FY-2019

Greenhouse Gas Inventory Report

Principal Author

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Special Acknowledgments

Florida Tech would like to recognize students Hannah Vest, Iven Webb and Joseph Luya for their dedication and efforts to perform the very first greenhouse gas (GHG) inventory for their 2019 senior design capstone project. The commitment that is shown by the students of the institution to better their community, environment and future is what separates them from their peers in the rest of the world. They have truly embodied the relentless pursuit of greatness we instill in our alumni.

About the Authors and Contributors

Quinn Duffy, Planning and Sustainability Specialist

Duffy has served as the sustainability coordinator in the Office of Facilities Operations at Florida Tech since 2019. A recent graduate of Florida Tech with a Bachelor of Science in Civil Engineering and a minor in sustainability, he is continuing with his education at Florida Tech where he hopes to transform the campus environment and mindset.

Ana Castañeda, Student

Castañeda is a student from Colombia studying sustainability, working as a sustainability technician for Facilities Operations and serving in the Student Organization for Sustainable Action (SOSA). Ana is absolutely dedicated to sustainability and the pursuit of best practices, greater action and thoughtful planning.

Suzy Daigle, Business Manager

Daigle is a graduate of the University of Louisiana at Lafayette with a Bachelor of Science in General Studies and serves as the secretary of the University Sustainability Council. Suzy is a huge supporter of sustainability and assists in the tracking, collection and validation of the data collected for our certifications, programs and award proposals.

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Florida Tech Faculty, Staff and Contributors

Ken Lindeman, Ph.D.; Student Organization for Student Action; Taylor Greene; Lee Martucci; Damon Hart; Jeff Sherman; Steve Czagas; G. Dewey Yeatts, Ph.D.; Chad Shoultz; Cheryl LeBlanc; Carlos Rivera; Chrystal Hillary and many more

Executive Summary

Florida Tech remains committed to the relentless pursuit of greatness through our sustainability initiatives. In order to provide a quantitative benchmark of our success and operate within best practices, the university has performed its first official GHG Inventory for the 2019 fiscal year (May 1, 2018, to April 30, 2019).

The following report will outline and define the values collected from our campus operations and recorded in the University of New Hampshire Sustainability Indicator Management & Analysis Program (SIMAP). This allows Florida Tech to have its data verified by a third party in order to utilize it as a published report for the Association for Advancement of Sustainability in Higher Education (AASHE) Sustainability Tracking Assessment & Reporting System (STARS).

The university produced 34,345 MTCO2 during the reporting period, and this period will serve as the baseline year until the previous year can be completed.

According to the United States Environmental Protection Agency (EPA) Energy Utilization Index (EUI, Zone-6 Education) the university is approximately 40% below the mean index number. Table 1 outlines the overall summary of Scope 1, Scope 2 and Scope 3 reported data.

Source	Amount (Unit)	Emissions (MTCDE)
Scope 1 (Total)		
Stationary Fuels	10,346 MMBtu	550.36
Transport Fuels	Varies	87.12
Fertilizer	5,250 lb	2.83
Refrigerants & Chemicals	Varies	314.21
Scope 2 (Total)		
Utilities	28.0 GWh	13,993.88
Renewable Energy	-31 MWh	-17.36
Scope 3 (Total)		
Commuting	Varies	15644.75
Food	1,068,707 lb	2548.42
Paper	5,642 reams	33.49
Waste	2,486,400 lb	431.64
Wastewater	49,072,400 gal	21.20
Sinks (Total)		
Non-Additional Sequestration	26.2 acres	3,864
Total Emissions	**34,345**	

Table 1: Executive Summary of Emissions

Inventory Parameters & Boundaries

Methods

Boundaries: This inventory's parameters were defined using "The Greenhouse Gas Protocol" (World Resources Institute, 2004). This report is centered around a financial control approach, meaning data was collected on items, entities and operations that Florida Tech has financial control over, including FIT Aviation Inc. and FIT Museums Inc. Some data was not able to be collected due to the lack of or inaccurately maintained records, leading to slightly deviated final results. Efforts will be made to correct the reporting standards for the next reporting period.

Baseline Year: The baseline year for this inventory is fiscal year 2019 (FY19). The fiscal year at Florida Tech runs from May 1 to April 31 each year. FY19 was chosen because at the start of the initial data collection it was the only complete fiscal year with appropriate data. Historic data will be included when available to show trends over the long term.

Boundary Conditions and Limitations: This report will take a financial control approach to the inventory. Under a financial control approach, the inventory would include anything that Florida Tech "has the full authority to introduce and implement its operating policies at the operation." (World Resources Institute, 2004)

Definition of Scopes: The categorization of various emission sources is outlined by the greenhouse gas protocol:

Scope 1: These are direct campus emissions that arise for on-site sources, including items such as fossil fuels, fertilizer, refrigerants and chemicals.

Scope 2: Purchased electricity & Renewable Energy Credits (RECs) make up the whole of this scope.

Scope 3: Indirect emissions from activities associated with travel, user experience and day-to-day operations, including items such as commuting, food, paper, etc.

Institutional Parameters

Florida Tech is a private, not-for-profit, doctoral-granting research university located in and around Melbourne, Florida. The educational institution is located in a mid-size city classified as IECC Zone-2 (hot) and classified as an independent educational facility in the State of Florida (International Code Council, 2015).

The main campus and Melbourne sites are considered to incorporate over 135 acres of land; 2 million square feet of gross building space; 4,685 full-time students; 775 employees and 357 faculty members. The total operating budget for FY19 was $197 million, with $2.6 million for research and $3.5 million for energy (Florida Institute of Technology, 2020).

Florida Tech is a 501(c)3 charitable educational organization under IRS tax law and operates with subsidiaries, primarily FIT Aviation Inc. and FIT Museums Inc. as separate entities under operational and financial control of the university (State of Florida Department of State, 2020).

Scope 1 Emissions Inventory

Stationary Fuels—Natural Gas

Initial natural gas information was only available as an amount purchased. Historic records of natural gas prices were used to estimate the amount used by Florida Tech. These values can be found on the U.S. Energy Information Administration (EIA) website ("Natural Gas Prices"). The conversion factors for finding the equivalent CO_2 emissions from the natural gas can also be found on the U.S. EIA website ("U.S. EIA Independent Statistics and Analysis."). Natural gas was assumed as noncogenerated natural gas. These numbers reflect usage for HVAC, back-up generators and laboratory use.

Conversion Factors

CO_2 53.02 kg CO_2 / MMBtu

Calculation Method

$$(10{,}346\ \text{MMBtu}) \times \left(\frac{53.02\ \text{kg CO}_2}{1\ \text{MMBtu}} \right) = 548{,}545\ \text{kg CO}_2$$

Generated Alternative Energy—Solar Production

Emissions related to sold alternative-produced electricity are calculated with respect to how much kWh the campus produces and returns to the grid. Florida Institute of Technology produces solar energy utilizing two arrays: a small array on the Facilities Transportation Depot and a larger array on the Olin Engineering Complex roof. The annual capacity of each array is 14,773 and 16,782 kWh, respectively. Data on the average production of the panels utilizing weather, location and historical trends were calculated using the PVWatts Calculator from the National Renewable Energy Laboratory (Alliance for Sustainable Energy LLC, 2020).

Conversion Factors

CO_2 0.55000 kg CO_2 / kWh

Calculation Method

$$(-31{,}355\ \text{kWh}) \times \left(\frac{550\ \text{g CO}_2}{1\ \text{kWh}} \right) \times \left(\frac{1}{1{,}000{,}000\ \text{g/eMT}} \right) = -17.35\ \text{eMT CO}_2$$

Transportation Fuels—Campus Fleet Gasoline

Florida Tech owns and operates many gasoline-fueled vehicles. The exact fuel usage of each vehicle is unknown, so emissions were calculated based on total fuel purchased. All campus gasoline vehicles draw gas from one central tank.

Conversion Factors

CO_2 8.86650 kg CO_2 / gal

Calculation Method

$$(36{,}076.00 \text{ gal}) \times \left(\frac{8.6650 \text{ kg } CO_2}{1 \text{ gal}} \right) = 319{,}867 \text{ kg } CO_2$$

Transportation Fuels—Campus Fleet Diesel

Florida Tech owns and operates many diesel-fueled vehicles. The exact fuel usage of each vehicle is unknown, so emissions were calculated based on total fuel purchased. All campus diesel vehicles draw gas from one central tank.

Conversion Factors

CO_2 10.2570 kg CO_2 / gal

Calculation Method

$$(1{,}000.00 \text{ gal}) \times \left(\frac{10.2570 \text{ kg } CO_2}{1 \text{ gal}} \right) = 10{,}257 \text{ kg } CO_2$$

Transportation Fuels—Campus Generators

Florida Tech owns and operates diesel emergency power back-up generators. These generators are serviced and filled with diesel regularly from the same fuel vendor that services the campus diesel tank.

Conversion Factors

CO_2 10.2570 kg CO_2 / gal

Calculation Method

$$(785.00 \text{ gal}) \times \left(\frac{10.2570 \text{ kg } CO_2}{1 \text{ gal}} \right) = 8{,}052 \text{ kg } CO_2$$

Transportation Fuels—Campus Fleet Other Fuels

Florida Tech owns and operates many vehicles other than typical campus fleet gasoline-, diesel-, generator- or aviation-fueled units. These numbers reflect the off-road vehicles utilized by the Office of Facilities Operations to maintain our campus day-to-day operations. These vehicles include heavy equipment, golf carts, lifts, etc.

Conversion Factors

CO_2 10.2570 kg CO_2 / gal

Calculation Method

$$(399.50 \text{ gal}) \times \left(\frac{10.2570 \text{ kg } CO_2}{1 \text{ gal}} \right) = 4{,}098 \text{ kg } CO_2$$

Transportation Fuels—FIT Aviation Fuel

Emissions related to the flight school are calculated based on the amount of fuel burned in order to operate all airplanes in service. This calculation does not take into account the different efficiencies of different aircrafts or the type of engine used in each plane. Avgas use information was provided by the accounting office of FIT Aviation for fiscal years 15 through 18.

Conversion Factors

CO_2 8.30543 kg CO_2 / gal

Calculation Method

$$(65{,}600 \text{ gal}) \times \left(\frac{8.30543 \text{ kg } CO_2}{1 \text{ gal}} \right) = 544{,}836 \text{ kg } CO_2$$

Fertilizer

Fertilizer usage primarily releases traceable amounts of CO_2. Florida Tech minimizes the use of fertilizers by adhering to a strict schedule for their use. Fertilizers are used twice yearly to maintain the campus greenery.

Conversion Factors

CO_2 0.00053 kg CO_2 / lb

Calculation Method

$$(5{,}250 \text{ lb}) \times \left(\frac{0.00053 \text{ kg } CO_2}{1 \text{ lb}} \right) = 2.83 \text{ kg } CO_2$$

Refrigerants

Refrigerants and chemicals that are used on campus in the operations of HVAC systems include multiple refrigerant agents that comply with current laws and standards. The inventory of these refrigerants is based on the capacity of the current building HVAC unit inventory, our chilled-water plants and other refrigeration units.

Conversion Factors

CO_2 0.86084 kg CO_2 / lb

Calculation Method

$$(365 \text{ lb}) \times \left(\frac{0.86084 \text{ kg } CO_2}{1 \text{ lb}} \right) = 314.21 \text{ kg } CO_2$$

Scope 2 Emissions Inventory

Purchased Electricity

Emissions related to purchased electricity are calculated with respect to how much kWh the campus consumes. Florida Tech acquires its electricity from Florida Power and Light (FPL); more specifically, the Cape Canaveral plant, which runs on natural gas.

Conversion Factors

CO_2 0.44956 kg CO_2 / kWh

Calculation Method

$$(28{,}012{,}030 \text{ kWh}) \times \left(\frac{499.56 \text{ g } CO_2}{1 \text{ kWh}} \right) \times \left(\frac{1}{1{,}000{,}000 \text{ g/eMT}} \right) = 13{,}993.88 \text{ eMT } CO_2$$

Generated Alternative Energy—Solar Production

Emissions related to sold alternative-produced electricity are calculated with respect to how much kWh the campus produces and returns to the grid. Florida Tech produces solar energy utilizing two arrays: a small array on the Facilities Transportation Depot and a larger on the Olin Engineering Complex roof. The annual capacity of each array are 14,773 and 16,782 kWh, respectively. Data on the average production of the panels utilizing weather, location and historical trends was calculated using the PVWatts Calculator from the National Renewable Energy Laboratory.

Conversion Factors

CO_2 0.44956 kg CO_2 / kWh

Calculation Method

$$(-31{,}555 \text{ kWh}) \times \left(\frac{499.56 \text{ g } CO_2}{1 \text{ kWh}} \right) \times \left(\frac{1}{1{,}000{,}000 \text{ g/eMT}} \right) = -17.35 \text{ eMT } CO_2$$

Scope 3 Emissions Inventory

Commuting

This category of emissions is based on the best available data, campus experience and professional recommendations that several departments on campus were able to provide. We estimate that of our faculty, staff and students who commute to and from campus daily, the below conversion factors are as accurate as possible.

Conversion Factors

Automobile: 92.5%—20 mi/trip

Bicycle: 4%—5 mi/trip

Carpool: 1%—20 mi/trip

Commuter Rail: 0%—0 mi/trip

Light Rail: 0%—0 mi/trip

Public Bus: 2%—15 mi/trip

Walk: 0.5%—5 mi/trip

Commuters

Faculty Commuters (400)

Staff Commuters (800)

Student Commuters (2,286)

Weekly Commuting Trips (10)

Commuting Weeks (45)

***Total Estimated GHG MTCDE:* 7,573.54**

Student Travel

This category of emissions is based on the best available data, campus experience and professional recommendations that several departments on campus were able to provide. We have estimated the average yearly traveling methods of our on-campus students who travel to and from home between semesters.

Conversion Factors

Air Travel: 67%

Automobile: 20%—900 mi/trip - 6 trips annually

Carpool: 10%—900 mi/trip - 6 trips annually

Rail: 2%—900 mi/trip - 6 trips annually

Public Bus: 1%—900 mi/trip - 6 trips annually

Commuters

Student Commuters (1648)

***Total Estimated GHG MTCDE:* 3,766**

Food Purchasing & Usage

The food purchasing and overall usage by a university campus is substantial, and it's very difficult to track the exact amount of meats, fruits and vegetables arriving from multiple vendors at multiple sites. Utilizing data from the Office of Dining Services, we were able to account for 80% of our food purchasing for the fiscal year in a semi-detailed format with general shipped weights of the food stuffs ordered. The conversion factors are listed below.

Conversion Factors

Beans: 0.78000 kg eCO_2/kg food

Beef: 26.45000 kg eCO_2/kg food

Cheese: 9.78000 kg eCO_2/kg food

Coffee and Tea: 5.05000 kg eCO_2/kg food

Eggs: 3.54000 kg eCO_2/kg food

Fish: 3.83000 kg eCO_2/kg food

Fruits: 0.36000 kg eCO_2/kg food

Grains: 0.86000 kg eCO_2/kg food

Liquids: 1.03000 kg eCO_2/kg food

Milk: 1.34000 kg $eCCO_2$/kg food

Nuts: 1.17000 kg eCO_2/kg food

Pork: 6.87000 kg eCO_2/kg food

Potatoes: 0.21000 kg eCO_2/kg food

Spices: 0.73000 kg eCO_2/kg food

Sugars: 0.93000 kg eCO_2/kg food

Vegetables: 0.73000 kg eCO_2/kg food

Overall food purchased

1,068,707 lb 0.453592 kg/lb = 484757.341

***Overall GHG MTCDE:* 2,548.42**

Food Weight, 2019

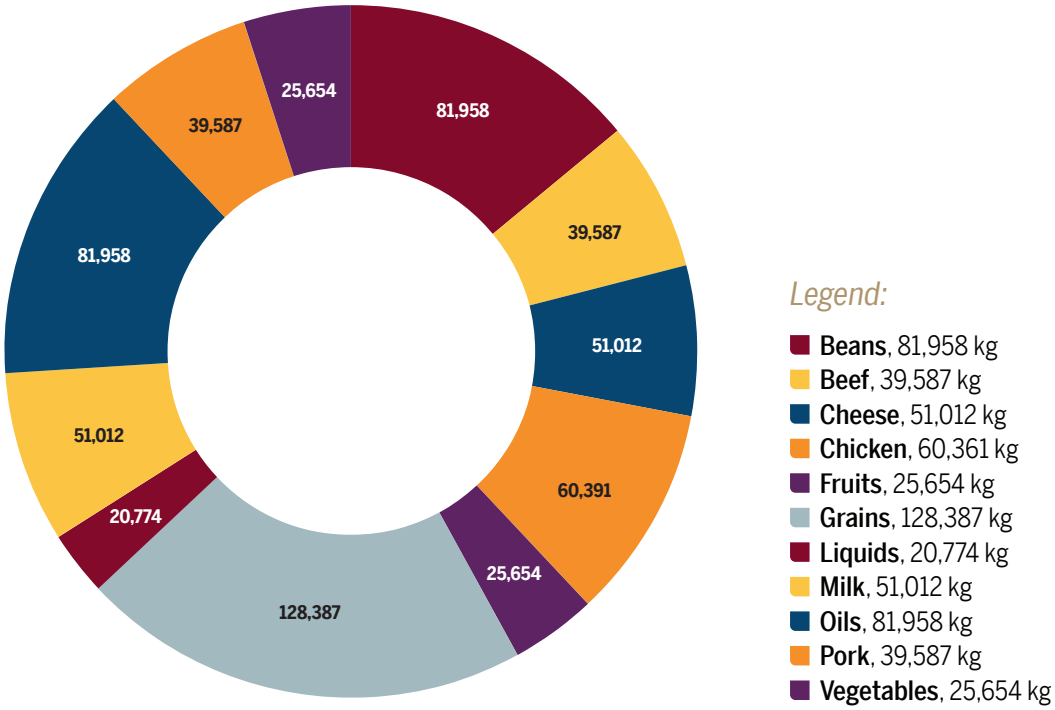

Figure 1: FY-2019 Food Weight Breakdown

Food-Related Emissions, 2019

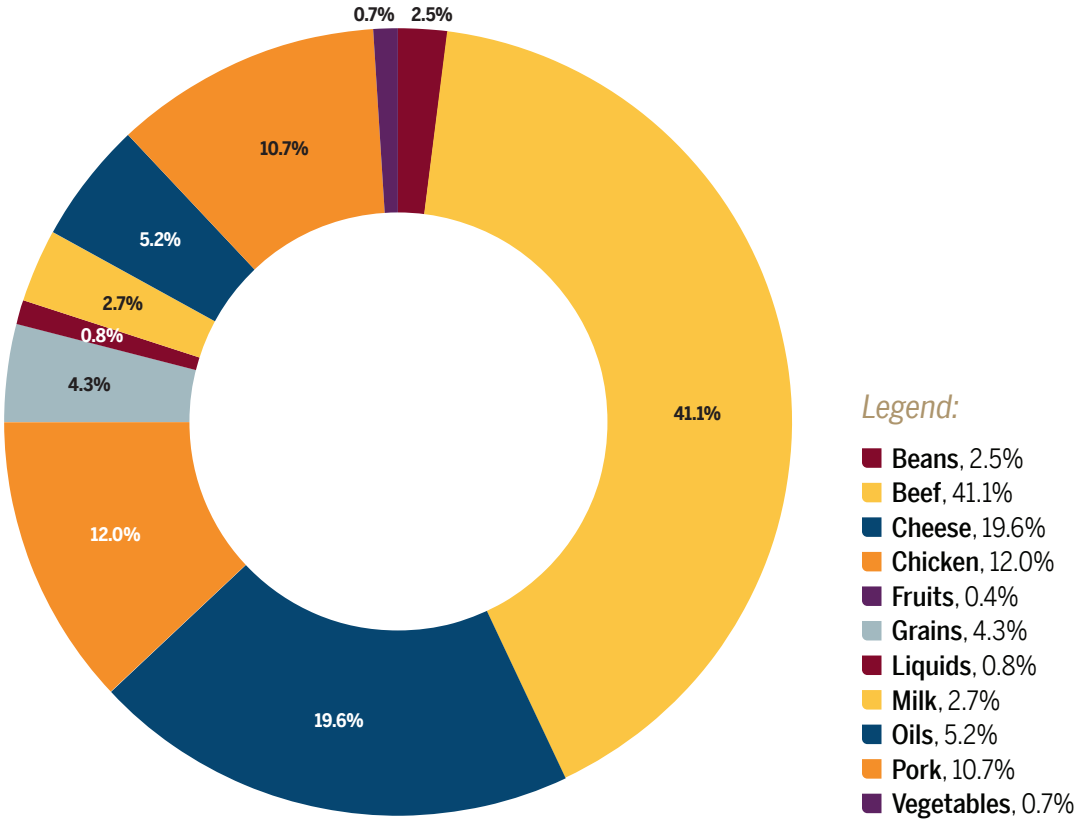

Figure 2: FY-2019 Food Carbon Emissions Breakdown

Paper Purchasing

The data collected from the campus community on paper purchasing is reflected by the total quantity of paper used by the university in reams. Data was collected from our campus printer/copier fleet and the Copy Center ordering information. We are confident that this will account for more than 90% of our paper purchasing, less the units that are not registered on the campus system. Below are the conversion factors for paper purchasing.

Conversion Factors

CO_2 0.00593 kg CO_2 / ream

Calculation Method

$$(5{,}642 \text{ reams}) \times \left(\frac{0.00593 \text{ kg } CO_2}{1 \text{ ream}} \right) = 34 \text{ eMT } CO_2$$

Waste and Wastewater

Waste and wastewater data is collected from the production and collection of landfill waste and central treatment-bound wastewater. Our primary sources of data are the City of Melbourne and Waste Management. The treatment plant is classified as aerobic, and the landfill in our county is a non-CH_4 recovery landfill. The conversion factors are listed below.

Conversion Factors

CO_2	0.000000432 kg CO_2 / gal
CO_2	0.0001736 kg CO_2 / pound

Calculation Method

$$(49{,}072{,}400 \text{ gal}) \times \left(\frac{0.000000432 \text{ kg } CO_2}{1 \text{ gal}}\right) = 21.21 \text{ kg } CO_2 \text{ wastewater}$$

$$(2{,}486{,}400 \text{ lb}) \times \left(\frac{0.0001736 \text{ kg } CO_2}{1 \text{ lb}}\right) = 431.64 \text{ kg } CO_2 \text{ waste}$$

Carbon Sinks and Sequestration

Nonadditional Sequestration

The Florida Tech campus is situated in a geographic location that straddles a small flowing body of water called Crane Creek, which feeds into the Indian River Lagoon. This means that a significant portion of wetlands exists on campus (26.02 acres), a portion of which is protected within the Joy & Gordon Patterson Botanical Garden (19.4 acres). These wetlands serve as a carbon sequestration for our campus footprint and a sponge for any emissions that occur. Although it does not subtract from the overall footprint, it is nonadditional sequestration. The conversion factors are listed below.

Conversion Factors

CO_2	148.5 kg CO_2 / acre

Calculation Method

$$(26.02 \text{ acres}) \times \left(\frac{-148.5 \text{ kg } CO_2}{1 \text{ acre}}\right) = -3{,}864 \text{ eMT } CO_2$$

Summary

This is the first of what will become annual reporting of Florida Tech's greenhouse gas emissions (GHG) for our entire campus operations. The first year will serve as an inaugural exercise of the collection of data, encouraging the participation of various campus departments and the involvement of our management system to recognize the significance of understanding the numbers that back up our operational qualities. Florida Tech has produced a net 34,345.34 metric tons carbon dioxide equivalent (MTCDE) of emissions for the 2019 fiscal year.

In comparison to universities of similar size, Florida Tech emits at a less-than-average rate. For example, Rice University in Houston, Texas, has about 4,000 undergraduate students, and gross Scope 1 and Scope 2 emissions from FY 2018 were 108,443 MTCDE (27.11 MTCDE/student). University of Florida, which is one of the sustainability leaders in Florida, incurred about 363,581 MTDCE from Scope 1 and Scope 2 sources for 51,887 students (7.01 MTCDE/student). Florida Tech produced a total of 14,948.40 Scope 1 and Scope 2 emissions for the same year for 4,685 students (3.19 MTCDE/student).

Overall, Florida Tech can always do better to lessen the impact it has on the local community, environment and overall health of the university, but it has made significant improvements in the last few years to be one of the cleanest universities in Florida.

Total Carbon, 2019

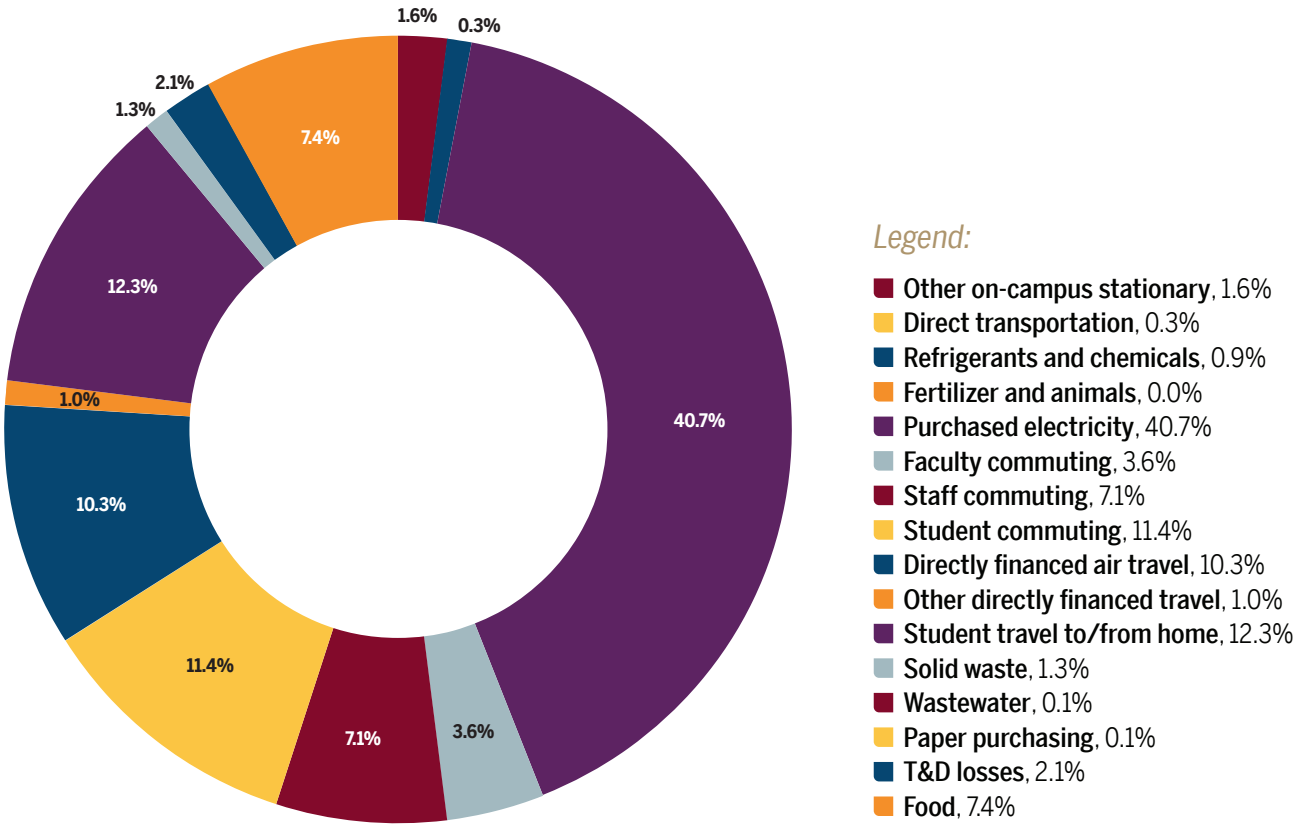

Figure 3: Total FY-2019 Carbon Emissions Breakdown

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Sources

1— Facilities Operations Electrical Department

2— Facilities Operations Transportation Department

3— Facilities Operations Transportation Department

4— Facilities Operations Transportation Department

5— Facilities Operations Transportation Department

6— Facilities Operations Transportation Department

7— Facilities Operations Grounds Department

8— Facilities Operations HVAC Department

9— Facilities Operations Accounts Payable Specialist

10—Facilities Operations Sustainability Coordinator

11— Florida Tech Human Resources, OIR, Student Life & Facilities Operations

12—Florida Tech Human Resources, OIR, Student Life & Facilities Operations

13—Florida Tech Dining Services & Facilities Operations Sustainability Coordinator

14—Florida Tech Copy Center

15—Facilities Operations Accounts Payable Specialist

16—Facilities Operations Grounds Department & Sustainability Coordinator

Appendix

By Scope

Scope 1, 3% Scope 2, 41% Scope 3, 56%

Figure 4: Total FY-2019 Carbon Emissions by Category

By Gas

CO_2, 98% CH_4, 1% N_2O, 1%

Figure 5: Total FY-2019 Carbon Emissions by Gas

University of New Hampshire SIMAP Collected Raw Data

Source	CO_2 (kg)	CO_2 (MTCDE)	CH_4 (kg)	CH_4 (MTCDE)	N_2O (kg)	N_2O (MTCDE)	GHG MTCDE
Other On-Campus Stationary	548,545	548.54	55	1.53	1	0.29	550.36
Direct Transportation	74,999	75	36	1	42	11.12	87.12
Refrigerants & Chemicals	0	0	0	0	0	0	314.21
Fertilizer & Animals	0	0	0	0	11	2.83	2.83
Purchased Electricity	13,924,581	13,924.58	1,030	28.85	153	40.45	13,993.88
Faculty Commuting	1,211,680	1,211.68	64	1.81	42	11.1	1,224.59
Staff Commuting	2,423,360	2,423.36	130	3.65	84	22.21	2,449.22
Student Commuting	3,858,572	3,858.57	206	5.76	134	35.4	3,899.73
Directly Financed Air Travel	3,517,693	3,517.69	38	1.07	39	10.42	3,529.18
Other Directly Financed Travel	330,858	330.86	18	0.5	12	3.07	334.43
Student Travel to/from Home	4,190,700	4,190.70	64	1.79	57	15.11	4,207.60
Solid Waste	0	0	15,416	431.64	0	0	431.64
Wastewater	0	0	0	0	80	21.2	21.2
Paper Purchasing	0	0	0	0	0	0	33.49
T&D Losses	713,881	713.88	53	1.48	8	2.07	717.43
Food	2,548,421	2,548.42	0	0	0	0	2,548.42

Table 2: FY-2019 Raw Data

University of New Hampshire SIMAP Raw Emissions Data By Scope

Scope	CO_2 (kg)	CH_4 (kg)	N_2O (kg)	GHG MTCDE
1	623,544	90	54	954.52
2	13,924,581	1,030	153	13,993.88
3	18,795,166	15,989	455	19,396.93

Table 3: FY-2019 Emissions Per Scope

University of New Hampshire SIMAP Total Emissions Data

CO_2 (kg)	CH_4 (kg)	N_2O (kg)	Gross MTCDE	Offsets (MTCDE)	Compost (MTCDE)	Non-Additional	Biogenic (MTCDE)	Net MTCDE
33,343,291	17,110	661	34,345.34	0	0	3,864.00	150.27	34,345.34

Table 4: FY-2019 Total Emissions & Net Emissions

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Office of Facilities Operations

Florida Institute of Technology
150 W. University Blvd.
Melbourne, FL 32901-6975