	N2O Emissions	Mileage	CO2 Emissions	CH4 Emissions	N2O Emissions	Mileage	CO2 Emissions	CH4 Emissions	N2O Emissions	eMT CO2
July	11,058	2.488	0.000	0.024	46,392	6.309	0.001	0.059	464,544	77.114	0.007	0.734	86.736
August	9,780	2.201	0.038	0.070	26,212	3.565	0.000	0.034	496,182	82.366	0.007	0.784	89.065
September	14,225	3.201	0.055	0.102	102,275	13.909	0.002	0.131	702,623	116.635	0.011	1.110	135.156
October	24,482	5.508	0.095	0.176	91,442	12.436	0.001	0.117	839,781	139.404	0.013	1.326	159.077
November	14,845	3.340	0.058	0.107	72,019	9.795	0.001	0.092	730,526	121.267	0.011	1.154	135.825
December	9,972	2.244	0.039	0.072	23,618	3.212	0.000	0.030	393,034	65.244	0.006	0.621	71.467
January	25,334	5.700	0.099	0.182	62,542	8.506	0.001	0.080	368,243	61.128	0.006	0.582	76.283
February	12,641	2.844	0.049	0.091	85,050	11.567	0.001	0.109	439,655	72.983	0.007	0.694	88.345
March	39,436	8.873	0.154	0.283	177,415	24.128	0.003	0.227	794,922	131.957	0.012	1.255	166.893
April	25,997	5.849	0.101	0.187	89,823	12.216	0.001	0.115	828,473	137.527	0.012	1.308	157.317
May	9,534	2.145	0.037	0.068	50,917	6.925	0.001	0.065	545,603	90.570	0.008	0.862	100.681
June	10,951	2.464	0.043	0.079	40,438	5.500	0.001	0.052	622,630	103.357	0.009	0.983	112.487
Annual Totals	**208,255**	**46.857**	**0.769**	**1.439**	**868,143**	**118.067**	**0.013**	**1.112**	**7,226,216**	**1,199.552**	**0.108**	**11.413**	**1,379.331**

Information received directly from World Travel.

Drexel University Greenhouse Gas Inventory for Fiscal Year 2020

Scope Type: **Three**
Source: **Landfill Waste**
Time Period: **July 1, 2019 to June 30,2020**

Month	Landfill Waste (short tons)	CO2 Emissions (eMT CO2)	CH4 Emissions (eMT CO2)	N2O Emissions (eMT CO2)	Total GHG Emissions (eMT CO2)
July	148.00	0	25.84	0	25.84
August	211.00	0	36.84	0	36.84
September	255.00	0	44.52	0	44.52
October	263.00	0	45.92	0	45.92
November	187.00	0	32.65	0	32.65
December	167.00	0	29.16	0	29.16
January	180.00	0	31.43	0	31.43
February	208.00	0	36.32	0	36.32
March	309.00	0	53.95	0	53.95
April	12.10	0	2.11	0	2.11
May	14.00	0	2.44	0	2.44
June	100.00	0	17.46	0	17.46
Annual Totals	**2,054.10**	**0**	**358.65**	**0**	**358.65**

Calculation Method Information
CO2 Emissions = Waste (short tons) x Emission Factor (kg CO2/MMBtu) / 1000
N2O Emissions = Waste (short tons) x Emission Factor (kg N2O/MMBtu) x GWPF (tonnes CO2/tonnes N2O) / 1000 CH4 Emissions = Waste (short tons) x Emission Factor (kg CH4/MMBtu) x GWPF(tonnes CO2/tonnes CH4) / 1000 Units are eMT CO2 = Equivalent Metric Tonnes of Carbon Dioxide
GWPF = Global Warming Potential Factor

Fuel Usage Data (Short Tons) Obtained from Drexel University records.
Emission Factors
CO2 Landfill Waste = 0 (kg/short ton) Obtained from Draft Inventory of U.S. Greenhouse Gas Emissions for Landfill Waste with Methane Recovery and Energy Production
CH4 Landfill Waste = 6.984127 (kg/short ton) Obtained from Draft Inventory of U.S. Greenhouse Gas Emissions for Landfill Waste with Methane Recovery and Energy Production
N2O Landfill Waste = 0 (kg/short ton) Obtained from Draft Inventory of U.S. Greenhouse Gas Emissions for Landfill Waste with Methane Recovery and Energy Production

Global Warming Potential (CO2 Equivalency Factors)
CO2 - Carbon Dioxide = 1 (tonnes CO2/tonnes CO2)
CH4 - Methane = 25 (tonnes CO2/tonnes CH4) Obtained from IPCC 4th Assessment Report
N2O - Nitrous Oxide = 25 (tonnes CO2/tonnes CH4) Obtained from IPCC 4th Assessment Report

Drexel University Greenhouse Gas Inventory for Fiscal Year 2020

Scope Type: **Two**
Source: **Corporate Travel – Commuter Rail**
Time Period: **July 1, 2019 to June 30,2020**

No Data Recorded for this Section in FY2020.

Scope Type: **Two**
Source: **Corporate Travel – Commuter Car**
Time Period: **July 1, 2019 to June 30,2020**

No Data Recorded for this Section in FY2020.

Drexel University Greenhouse Gas Inventory for Fiscal Year 2020

Scope Type: **Two**
Source: **Commuting Travel – Light Rail**
Time Period: **July 1, 2019 to June 30,2020**

No Data Recorded for this Section in FY2020.