
2023
Green
Places

Durham Academy Fiscal Year 2023 Greenhouse Gas Summary Report

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Introduction

Thank you for partnering with GreenPlaces to assess your company's carbon footprint. Learning your emission sources is a critical step in your sustainability journey. We've prepared this document to help you understand your footprint and the methodologies we use to measure your emissions. Please feel free to reach out to our team with any questions or clarifications.

Prepared By

GreenPlaces

For

Assessment Summary

Based on the information provided and the analysis conducted, subject to the attached Statement of Limiting Conditions, we have concluded that as of the assessment date, Durham Academy (also referred to as the client or reporting company) emissions from the examined categories is as follows:

Category	Location-Based Emissions (mT CO_2e)	Market-Based Emissions (mT CO_2e)
Scope 1	652.6302	652.6302
Scope 2	1092.6580	941.2933
Scope 3	6,042.9808	6,042.9808
Total	7788.2690	7,636.9336

Company Overview

Durham Academy is an independent, coeducational day school in Durham, North Carolina, whose students range from pre-kindergarten to grade twelve.

The purpose of a Durham Academy education is to prepare each student to live a moral, happy, and productive life. The development of intellect is central to such a life, and thus, intellectual endeavor and growth are the primary work of the school. The acquisition of knowledge, the development of skills, critical judgment, and intellectual curiosity, and increased understanding are the goals of the school's academic program.

Geographic Boundary

This report includes the Durham Academy campus buildings listed below.

1. Upper School Building: 3601 Ridge Road, Durham, NC
2. Middle School Building: 3116 Academy Road, Durham, NC
3. Lower School Building: 3501 Ridge Road, Durham, NC
4. Administration Building: 3130 Pickett Road, Durham, NC

Base Year and Reporting Period

The Greenhouse Gas (GHG) Protocol calls for the base year to be identified as the earliest point in time for which a company has reliable data. GreenPlaces began working with Durham Academy in 2022 to calculate their base year footprint for fiscal year 2022 (7/1/2021-6/30/2022). GreenPlaces uses a “fixed base year” approach that allows emissions to be tracked over time on a like-with-like basis. This greenhouse gas inventory report focuses on the reporting company’s emissions for fiscal year 2023 (7/1/2022-6/30/2023).

Table 1.0a Operational Scopes

Scope 1	mT CO_2e	Specific exclusions and reason for exclusion	Estimated Activity	Source(s)
Fugitive Emissions	**109.6302**	R-22 was excluded as it is reported under the Montreal Protocol only.	Average operational leakage rate of 0.5% applied for domestic refrigeration and 10% for HVAC and heat pumps. Average refrigerant remaining at a disposal rate of 80% and recovery efficiency of 80% applied to discarded units.	(EPA, 2023) (UK DEFRA, 2023)
Stationary Combustion	**456.3045**	No known exclusions made to this section of the report.	None, primary data provided.	(EPA, 2023)
Mobile Combustion	**456.3045**	Several pieces of maintenance equipment used on Ridge Road were excluded due to lack of data.	Average fuel efficiency was applied to calculate fuel usage.	See citation page at the end of report (too many to list)
Process Emissions	**Not Relevant, Excluded**	Not Applicable.	Not Applicable.	Not Applicable.
Total Scope 1 Emissions	**652.6596 mT CO_2e**			

Scope 2	mT CO_2e	Specific exclusions and reason for exclusion	Estimated Activity	Source(s)
Purchased Electricity - Location Based eGRID Emission Factor Source	**1,092.6580**	No known exclusions were made to this section of the report.	As primary data was provided, no estimates were made.	(EPA, 2023)
Purchased Electricity - Market-Based Green-e® Emission Factor Source	**941.2933**	No known exclusions were made to this section of the report.	As primary data was provided, no estimates were made.	(“Duke Energy”, 2023)
Total Scope 2 Emissions (Location-Based)	**1,092.6580 mT CO_2e**			

Total Scope 2 Emissions (Market-Based)	941.2933 mT CO_2e

Scope 3	mT CO_2e	Specific exclusions, % this represents for relevant scope	Estimated Activity	
Category 1: Purchased Goods and Services	**86.7426**	Any spend on travel was moved to the business travel section of the report.	Through the use of the Comprehensive Environmental Data Archive database, GreenPlaces calculated cradle-to-gate emissions.	(CEDA, 2022)
Category 2: Capital Goods	**3,848.4058**	No known exclusions were made to this section of the report.	Through the use of the Comprehensive Environmental Data Archive database, GreenPlaces calculated cradle-to-gate emissions.	(CEDA, 2022)
Category 3: Fuel- and Energy-Related Activities Not Included in Scope 1 or Scope 2	**577.6761**	No known exclusions were made to this section of the report.	An average gross grid loss of 5.3% was applied. Well-to-tank emission factors were applied. No other estimations or assumptions were made.	(EPA, 2023)
Category 4: Upstream Transportation and Distribution	**Relevant, Excluded.**	Durham Academy likely has items shipped to the campus that should be included in this section of the report. GreenPlaces will work with Durham Academy to collect this data in the future.	Not Applicable.	Not Applicable.
Category 5: Waste Generated in Operations	**Waste: 270.3492** **Water: 23.1475**	Waste: No known exclusions made to this section of the report.	As primary data was provided for both waste and water,	(Ecoinvent, n.d.)

		Water: No known exclusions made to this section of the report.	estimates were not applied.	(EPA, 2023) (EPA, 2016)
Category 6: Business Travel	**428.2953**	No known exclusions were made to this section of the report.	Estimates were not applied. Emission factors were applied to both distance-based and spend-based data.	(CEDA, 2022)
Category 7: Employee Commuting & Student Commuting	**Total: 808.3616** **Faculty: 261.2801** **Student: 547.0816**	No known exclusions were made to this section of the report.	Estimates were applied to employees and students who did not respond to the commuter survey.	(EPA, 2023)
Category 8: Upstream Leased Assets	**Not Relevant, Excluded.**	Not Applicable.	Not Applicable.	Not Applicable.
Category 9: Downstream Transportation and Distribution	**Not Relevant, Excluded.**	Not Applicable.	Not Applicable.	Not Applicable.
Category 10: Processing of Sold Products	**Not Relevant, Excluded.**	Not Applicable.	Not Applicable.	Not Applicable.
Category 11: Use of Sold Products	**Not Relevant, Excluded.**	Not Applicable.	Not Applicable.	Not Applicable.
Category 12: End-of-Life Treatment of Sold Products	**Not Relevant, Excluded.**	Not Applicable.	Not Applicable.	Not Applicable.
Category 13: Downstream Leased Assets	**Not Relevant, Excluded.**	Not Applicable.	Not Applicable.	Not Applicable.
Category 14: Franchises	**Not Relevant, Excluded.**	Not Applicable.	Not Applicable.	Not Applicable.

Category 15: Investments	**Not Relevant, Excluded.**	Not Applicable.	Not Applicable.	Not Applicable.
Total Scope 3 Emissions	**6,042.9808 mT CO_2e**			
Total Scope 1, 2 & 3 **Market-based emissions using eGRID emission factors are used in footprint total.**	**7,636.9336 mT CO_2e**			

Table 1.0b Intensity Ratios

Total emissions in mT CO_2e per student, based on total student count of 1237.	6.1738 mT CO_2e/employee	**Total emissions in mT CO_2e per 1,000 sq ft, based on total square footage of 279,349.**	27.3383 mT CO_2e/1,000 sq ft

Targets

After the conclusion of this assessment report, GreenPlaces will strategize emissions reduction targets with Durham Academy.

Carbon Offsets and Renewable Energy Credits

GreenPlaces has not purchased carbon offsets or renewable energy credits on behalf of Durham Academy's fiscal year 2023 footprint at the time of this report.

Discussion of Methodology

1.0 Objective

GreenPlaces strives to provide clients with a comprehensive, accurate representation of their current carbon footprint, adhering to the GHG Protocol accounting and reporting principles: relevance, completeness, consistency, transparency, and accuracy.

2.0 Scope 1 Emissions

Stationary Combustion: Durham Academy

Natural Gas:

The client was able to provide bills for each natural gas meter on campus. Greenplaces then summed the total mmBtu of natural gas consumed per month to determine annual usage per meter. If there was a month of data missing for any given meter, average usage calculated from the provided months was applied.

GreenPlaces then applied the natural gas emission factor (EPA, 2023) to the mmBtu of natural gas consumed per meter to calculate emissions from natural gas. As primary data was provided and only a few months per meter had to be estimated; there is only a small to fair amount of uncertainty associated with these calculations. Table 2.0 below displays the meter number, associated location, mmBtu of natural gas consumed, and the associated emissions. Total emissions from natural gas for all meters came to **456.3045 mT CO_2e**.

Table 2.0 Natural Gas Emissions: Durham Academy

Source: EPA, "Emission Factors for Greenhouse Gas Inventories," Table 1, Stationary Combustion, 2023.

Meter #	Location	mmBtu / year	Total emissions (mT CO2e)
34311	Unable to map to location	33.5555	1.7823
380106	Middle School Gym	354.2475	18.8158
437740	Upper School: Kirby Gym	237.8654	12.6342
473501	Middle School: 100 Building (AWL)	832.0732	44.1954
482165	Lower School: Maintenance Building (Ridge Road)	109.6071	5.8218
509180	Unable to map to location	959.0941	50.9421

528482	Middle School (Library)	905.3920	48.0897
568009	Lower School Gym	653.1216	34.6904
757741	Upper School: STEM & Humanities Center	4,208.4913	223.5332
809393	Upper School: Kenan Auditorium	297.4629	15.7997
Totals		**8,590.9107**	**456.3045**

2.1 Mobile Combustion

Mobile Combustion: Durham Academy

Campus Maintenance Vehicles- Ridge Road:

During the reporting period, Durham Academy reported owning several buses, maintenance vehicles, and maintenance equipment across all school campuses. To start, it was reported that there are four campus maintenance vehicles assigned to the Ridge Road campus location: a 2015 Chevy pickup truck, a 2003 Chrysler pickup truck, a 2019 Chevy Silverado pickup truck, and a 2012 KIA SUV. The reported miles traveled, average MPG, and resulting gallons consumed are listed below:

- Chevrolet pickup truck
  - 5,500 miles traveled
  - 10.8 MPG
  - ~509.2593 gallons
- Chrysler pickup truck
  - 3,500 miles traveled
  - 9.0 MPG
  - 388.8889 gallons
- Chevy Silverado pickup truck
  - 4,500 miles traveled
  - 16 MPG (“US Department of Energy,”n.d.)
  - 281.25 gallons
- KIA SUV
  - 5,298 miles traveled

    - 30 MPG (“US Department of Energy,” n.d.)
    - 176.6 gallons

As vehicle manufacturing years were provided by the client, specific emission factors were applied to the CH_4 and N_2O emissions to reflect this data. The emission factor for CO_2 gasoline combustion remained constant for all vehicles. Following this method, GreenPlaces calculated that the Ridge Road maintenance vehicles have a collective estimated emissions of **11.9620 mT CO_2e.** Table 4.0c depicts the vehicle, miles traveled, gallons of fuel consumed, emission factor, and total emissions for Ridge Road campus vehicles. It should be noted that due to the estimations made to determine MPG for the Chevy Silverado and KIA SUV, there is a fair amount of uncertainty associated with these emissions.

Campus Maintenance Vehicles- Academy Road:

Four campus maintenance vehicles were reported by the client for the Academy Road location.These vehicles include a 1999 Dodge 4WD pickup truck, a 2009 Chevrolet pickup truck, a 2007 Chevrolet 2500 van, and a 2017 Jeep Cherokee. The reported miles traveled, average MPG, and resulting gallons consumed is listed below:

- Dodge 4WD pickup truck
    - 2,318 miles traveled
    - 17 MPG (“ 1999 Dodge Dakota Information,” n.d.)
    - ~136.3529 gallons
- Chevrolet pickup traveled
    - 803 miles traveled
    - 14 MPG (“Fuelly,” n.d.)
    - ~57.3571 gallons
- Chevrolet 2500 van
    - 4,490 miles traveled
    - 11 MPG (“Fuelly,” n.d.)
    - 408.1818 gallons
- Jeep Cherokee
    - 7,521 miles traveled
    - 23.0 MPG (“US Department of Energy,” n.d.)
    - 327.0000 gallons

As vehicle manufacturing years were provided by the client, specific emission factors were applied to the CH_4 and N_2O emissions to reflect this data. The emission factor for CO_2 gasoline combustion remained constant for all vehicles.

Total emissions for all Academy Road Maintenance vehicles came to **8.2163 mT CO_2e.** Table 4.0d depicts the vehicle, miles traveled, gallons of fuel consumed,

emission factor, and total emissions for Academy Road campus vehicles. It should be noted that due to the estimations made to determine the average MPG per vehicle, there is a fair amount of uncertainty associated with these emissions.

Gasoline-Powered Maintenance Equipment- Ridge Road:

Gasoline-powered maintenance equipment for Ridge Road was another source of emissions for mobile combustion. The Ridge Road campus was documented using fourteen gasoline-powered types of maintenance equipment. For the gasoline-powered equipment, the client provided the hours the equipment was used per year, and GreenPlaces researched the average gallons used per hour. Table 4.0a displays the specific maintenance equipment used at the Ridge Road campus, the average gallons of fuel used per hour by the equipment, the fuel source, the hours used per year, the gallons of fuel consumed per year, and any supplemental sources used by GreenPlaces. Once the total gallons of gasoline consumed were calculated, GreenPlaces applied the lawn and garden care equipment emission factor for gasoline. The four-stroke gasoline lawn and garden equipment emission factor was applied to mowers and gators, and the two-stroke gasoline lawn and garden equipment emission factor was applied to all other gasoline-powered equipment. Total emissions from all gasoline-powered maintenance equipment used at the Ridge Road Campus came to **18.0707 mT CO_2e.** Table 4.0a displays the total gallons of gasoline consumed by the Ridge-Road gasoline-powered maintenance equipment, the emission factor applied, and the total emissions. As GreenPlaces had to research and estimate the average gallons of gasoline consumed per hour for most of the equipment provided, there is a fair amount of uncertainty associated with these calculations.

Diesel-Powered Maintenance Equipment- Ridge Road:

Another source of mobile combustion for Durham Academy is the diesel-powered maintenance equipment used at Ridge Road. The Ridge Road campus was documented using three diesel-powered types of maintenance equipment. For the diesel-powered equipment, the client provided the hours the equipment was used per year. GreenPlaces researched the average gallons used per hour. Table 4.0a displays the specific maintenance equipment used at the Ridge Road campus, the average gallons of fuel used per hour by the equipment, the fuel source, the hours used per year, the gallons of fuel consumed per year, and any sources used by GreenPlaces. Once the total gallons of diesel consumed were calculated, GreenPlaces applied the lawn and garden care equipment emission factor for 4-stroke diesel.

Total emissions for all diesel-fueled maintenance equipment used at Ridge Road came to **4.9448 mT CO_2e.** Table 4.0a displays the total gallons of diesel fuel

consumed by the Ridge Road maintenance equipment, the emission factor applied, and the total emissions. As GreenPlaces had to research and estimate the average gallons of gasoline consumed per hour for most of the equipment provided, there is a fair amount of uncertainty associated with these calculations.

Gasoline-Powered Maintenance Equipment- Academy Road:

Gasoline-powered maintenance equipment was also used at the Academy Road campus location, where eleven separate pieces of gasoline-powered maintenance equipment were used. For the gasoline-powered equipment, the client provided the hours the equipment was used per year, and GreenPlaces researched the average gallons used per hour per specific maintenance equipment and the fuel source used per maintenance equipment. Table 4.0b displays the specific maintenance equipment used at the Academy Road campus, the average gallons of fuel used per hour by the equipment, the fuel source, the hours used per year, the gallons of fuel consumed per year, and any sources used by GreenPlaces. Once the total gallons of gasoline consumed was calculated, GreenPlaces applied the lawn and garden care equipment emission factor for gasoline. The four-stroke gasoline lawn and garden equipment emission factor was applied to mowers and gators, and the two-stroke gasoline lawn and garden equipment emission factor was applied to all other equipment. Total emissions for all gasoline-powered maintenance equipment used on Academy Road came to **13.4012 mT CO_2e**. As GreenPlaces had to research and estimate the average gallons of gasoline consumed per hour for most of the equipment provided, there is a fair amount of uncertainty associated with these calculations.

Diesel-Powered Maintenance Equipment- Academy Road:

One diesel-powered maintenance equipment was used at the Academy Road location. For the diesel-powered equipment, the client provided the hours the equipment was used per year, and GreenPlaces researched the average gallons used per hour for the specific maintenance equipment and the fuel source used for the maintenance equipment. Table 4.0b displays the specific maintenance equipment used at the Academy Road campus, the average gallons of fuel used per hour by the equipment, the fuel source, the hours used per year, the gallons of fuel consumed per year, and any sources used by GreenPlaces. Once the total gallons of diesel fuel consumed were calculated, GreenPlaces applied the lawn and garden care equipment emission factor for 4-stroke diesel. Total emissions for the diesel fuel-powered maintenance equipment at Academy Road came to **0.1369 mT CO_2e**. As GreenPlaces had to research and estimate the average gallons of gasoline consumed per hour for most of the equipment provided, there is a fair amount of uncertainty associated with these calculations.

Disclaimer for All Maintenance Equipment:

It should be noted that several pieces of maintenance equipment across Academy and Ridge Road locations were unable to be accounted for due to insufficient data. This equipment included the Toro stand-on Spraymaster Max powered by gasoline, a Bobcat powered by diesel, two pressure washers powered by gasoline, an edger powered by gasoline, an aerator powered by gasoline, and two water pumps powered by gasoline. In all instances, GreenPlaces was unable to find accurate gallons of fuel used per hour for the specific equipment.

Durham Academy Buses (Capstone):

Durham Academy-owned bus emissions are all accounted for under mobile combustion. The client provided information on their owned buses, including that the regular-size bus traveled 427 miles in the reporting year and the mini-bus traveled 769 miles in the reporting year. GreenPlaces researched and found that the average regular-size diesel school bus gets 6.6 MPG, and the average diesel-fueled mini-bus gets 13.3 MPG (Laughlin, 2004). With this information, GreenPlaces was able to calculate that the regular-size buses consumed 64.7576 gallons of fuel and the mini-bus consumed 57.8271 gallons of fuel. The client was also able to provide manufacturing stickers from the buses with the year they were made. This information determined which specific emission factor was applied to the total mileage, as there is one emission factor for buses made between 1960 and 2006 and another emission factor for buses made between 2007 and 2019. Emission factors were then properly assigned, and total emissions for Durham Academy-owned school buses came to **1.2649 mT CO_2e.** Table 4.0e displays the breakdown of total 2021 mileage, gallons of fuel consumed, emission factor applied, and total mT CO_2e for regular-sized school buses manufactured between1960 and 2006 and between 2007 and 2019 and mini school buses manufactured between 1960 and 2006 and between 2007 and 2019. As several estimations were made regarding the average gallons of fuel consumed per specific bus type, there is a fair amount of uncertainty associated with these calculations.

Durham Academy Buses From Retreats and Robotics Trip:

The client reported on several retreats and a robotics trip where Durham Academy-owned buses were used for transportation. For the retreats, the client was able to provide the total regular bus mileage of 10,037 and the total mini-bus mileage of 12,770. For the robotics trip, a total regular bus mileage of 717.2 was reported. From there, GreenPlaces applied the average MPG for the regular bus of 6.6 and 13.3 MPG for the mini-bus (Laughlin, 2004). With this information, GreenPlaces calculated that the regular buses used for the retreats consumed

1,520.7879 gallons of diesel, the regular bus used for the robotics trips consumed 108.6667 gallons of diesel, and the mini-buses used for the capstone retreat consumed 960.1504 gallons of diesel. Manufacturing year was not provided for the robotics buses; therefore, GreenPlaces assumed the buses were manufactured between 2007 and 2019 and applied the corresponding emission factors for CH_4 and N_2O diesel-fueled medium to heavy-duty vehicles. Manufacturing year was provided for the retreat buses, and the corresponding emission factors for CH_4 and N_2O diesel-fueled medium to heavy-duty vehicles were applied. The diesel fuel mobile combustion emission factor was applied to CO_2 emissions for all buses. Emissions for regular and mini-bus transportation for retreats came to 25.4973 mT CO_2e, and emissions for the robotics trip came to 1.1189 mT CO_2e for a total combined emissions of **26.6162 mT CO_2e.** Table 4.0f displays total mileage, gallons of fuel consumed, emission factor applied, and total mT CO_2e for all capstone buses as well as the robotics bus. As average MPG was applied to calculate fuel consumed and manufacturing year was estimated, there is a fair amount of uncertainty associated with these estimations.

School-Owned Tesla:

Durham Academy reported owning a Tesla Model 3 that traveled 8,071 miles in the reporting year. GreenPlaces divided the miles traveled by the average miles per kWh of 2.9 for electric vehicles to calculate the total kWh consumed by the Tesla. The electricity emission factor specific to North Carolina was then applied to calculate emissions from the Tesla.GreenPlaces calculated that the total emissions from the Tesla Model 3 came to **2.3543 mT CO_2e.** Table 4.0g displays the mileage, the emission factor applied, and the total emissions from the Tesla Model 3. As exact mileage was provided, there is only a small to fair amount of uncertainty associated with these calculations.

Total emissions for all mobile combustion at Durham Academy came to **86.7249 mT**

Table 4.0a - Maintenance Equipment Details- Ridge Road

Equipment Name	Average gallons of Gasoline use per hour	Fuel Type	Hours Used Per Year	Total Gallons Used Per Year	Source
Gator Utility Vehicle, John Deere	0.35	4-stroke, gasoline	115	40.25	(Pendergast, n.d.)
John Deere 950m Mower, 2021	1.4	4-stroke, gasoline	100	140	(Media, n.d.)
Mower Exmark Lazer Z, 2014	1.2	4-stroke, gasoline	150	180	(Roberts, n.d.)
Mower Exmark Metro	0.59	4-stroke, gasoline	20	11.8	(GreenLand, n.d.)
Mower Exmark Turf Tracer	0.59	4-stroke, gasoline	150	88.5	(GreenLand, n.d.)
Tiller	2.90	2-stroke, gasoline	8	23.2	(“RFP Review Sheet”, n.d.)
Hedge Trimmer	2.6	2-stroke, gasoline	20	52	(“The Farming Forum”, n.d.)
Hedge Trimmer	2.6	2-stroke, gasoline	15	39	(“The Farming Forum”, n.d.)
Tree Trimmer	2.6	2-stroke, gasoline	15	39	(“The Farming Forum”, n.d.)
Hedge Trimmer	2.6	2-stroke, gasoline	40	104	(“The Farming Forum”, n.d.)

String Trimmer	2.6	2-stroke, gasoline	140	364	(“The Farming Forum”, n.d.)
String Trimmer	2.6	2-stroke, gasoline	100	260	(“The Farming Forum”, n.d.)
Leaf Blower	1.00	2-stroke, gasoline	450	450	(“Garden Tool Expert”, 2020)
Leaf Blower	1.00	2-stroke, gasoline	60	60	(“Garden Tool Expert”, 2020)
BR800 Blower	1.00	2-stroke, gasoline	120	120	(“Garden Tool Expert”, 2020)
John Deere 790 Tractor	2.90	Diesel	30	87	(“RFP Review Sheet”, n.d.)
John deere 4005 Tractor	2.90	Diesel	100	290	(“RFP Review Sheet”, n.d.)
Field Mower Toro 3575-D	0.59	Diesel	160	94.4	(GreenLand, n.d.)

Table 4.0b -Maintenance Equipment Details- Academy Road

Equipment Name	Average gallons of Gasoline use per hour	Fuel Source	Hours Used Per Year	Total Gallons Used Per Year	Source
John Deere Z925A	1.40	4-stroke, gasoline	73	102.2	(Media, n.d.)
John Deere 11445 Mower	1.40	4-stroke, gasoline	35	49	(Media, n.d.)

Toro 4000HD Z-Turn Mower	1.4	4-stroke, gasoline	29	40.6	(Media, n.d.)
Toro Reelmaster 5510 Mower	1.4	4-stroke, gasoline	33	46.2	(Media, n.d.)
John Deere TH (6X4) Gator	0.35	4-stroke, gasoline	75	26.25	(Pendergast, n.d.)
John Deere TX (4X2) Gator	0.35	4-stroke, gasoline	69	24.15	(Pendergast, n.d.)
STIHL BR700 Backpack Blower	1.0	2-stroke, gasoline	365	365	(GreenLand, n.d.)
STIHL BR600 Backpack Blower	1.0	2-stroke, gasoline	62	62	(GreenLand, n.d.)
STIHL BG86 Handheld Blower	1.0	2-stroke, gasoline	730	730	(GreenLand, n.d.)
STIHL MS 311 Chainsaw	1.0	2-stroke, gasoline	6	6	(“Just Chainsaws”, 2022)
STIHL MS 260 Chainsaw	1.0	2-stroke, gasoline	12	12	(“Just Chainsaws”, 2022)
John Deere 970 Tractor	4.5	Diesel	2.9	13.05	(“Tractor by Net”, 2006)

Table 4.0c - Mobile Combustion: Campus Maintenance Vehicles- Ridge Road

Source: *EPA, GHG Emission Factors Hub 2023.*

Vehicle	Total 2021 Mileage	Average Gallons of Fuel Consumed	Emission Factor (kg CO_2e/Mile)	Total Emissions mT CO_2e
2015 Chevrolet pickup truck	5,500	509.2593	0.8141	4.4777
2003 Chrysler pickup truck	3,500	388.8889	0.9872	3.4553
2019 Chevy Silverado pickup truck	4,500	281.2500	0.5493	2.4720
2012 KIA SUV	5,298	176.6000	0.2939	1.5570
Totals	–	–	–	11.9620

Table 4.0d - Mobile Combustion: Campus Maintenance Vehicles- Academy Road

Source: *EPA, GHG Emission Factors Hub 2023.*

Vehicle	Total 2021 Mileage	Average Gallons of Fuel Consumed	Emission Factor (kg CO_2e/Mile)	Total Emissions mT CO_2e
Dodge 4WD pickup truck, 1999	2,318	136.3529	0.5357	1.2418
Chevrolet pickup truck, 2009	803	57.3571	0.6285	0.5046
Chevrolet 2500 van, 2007	4,490	408.1818	0.8003	3.5932
Jeep cherokee, 2017	7,521	327.0000	0.3825	2.8767
Totals	–	–	–	8.2163

Table 4.0e - Mobile Combustion: Durham Academy Buses (Capstone)

Source: *EPA, GHG Emission Factors Hub 2023.*

Vehicle	Total Mileage	Average Gallons of Fuel Consumed	Emission Factor (kg CO_2e/Mile)	Total Emissions mT CO_2e
Regular bus made between 1960 and 2006	115.4	17.4848	1.5485	0.1787
Regular bus made between 2007 and 2019	312	47.2723	1.5601	0.4867
Mini-bus made between 1960 and 2006	88.9	6.6842	0.7692	0.0684
Mini- bus made between 2007 and 2019	680.2	51.1429	0.7808	0.5311
Totals	1,196.5000	122.5846	–	1.2649

Table 4.0f - Mobile Combustion: Durham Academy Buses (Retreat and Robotics)

Source: *EPA, GHG Emission Factors Hub 2023.*

Vehicle	Total Mileage	Average Gallons of Fuel Consumed	Emission Factor (kg CO_2e/Mile)	Total Emissions mT CO_2e
Regular bus made between 1960 and 2006	5018.6000	760.3939	1.5485	7.7714
Regular bus made between 2007 and 2019	5018.6000	760.3939	1.5601	7.8293
Mini-bus made between 1960 and 2006	6385.0000	480.0752	0.7692	4.9115
Mini- bus made between 2007 and 2019	6385.0000	480.0752	0.7808	4.9851

Robotics	717.2000	108.6667	1.5601	1.1189
Totals	23,524.4000	2,589.6000	–	26.6162

Table 4.0g - Mobile Combustion: Durham Academy Tesla Model 3

Source: *EPA, GHG Emission Factors Hub 2023.*

Vehicle	Total Mileage	Average kWh Consumed	Emission Factor (kg CO_2e/Mile)	Total Emissions mT CO_2e
Tesla Model 3	8,071.0000	2,783.1034	0.2917	2.3543

2.2 Fugitive Emissions

Fugitive Emissions: Durham Academy

To find emissions from operational use of refrigeration, HVAC, and heat pumps systems as well as emissions from the disposal of heat pump systems, GreenPlaces followed the reporting guidelines of the UK DEFRA (Screening Method).

Durham Academy reported on domestic refrigeration units, heat pumps, and HVAC units with the following refrigerant types and associated global warming potentials (GWP's).

- R-134A: 1,430
- R-600A: 0
- R-290: 0
- R-410A: 2,088
- R-22: 1,810

The GWP for each unit that was operational during the reporting period was then multiplied by the charge capacity and by the units specific operational leakage rate as follows.

- Domestic Refrigerations: 0.5%
- Heat Pumps: 10%
- HVAC : 10%

Following these methods, total emissions from the steady-state operation of refrigeration, HVAC, and heat pump units came to 34.7139 mT CO2e.

Durham Academy also indicated that all refrigeration, HVAC, and heat pump units from the 300-400 buildings were discarded during the reporting period due to construction and demolition. For all domestic refrigerators discarded, an 80% refrigerant remaining at disposal was applied, and a 70% recovery efficiency was applied. For HVAC and heat pumps discarded, a disposal rate of 80% was applied to the refrigerant remaining, and a recovery efficiency of 80% was applied. Following these methods, total emissions from the disposal of refrigeration units, HVACs, and heat pumps came to 74.9163 mT CO_2e.

It should be noted that although R-22 is listed above as a refrigerant used by Durham Academy for visibility, emissions from R-22 are not included in this report. They are not included because R-22 is a refrigerant monitored under the Montreal Protocol, which is not the standard GreenPlaces follows.

Grand total emissions from fugitive emissions from steady state operations as well as disposal came to **109.6302 mT CO_2e**. As the screening method was applied and service records could not be provided, there is a fair amount of uncertainty associated with these calculations.

3.0 Scope 2 Emissions

Purchased Electricity: Durham Academy

The reporting company was able to provide primary data on electricity consumption for all meters used At Durham Academy. However, the client was only able to provide kWh usage for the 5/2023-6/2023 period for each meter. That being said, the 5/2023-6/2023 bills all provided a 12-month usage chart, allowing GreenPlaces to apply the total 12-month kWh usage per meter for the reporting period of 5/2023 through 6/2023. Although this does not directly reflect Durham Academy's reporting period of 7/1/2022-6/30/2023, it is only a month off, and the usage is likely an accurate representation of the reporting period.

Once the total kWh per meter was calculated, the location-based and market-based emission factors were applied to calculate emissions (EPA, 2023). Following these

methods, total location-based electricity emissions came to **1,092.6580 mT CO_2e,** and total market-based electricity emissions came to **941.2933 mT CO_2e**. As the billing period provided by Durham Academy is slightly different from the reporting period reflected in this report, there is a small amount of uncertainty associated with these calculations. Tale 5.0 below displays the meter number, associated location, kWh consumed, location-based emissions, and market-based emissions.

Table 5.0 Location-based & Market-based Electricity Emissions: Durham Academy

Source: EPA, "Emission Factors for Greenhouse Gas Inventories," Table 6 Electricity, March 2023 From EPA eGRID 2021.

Location	kWh/ year	Total Market-based emissions (mT CO2e)	Total Location-based emissions (mT CO2e)
Outdoor lighting 1	7,488	1.8817	2.1842
Outdoor lighting 2	13,416	3.3713	3.9134
Outdoor lighting 3	20,208	5.0781	5.8946
Outdoor lighting 4	41,184	10.3491	12.0133
329284139	14,934	3.7528	4.3562
77670084	28,077	7.0555	8.1900
77552058	19,932	5.0087	5.8141
77633931	37,783	9.4945	11.0213
77617050	8,178	2.0550	2.3855
77617081	35,714	8.9746	10.4177
77568555	82192	20.6540	23.9753
77568554	0	0	0
77633626	212,380	53.3690	61.9510

77633625	335,336	84.2666	97.8171
328506177	350,152	87.9897	102.1389
320252099	575,122	144.5224	167.7623
77633932	702,124	176.4367	204.8086
322043702	1,083,033	272.1553	315.9193
77568554	177,974	44.7231	51.9148
344036700	0	0	0
327974508	300	0.0754	0.0875
319358968	318	0.0799	0.0928
Totals	**3,745,845.00**	**941.2933**	**1,092.6580**

4.0 Scope 3 Emissions

4.1 Category 1: Purchased Goods & Services

Purchased Goods and Services: Durham Academy

The client was able to provide data on purchased goods and services. All purchases were categorized into an appropriate CEDA category (CEDA, 2022), and the spend-based method was then used to calculate emissions. Of the categories reported by Durham Academy, GreenPlaces made assumptions about the physical items purchased in each category when specific details were not provided.

Emissions from Durham Academy's AWS were added to Durham Academy's purchased goods emissions. Emissions from AWS were calculated at 3.6000 mT CO_2e.

Total emissions from purchased goods for all locations and all categories came to **86.7426 mT CO_2e**. As the spend-based method was applied, there was a fair amount of uncertainty associated with these calculations.

4.2 Category 2: Capital Goods

Capital Goods: Durham Academy

The client was able to provide data on capital goods. All purchases were categorized into an appropriate CEDA category (CEDA, 2022), and the spend-based method was then used to calculate emissions. Of the categories reported by Durham Academy, GreenPlaces made assumptions about the physical items purchased in each category when specific details were not provided.

Total emissions from purchased goods for all locations and all categories came to **3,848.4058 mT CO_2e**. As the spend-based method was applied, there was a fair amount of uncertainty associated with these calculations.

4.3 Category 3: Fuel- and Energy-Related Activities Not Included in Scope 1 or Scope 2

Transmission and Distribution Losses (T & D Losses): Durham Academy

Emissions from upstream purchased electricity are not included in this assessment; however, emissions from T & D losses are reported here. Electricity usage for the office was estimated using methods explained in Section 3.1. Following the EPA's recommendation, GreenPlaces applied the US average T & D loss rate of 5.3% to the annual electricity consumption to account for T & D losses.

Total T & D losses for Durham Academy were approximately 57.9108 mT CO2e.

GreenPlaces also included emissions for well-to-tank (WTT) generation and well-to-tank T & D losses for electricity (UK DEFRA, 2022). Total WTT emissions came to 420.8045 mT CO2e.

Well-to-tank emissions were included for natural gas and mobile combustion. Total WTT emissions from natural gas came to 78.2019 mT CO_2e, and total WTT emissions from mobile combustion came to 20.6588 mT CO_2e (UK DEFRA, 2022).

Total emissions from T & D and WTT losses came to **577.6761mT CO_2e**. There is a fair to large amount of uncertainty associated with these calculations.

4.5 Category 5: Waste & Water Generated in Operations

Waste Generated in Operations: Durham Academy

Waste:

The client was able to provide waste bills for all three schools (lower, middle, and upper) and was able to provide compost data for the middle and upper schools.

GreenPlaces went through all waste bills for each school to determine the total gallons of mixed recycling and total cubic yards of mixed solid waste and corrugated cardboard produced in fiscal year 2023.

Once the total volume of waste per school was calculated, the volume was converted to short tons of waste based on waste type (EPA, 2016). All landfilled waste was assumed to be mixed solid waste (MSW), all recycled waste was assumed to be mixed recyclables, all cardboard waste was assumed to be corrugated cardboard, and all compost was assumed to be mixed organic material.

Once the total short tons of waste produced per school and per waste type was calculated, emission factors were assigned based on the disposal method of the waste. Total emissions from waste per school are listed below.

- Lower School: 67.5956 mT CO_2e
- Middle School: 124.3385 mT CO_2e
- Upper School: 78.4152 mT CO_2e

Grand total emissions from waste from all schools came to **270.3492 mT CO_2e**. As primary data was provided, there is only a small to fair amount of uncertainty associated with these calculations.

Water:

The client was able to provide water usage across several meters. For some meters, there were missing months of data where the average water usage for months where data was provided was applied.

Once total water usage was calculated per meter, the emission factor for water was applied (ecoinvent, n.d.). Total emissions from water came to **23.1475 mT CO_2e**. As primary data was applied and estimates were only applied for a few missing months of data, there is a small to fair amount of uncertainty associated with these calculations.

4.6 Category 6: Business Travel

Business Travel: Durham Academy

Business travel data was a mix of distance-based and spend-based. Distance-based data was provided for flights, bus transport, and subway. GreenPlaces summed the total distance traveled via each mode of transportation and then applied the specific emission factor to the total mileage to calculate emissions. As primary data was provided here, there is only a small amount of uncertainty.

Spend-based business travel data was provided for hotels, ground transport, and flights. GreenPlaces then applied the appropriate emission factors (CEDA, 2022) to the total spend per category to calculate emissions. As spend-based data was used for these calculations, there is a fair to large amount of uncertainty.

Total emissions per business travel category is provided below in mT CO_2e.

- Flights: 383.9036
- Ground Transport: 16.9075
- Hotels: 27.4842

Total emissions from business travel are **428.2953 mT CO_2e.**

4.7 Category 7: Employee Commute

Employee Commute: Durham Academy

The client was able to provide a commuter survey for all faculty and students to complete. Of the 277 total faculty employees, only 86 responded to the commuter survey. For the 459 total upper school students; 295 responded to the survey. For the 390 total middle school students; 387 responded to the survey. Lastly; for the 398 lower school students; 84 responded to the survey. Greenplaces used the responses to determine the annual miles traveled per commute method for faculty members and for students from each of the three schools..

GreenPlaces then used the responses to create an average commute distance and commute method breakdown for the remaining faculty members and students per school who did not respond to the survey.

Following these methods, total emissions from employee and student commuting came to **808.3616 mT CO_2e.** A breakdown of emissions per school and for faculty members is as follows in mT CO_2e.

Faculty Commute: 229.1285
Upper School: 242.0548
Middle School: 148.7461
Lower School: 134.1880
Faculty (summer): 32.1515
Students (summer): 22.0927

It should be noted that the employee commute data from 2022 for summer school was also included in calculations. As a mix of primary data and estimates was applied to calculate emissions, there is a fair amount of uncertainty. It should be noted that student commuting was included, however it falls out of Durham Academy's control and does not need to be reported.

Assessment Results

Based on the information provided and the analysis conducted, and subject to the attached Statement of Limiting Conditions, we have concluded that Durham Academy's scope 1 and 2 emissions, with market-based method purchased electricity, as of the assessment date are: 1,593.9529 mT of CO_2e. Scope 3 emissions as of this assessment date are approximately 6,042.9808 mT CO_2e. It should be noted that this is likely a conservative number as not all emission scopes were accounted for.

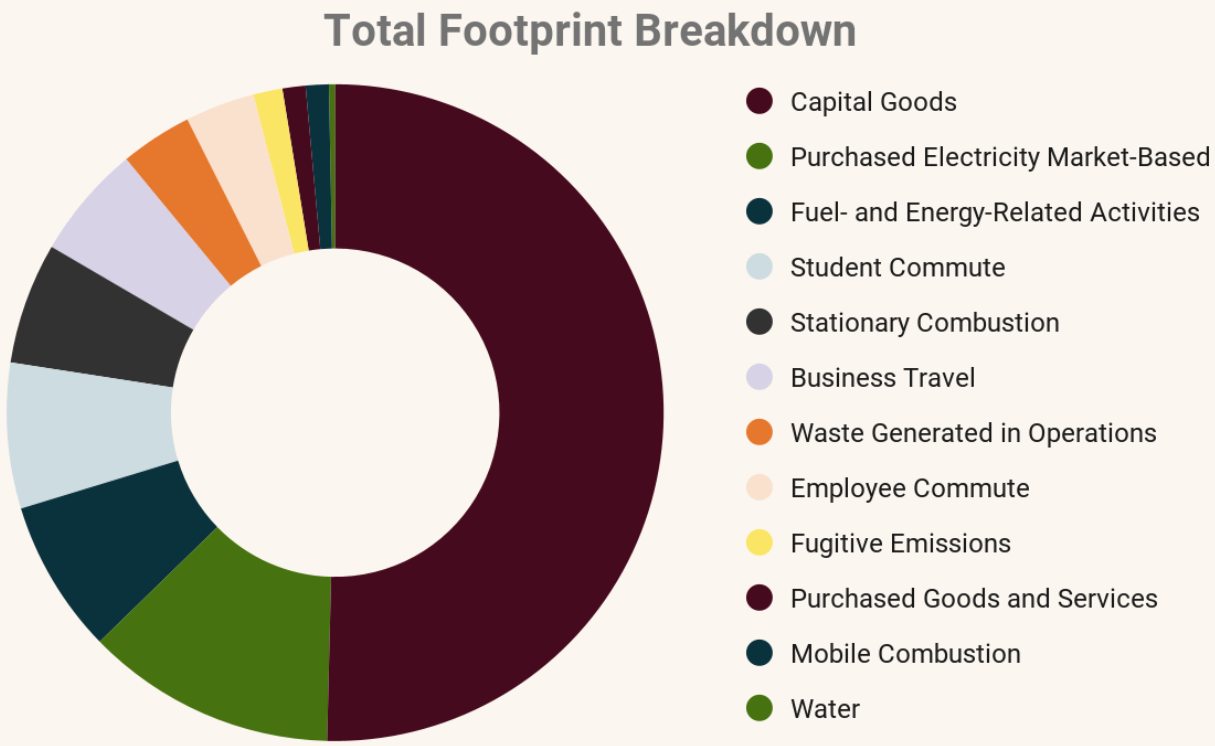
Total emissions are:

7,636.9336 mT of CO_2e

[Visual breakdown by category, next pg.]

Total emissions are:

7,636.9336 mT of CO_2e



Capital Goods 50.39%

These are the scope 3 emissions that come from capital improvement projects. ~3,848.41 mT CO_2e

Electricity 12.33%

These are the scope 2 emissions that come from the electricity your business purchases. ~941.29 mT CO_2e

Transmission & Distribution Losses 7.56%

These scope 3 emissions in the category Fuel- and Energy-Related Activities, come from electricity lost along the utility chain process. ~577.6761 mT CO_2e

Student Commute 7.16%
These are the scope 3 emissions that come from the school students' commutes to work. We consider local transit patterns in these scope 3 calculations. ~547.08 mT CO_2e

Stationary Combustion 5.97%
These are scope 1 emissions from natural gas burned on site. ~456.3045 mT CO_2e

Business Travel 5.61%
These scope 3 emissions include flights, hotels, ground transit, and trains ~428.2953 mT CO_2e

Waste 3.54%
These are the scope 3 emissions that come from the processing of waste generated on site. ~270.3492 mT CO_2e

Employee Commute 3.42%
These are the scope 3 emissions that come from the company employees' commutes to work. We consider local transit patterns in these scope 3 calculations. ~261.2801 mT CO_2e

Fugitive Emissions 1.44%
These are scope 1 emissions from operational leakage of refrigerants. ~109.6302 mT CO_2e

Purchased Goods & Services 1.14%
These are the scope 3 emissions that come from the things your business purchases to operate. ~86.7426 mT CO_2e

Mobile Combustion 1.14%
These are scope 1 emissions from company-owned vehicles. ~86.7249 mT CO_2e

Water 0.30%
These are scope 3 emissions from water consumed site. ~23.15 mT CO_2e

Documentation

When conducting carbon assessments, GreenPlaces recommends that clients include any verifying documentation of carbon emissions, REC, and carbon credit purchases as applicable.

Statement of Limiting Conditions

1. This Carbon Assessment is valid only for the stated purpose and as of the date of its completion.
2. Information provided by the client or its representatives has been accepted by GreenPlaces without verification and is not audited, reviewed, or otherwise validated. The carbon footprint arrived at herein is based on such information.
3. GreenPlaces has obtained certain information regarding GHG from public sources that it believes to be reliable. However, GreenPlaces makes no representation regarding the accuracy or completeness of such information and has not taken action to corroborate such information.
4. This Carbon Assessment does not constitute an environmental site assessment, and GreenPlaces takes no responsibility for identifying any actual or potential environmental liabilities or contamination on or associated with the Client's property.
5. The prior written consent of GreenPlaces is required before all or any part of the contents of this Carbon Assessment may be disseminated to the public or reproduced or distributed to any third parties. Any modification of this Carbon Assessment requires the prior written consent of GreenPlaces.

Works Cited

EPA GHG Emissions Factor Hub, 2023.

European Commission (2013). EU buildings factsheets - energy european commission. Energy - European Commission. (2016, November 17). Retrieved July 15, 2022, from https://ec.europa.eu/energy/eu-buildings-factsheets_en%202018%20to,most%20common%20means%20of%20commuting.

Suh, S. (2010). Comprehensive Environmental Data Archive (CEDA). In J. Murray & R. Wood (Eds.), The Sustainability Practitioner's Guide to Input-Output Analysis (pp. 111-123). Urbana-Champaign, IL: Common Ground Publishing.

World Resources Institute. (2015). GHG Protocol Scope 2 Guidance. Greenhouse Gas Protocol.

World Resources Institute. (2018). Technical Guidance for Calculating Scope 3 Emissions. Greenhouse Gas Protocol

Scribd. (2021). *SASB Standards*. conEdison. Retrieved January 5, 2023, from https://www.scribd.com/doc/40011849/Accounting-Standards-Final-Project-Report

UK DEFRA. (2022, September 20). Greenhouse gas reporting: Conversion factors 2022. Department for Energy Security and Net Zero. https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2022

Volume-to-weight conversion chart - US EPA. RecycleMania. (n.d.). Retrieved October 21, 2022, from https://archive.epa.gov/wastes/conserve/tools/rogo/web/pdf/volume-weight-conversions.pdf

US Department of Energy. (n.d.). *Gas Mileage of 2019 Chevrolet Silverado*. WWW.Fueleconomy.gov. Retrieved November 16, 2022, from https://fueleconomy.gov/feg/bymodel/2019_Chevrolet_Silverado.shtml

US Department of Energy. (n.d.). *WWW.Fueleconomy.com*. 2012 Kia Forte Eco. Retrieved November 16, 2022, from https://fueleconomy.gov/feg/Find.do?action=sbs&id=31752

1999 Dodge Dakota Information, Specs, reviews, ratings, and cars for sale on Autos Marketplace. MSN. (n.d.). Retrieved November 16, 2022, from https://www.msn.com/en-us/autos/marketplace/v/1999_dodge_dakota?form=SNAPS8&sid=134a1ddd-8135-d610-e45a-4c3d96ce8f2a

Fuelly. 2009 Chevrolet Silverado 1500 MPG. (n.d.). Retrieved November 16, 2022, from https://www.fuelly.com/car/chevrolet/silverado_1500/2009?page=4#:~:text=2009%20Chevrolet%20Silverado%201500%20MPG%20Based%20on%20data,of%20the%20fuel-ups%20with%20458%20outliers%20%282.78%25%29%20removed.

Fuelly. 2007 Chevrolet Suburban 2500 MPG. (n.d.). Retrieved November 16, 2022, from https://www.fuelly.com/car/chevrolet/suburban_2500/2007#:~:text=2007%20Chevrolet%20Suburban%202500%20MPG%20Based%20on%20data,of%20the%20fuel-ups%20with%2052%20outliers%20%287.91%25%29%20removed.

US Department of Energy. (n.d.). *WWW.Fueleconomy.com*. Fuel Economy of 2014 Jeep Cherokee+4WD. Retrieved November 16, 2022, from https://fueleconomy.gov/feg/PowerSearch.do?action=noform&srchtyp=ymm&path=1&year1=2014&year2=2014&make=Jeep&model=Cherokee%2B4WD

Pendergast, M. (n.d.). *John Deere Gator 6X4 specifications*. Hunker. Retrieved November 16, 2022, from https://www.hunker.com/13426018/john-deere-gator-6x4-specifications

Media, B. (n.d.). *How can a commercial landscaper calculate fuel cost for lawn mowers?* Koenig Equipment. Retrieved November 16, 2022, from https://www.koenigequipment.com/blog/how-can-commercial-landscaper-calculate-fuel-cost-lawn-mowers#:~:text=Most%20of%20our%20John%20Deere%20commercial%20mowers%20have,efficiency.%20Our%20commercial%20mowers%20will%20average%201.1-1.9%20gallons%2Fhour.

Roberts, D. (2017, May 20). *Exmark X series fuel consumption*. Lawn Care Forum. Retrieved November 16, 2022, from https://www.lawnsite.com/threads/exmark-x-series-fuel-consumption.468420/

How much gas does a lawn mower use per hour. GreeLand. (2022, March 3). Retrieved November 16, 2022, from https://www.treelawncareservices.us/how-much-gas-does-a-lawn-mower-use-per-hour/

Review form revised after interviews and best and final offers. RFP Review Sheet. (n.d.). Retrieved November 16, 2022, from http://concordnh.gov/DocumentCenter/View/3085/RFP-05-14-Review-Form-Revised-after-Interviews-and-Best-and-Final-Offers-2?bidId=

The Farming Forum. (2017, January 24). *Hedge cutting fuel per hour*. The Farming Forum. Retrieved November 16, 2022, from https://thefarmingforum.co.uk/index.php?threads%2Fhedge-cutting-fuel-per-hour.154978%2F

How to mix gas for a leaf blower- The ultimate guide. Garden Tool Expert. (2020, April 17). Retrieved November 16, 2022, from https://www.gardentoolexpert.com/how-to-mix-gas-for-a-leaf-blower-the-ultimate-guide/#:~:text=Typically%2C%20all%20gas%20leaf%20blowers%20are%20designed%20to,engine%20oil%20to%20about%20one%20gallon%20of%20gas.

Oil gas ratio for chainsaw. Just Chainsaws. (2021, April 18). Retrieved November 16, 2022, from https://justchainsaws.com/oil-gas-ratio-for-chainsaw/#:~:text=A%20chainsaw%20is%20a%20great%20tool%20for%20cutting,work%20per%20gallon%20of%20gasoline%20has%20been%20reported.

TractorByNet - Tractor Forum. (2006, December 20). *General rule for gal/hour fuel consumption*. TractorByNet. Retrieved November 16, 2022, from https://www.tractorbynet.com/forums/threads/general-rule-for-gal-hour-fuel-consumption.91521/#:~:text=It%20appears%20that%20running%20at%20full%20capacity%20using,3%201%2F4%20gallons%20per%20hour.%20Hopefully%20this%20helps.

Laughlin, M. (2004, April). *Economic Analysis of Alternative Fuel School Buses* . Clean Cities. Retrieved November 16, 2022, from https://afdc.energy.gov/files/pdfs/school_bus_economic_anal.pdf

Ecoinvent database. ecoinvent. (2022, October 18). Retrieved December 10, 2022, from https://ecoinvent.org/the-ecoinvent-database/

Carbon Emissions Education. Duke Energy. (n.d.). Retrieved December 11, 2022, from https://www.duke-energy.com/energy-education/energy-savings-and-efficiency/calculate-your-carbon-footprint

Georg, S. (n.d.). Distance . www.distance.to. Retrieved November 28, 2022, from https://www.distance.to/RDU,Raleigh-Durham,NC,USA/MSP,4300-Glumack-Dr,Saint-Paul,MN,55111,USA

Estimating energy consumption & GHG emissions for Remote Workers - Anthesis. White Paper. (2021, February). Retrieved December 12, 2022, from https://www.anthesisgroup.com/wp-content/uploads/2021/02/Anthesis_-Remote-Worker-Emissions-Methodology_Feb-2021.pdf

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