

**DRAFT REPORT**

**FLORIDA TECH FY-2019 GHG REPORT**

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# Executive Summary

**Florida Tech FY-2019 Greenhouse Gas Emission Report**

The Florida Institute of Technology remains committed to the relentless pursuit of greatness through our sustainability initiatives. In order to provide some sort of quantitative benchmark for our success to be measured against and operate within best practices, the University has performed its first official Greenhouse Gas Inventory (GHG) for the 2019 Fiscal Year (May 1st, 2018 to April 30th, 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 the University to have our data verified by a 3rd 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 about 40% below the mean index number. Table 1 outlines the overall summary of Scope 1, Scope 2, and Scope 3 reported data.

Table : Executive Summary of Emissions

|  |  |  |
| --- | --- | --- |
| 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 |

# 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 Institute of Technology has financial control over, including FIT Aviation and FIT Museums. 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 (FY-19). The Fiscal Year at Florida Tech runs from May 1st to April 31st 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.
* Includes items such as: fossil fuels, fertilizer, refrigerants, & chemicals.

Scope 2

* Purchased electricity & Renewable Energy Credits (RECs) makes up the whole of this scope.

Scope 3

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

## Institutional Parameters

Florida Institute of Technology, Inc. and its subsidiaries are a private not-for-profit Doctoral Granting Research University located in and around Melbourne, FL. 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, and a Full Time Enrollment (FTE) student population of 4,685, 775 employees, and 357 faculty members. The total operating budget for FY-19 was $197 million with $2.6 million for research and $3.5 million for energy (Florida Institute of Technology, Inc. , 2020).

Florida Institute of Technology, Inc. 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 price 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 CO2 emissions from the natural gas can also be found on the U.S. EIA website (“U.S. Energy Information Administration - EIA - Independent Statistics and Analysis.”). Natural gas was assumed as Non-cogenerated natural gas. These numbers reflect usage for HVAC, back-up generators, and laboratory use.

*Conversion Factors*

 CO2 53.02 kg CO2 / MMBtu

*Calculation Method*

$$\left(10,346 MMBtu\right) ×\left( \frac{53.02 kg CO\_{2}}{1 MMBtu}\right) = 548,545 kg CO\_{2}$$

**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 on the Olin Engineering Complex roof[[1]](#footnote-1). 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 PVWatts Calculator from the National Renewable Energy Laboratory (Alliance for Sustainable Energy, LLC, 2020).

*Conversion Factors*

 CO2 0.55000 kg CO2 /kWh

*Calculation Method*

$$\left(-31,555 kWh\right) × \left(\frac{550 g CO\_{2}}{1 kWh}\right) × \left(\frac{1}{1,000,000 ^{g}/\_{eMT}}\right) = -17.35 eMT CO\_{2} $$

**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 the total fuel purchased. All campus gasoline vehicles draw the gas they need from one central tank[[2]](#footnote-2).

*Conversion Factors*

 CO2 8.86650 kg CO2 /gal

*Calculation Method*

$$\left(36,076.00 gal\right) × \left(\frac{8.86650 kg CO\_{2}}{1 gal}\right) = 319,867 kg CO\_{2}$$

**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 the total fuel purchased. All campus diesel vehicles draw the gas they need from one central tank[[3]](#footnote-3).

*Conversion Factors*

 CO2 10.2570 kg CO2 /gal

*Calculation Method*

$$\left(1,000.00 gal\right) × \left(\frac{10.2570 kg CO\_{2}}{1 gal}\right) = 10,257 kg CO\_{2}$$

**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[[4]](#footnote-4).

*Conversion Factors*

 CO2 10.2570 kg CO2 /gal

*Calculation Method*

$$\left(785 gal\right) × \left(\frac{10.2570 kg CO\_{2}}{1 gal}\right) = 8,052 kg CO\_{2}$$

**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 University Facilities Operations to maintain our campus day-to-day operations. These vehicles include heavy equipment, golf carts, lifts, etc[[5]](#footnote-5).

*Conversion Factors*

 CO2 10.2570 kg CO2 /gal

*Calculation Method*

$$\left(399.50 gal\right) × \left(\frac{10.2570 kg CO\_{2}}{1 gal}\right) = 4098 kg CO\_{2}$$

**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 Fuel use information was provided by the accounting department of FIT Aviation for fiscal years 15 through 18[[6]](#footnote-6).

*Conversion Factors*

 CO2 8.30543 kg CO2 /gal

*Calculation Method*

$$\left(65,600 gal\right) × \left(\frac{8.30543 kg CO\_{2}}{1 gal}\right) = 544,836 kg CO\_{2}$$

**Fertilizer**

Fertilizer usage primarily releases traceable amounts of CO2. Florida Tech minimizes the use of fertilizers by adhering to a strict schedule for its use. Fertilizers are used twice yearly to maintain the campus greenery[[7]](#footnote-7).

*Conversion Factors*

 CO2 0.00053 kg CO2 /lb

*Calculation Method*

$$\left(5,250 lb\right) × \left(\frac{0.00053 kg CO\_{2}}{1 lb}\right) = 2.83 kg CO\_{2}$$

**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[[8]](#footnote-8).

*Conversion Factors*

 CO2 0.86084 kg CO2 /lb

*Calculation Method*

$$\left(365 lb\right) × \left(\frac{0.86084 kg CO\_{2}}{1 lb}\right) = 314.21 kg CO\_{2}$$

# Scope 2 Emissions Inventory

**Purchased Electricity**

Emissions related to purchased electricity are calculated with respect to how much kWh the campus consumes. Florida Institute of Technology acquires their electricity from Florida Power and Light (FPL), more specifically the Cape Canaveral Plant, which runs on Natural Gas[[9]](#footnote-9).

*Conversion Factors*

 CO2 0.49956 kg CO2 /kWh

*Calculation Method*

$$\left(28,012,030 kWh\right) × \left(\frac{499.56 g CO\_{2}}{1 kWh}\right) × \left(\frac{1}{1,000,000 ^{g}/\_{eMT}}\right) = 13,993.88 eMT CO\_{2}$$

**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 Institute of Technology 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 PVWatts Calculator from the National Renewable Energy Laboratory[[10]](#footnote-10).

*Conversion Factors*

 CO2 0.49956 kg CO2 /kWh

*Calculation Method*

$$\left(-31,555 kWh\right) × \left(\frac{499.56 CO\_{2}}{1 kWh}\right) × \left(\frac{1}{1,000,000 ^{g}/\_{eMT}}\right) = -17.35 eMT CO\_{2}$$

# Scope 3 Emissions Inventory

**Faculty & Staff 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 whom commute to and from campus daily that the below conversion factors are as accurate as possible[[11]](#footnote-11).

*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

Faculty Commuters (400)

Staff Commuters (800)

Student Commuters (2286)

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 student population who travel to and from home between semesters[[12]](#footnote-12).

*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

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 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[[13]](#footnote-13). The conversion factors are listed below:

*Conversion Factors*

 Beans: 0.78000 kg eCO2/kg food

 Beef: 26.45000 kg eCO2/kg food

 Cheese: 9.78000 kg eCO2/kg food

 Coffee & Tea: 5.05000 kg eCO2/kg food

 Eggs: 3.54000 kg eCO2/kg food

 Fish: 3.83000 kg eCO2/kg food

 Fruits: 0.36000 kg eCO­2/kg food

 Grains: 0.86000 kg eCO2/kg food

 Liquids: 1.03000 kg eCO2/kg food

 Milk: 1.34000 kg eCO2/kg food

 Nuts: 1.17000 kg eCO2/kg food

 Pork: 6.87000 kg eCO2/kg food

 Potatoes: 0.21000 kg eCO2/kg food

 Spices: 0.73000 kg eCO2/kg food

 Sugars: 0.93000 kg eCO2/kg food

 Vegetables: 0.73000 kg eCO2/kg food

Overall food purchased: 1,068,707 lb $×$ 0.453592 kg/lb = 484757.341

Overall GHG MTCDE: 2,548.42



Figure : FY-2019 Food Weight Breakdown



Figure : 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[[14]](#footnote-14).

*Conversion Factors*

 CO2 0.00593 kg CO2 /ream

*Calculation Method*

$$\left(5642 reams\right) × \left(\frac{0.00593 kg CO\_{2}}{1 ream}\right)= 34 eMT CO\_{2}$$

**Waste & 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-CH4 recovery landfill. The conversion factors are listed below[[15]](#footnote-15).

*Conversion Factors*

 CO2 0.000000432 kg CO2 /gallon

CO2 0.0001736 kg CO2 /pound

*Calculation Method*

$$\left(49,072,400 gallon\right) × \left(\frac{0.000000432 kg CO\_{2}}{1 gal}\right) = 21.21 kg CO\_{2} Wastewater$$

$$\left(2,486,400 lb\right) × \left(\frac{0.0001736 kg CO\_{2}}{1 lb}\right) = 431.64 kg CO\_{2} Waste$$

# Carbon Sinks & Sequestration

**Non-Additional 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 exist on campus (26.02 acres), a portion of which is protected within the Gordon & Joy Patterson Botanical Gardens (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 non-additional sequestration[[16]](#footnote-16). The conversion factors are listed below.

*Conversion Factors*

 CO2 148.50000 kg CO2 /acre

*Calculation Method*

$$\left(26.02 acres\right) × \left(\frac{-148,50000 kg CO\_{2}}{1 acre}\right)= -3864 eMT CO\_{2}$$

# Summary

This is the first of what will become annual reporting of the Florida Institute of Technology’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 & 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 & Scope 2 sources for 51,887 students (7.01 MTCDE/Student). Florida Tech produced a total of 14,948.40 Scope 1 & 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.

Figure : Total FY-2019 Carbon Emissions Breakdown

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# Appendix



Figure : Total FY-2019 Carbon Emissions by Category



Figure : total FY-2019 Carbon Emissions by Gas

Table : FY-2019 Raw Data

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Source | CO2 (kg) | CO2 (MTCDE) | CH4 (kg) | CH4 (MTCDE) | N2O (kg) | N2O (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 : FY-2019 Emissions Per Scope

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Scope | CO2 (kg) | CH4 (kg) | N2O (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 : FY-2019 Total Emissions & Net Emissions

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CO2 (kg) | CH4 (kg) | N2O (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 |

1. Source: Facilities Operations Electrical Department [↑](#footnote-ref-1)
2. Source: Facilities Operations Transportation Department [↑](#footnote-ref-2)
3. Source: Facilities Operations Transportation Department [↑](#footnote-ref-3)
4. Source: Facilities Operations Transportation Department [↑](#footnote-ref-4)
5. Source: Facilities Operations Transportation Department [↑](#footnote-ref-5)
6. Source: Facilities Operations Transportation Department [↑](#footnote-ref-6)
7. Source: Facilities Operations Grounds Department [↑](#footnote-ref-7)
8. Source: Facilities Operations HVAC Department [↑](#footnote-ref-8)
9. Source: Facilities Operations Accounts Payable Specialist [↑](#footnote-ref-9)
10. Source: Facilities Operations Sustainability Coordinator [↑](#footnote-ref-10)
11. Source(s): Florida Tech Human Resources, OIR, Student Life, & Facilities Operations [↑](#footnote-ref-11)
12. Source(s): Florida Tech Human Resources, OIR, Student Life, & Facilities Operations [↑](#footnote-ref-12)
13. Source(s): Florida Tech Dining Services & Facilities Operations Sustainability Coordinator [↑](#footnote-ref-13)
14. Source: Florida Tech Copy Center [↑](#footnote-ref-14)
15. Source: Facilities Operations Accounts Payable Specialist [↑](#footnote-ref-15)
16. Facilities Operations Grounds Department & Sustainability Coordinator [↑](#footnote-ref-16)