UNIVERSITY OF NORTH CAROLINA WILMINGTON

Greenhouse Gas Inventory

November 2011

Prepared for UNCW by

brendle GROUP

ACKNOWLEDGEMENTS

University of North Carolina Wilmington would like to acknowledge the following individuals for their time and expertise in contributing to this report:

Terry Blake, Facilities Administration
Michelle Dickens, Business Applications and Access Management
Pamela Elliot, Environmental Health & Safety
Rita Gordon, Auxiliary Services and Sustainability Committee
Stan Harts, Environmental Health & Safety and Sustainability Committee
Whitney Lawson, Office of Institutional Research
Starkey McGowan, Purchasing Services
Gail Morrison, Facilities Administration
Bart Neu, Parking and Transportation Services
Diane Reed, Career Center and Sustainability Committee
Ed Samuels, Office of Facilities
Roger Shaw, Geography-Geology and Sustainability Committee
Jay Styron, Marine Operations, Center for Marine Science
Robert Warren, Physical Plant

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EXECUTIVE SUMMARY

This GHG inventory represents an important piece of University of North Carolina Wilmington's (UNCW's) efforts to be a leader in higher education sustainability by measuring its contribution of GHG emissions. It will be a tool for UNCW to identify, prioritize, and track efforts to reduce GHG emissions over time.

The inventory indicates that in fiscal year 2010 (July 2009 to June 2010), UNCW was responsible for 69,621 metric tons of carbon dioxide equivalent ($MTCO_2e$) emissions. Electricity consumption, the single largest source of emissions, accounted for 55.2 percent and natural gas consumption, the second largest source, accounted for 9.9 percent. Both sources are primarily consumed in

buildings and together account for over 60 percent of all emissions at the university. Understanding the sources and scale of the university's emissions is the foundation upon which informed strategies can be developed to reduce emissions.

Boundaries

The inventory includes all activities and facilities under the operational control of UNCW, including the main campus, the Center for Marine Science, and a number of leased and owned facilities at dispersed locations, including the Harbor Island Research Facility, Aquarius Reef Base in Key Largo, and the Airlie Commons.

Scope

Three emission scopes are addressed in the inventory. Scope 1 emission sources − those that occur directly on UNCW campuses − include natural gas, fleet vehicles, refrigerants, and fertilizer application. The Scope 2 emission source − indirect emissions from electricity generation − is purchased electricity. Scope 3 emission sources − indirect emissions occurring off campus that are the result of activities or demand generated by UNCW − include faculty/staff and student commuting, directly financed air travel and other travel, paper purchases, and solid and wastewater disposal.

Timeframe

The inventory includes fiscal year 2006 through fiscal year 2010. Data were consistently available across all emission sources for fiscal years 2007 through 2010.

Methodology

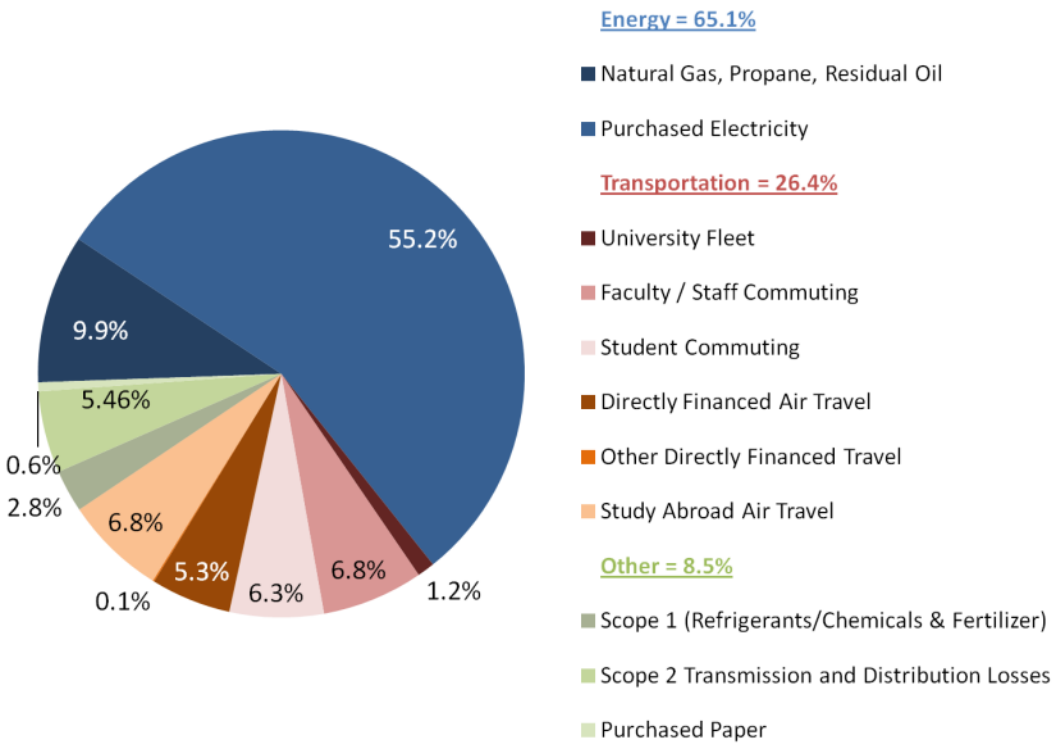
Though UNCW has not signed the American College & University President's Climate Commitment (ACUPCC) to date, the inventory was prepared according to the guidance of ACUPCC to prepare for that possibility. The Clean Air-Cool Planet Campus Carbon Calculator™ (CA-CP) Version 6.6 was used to generate the inventory. This tool generally follows the Greenhouse Gas Reporting Protocol and is designed for college and university campuses. It provides a consistent inventory approach for the more than 600 signatories of ACUPCC.

Results

UNCW's GHG emissions in fiscal year 2010 were estimated to be 69,621 $MTCO_2e$. These emissions result from a number of sources as portrayed in Figure 1. Emissions from energy use in buildings accounts for 65.1 percent of the inventory,

transportation emissions account for 26.4percent, and other sources made up the remaining 8.5 percent.

Figure 1. Fiscal Year 2010 GHG Emissions by Sector



The emissions at UNCW were fairly constant over the period from fiscal year 2007 to fiscal year 2010 as portrayed in Figure 2 while square footage and student enrollment increased. Study abroad travel data was not available for FY'07 or FY'08 resulting in lower emissions shown for those years.

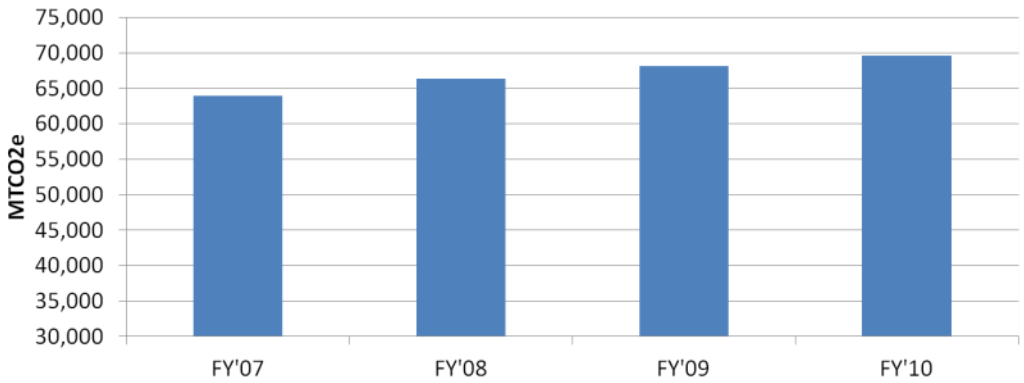


Figure 2. Fiscal Year 2007 to Fiscal Year 2010 GHG Emissions

The emission sources that constitute the inventory are identified by scope in Table 1.

Table 1. Fiscal Year 2010 GHG Emissions

		Scope	eCO_2 *(metric tons)*	Percent
Building Energy	Natural Gas, Propane, Residual Oil	1	6,910	9.9%
	Purchased Electricity	2	38,422	55.2%
Transportation	University Fleet	1	812	1.2%
	Faculty / Staff Commuting	3	4,708	6.8%
	Student Commuting	3	4,370	6.3%
	Directly Financed Air Travel	3	3,724	5.3%
	Other Directly Financed Travel	3	64	0.1%
	Study Abroad Air Travel	3	4,714	6.8%
Other	Refrigerants and Chemicals	1	1,943	2.8%
	Fertilizer	1	24	0.03%
	Solid Waste	3	-328	-0.5%
	Wastewater	3	41	0.06%
	Paper Purchasing	3	417	0.6%
	Scope 2 Transmission and Distribution Losses	3	3,800	5.5%
TOTAL			**69,621**	**100.0%**

Benchmarking

To provide context for UNCW's GHG emissions, comparisons were made with some peer and other institutions. These comparisons were made for the most recent year of inventory data available. All inventory data were obtained from ACUPCC's Reporting System and all of the peer institutions also used CA-CP to complete their inventories.

Comparisons are only made for Gross Scope 1 and Scope 2 emissions since data sources and quality for Scope 3 emissions can vary more widely between institutions.

On the basis of full time equivalent (FTE) students, UNCW's emissions are about average when compared with the peer schools.

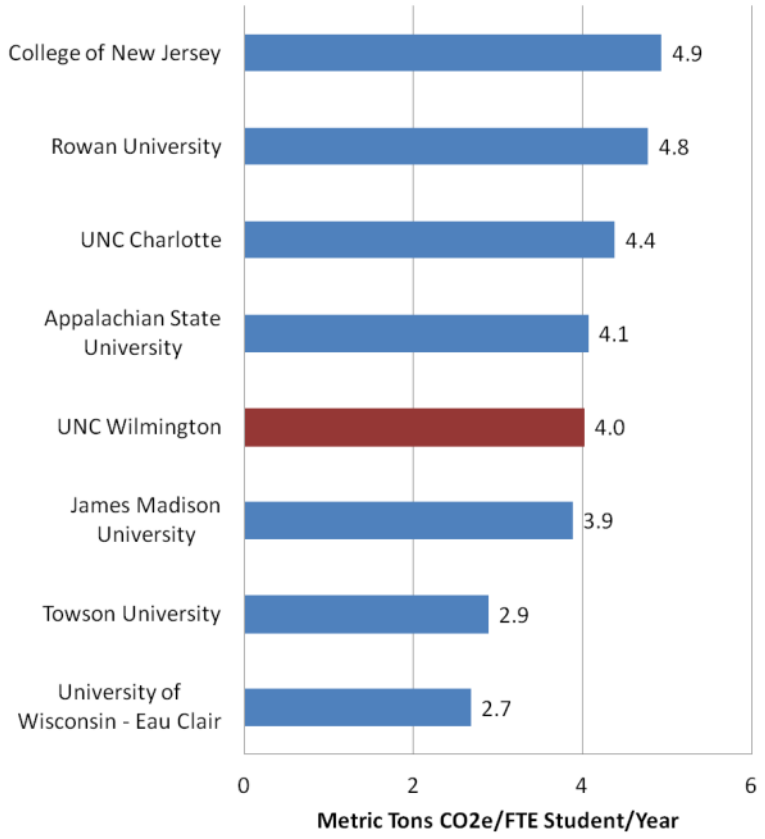


Figure 3. Gross Scope 1 and 2 Emissions per FTE Student

Current Initiatives and Growth

There are a number of initiatives underway at UNCW that will contribute to reducing GHG emissions in future inventories. These include energy performance contracting, green building for new and renovated buildings, expanded transportation options, and improved recycling infrastructure.

The UNCW Campus Master Plan will also influence future inventories. New buildings and infrastructure considered in the Master Plan may increase emissions but these increases may be offset, to some extent, by some of the goals in the Plan. For example, goals under consideration include a car-free campus core, improved pedestrian circulation, integrated bicycle routes, an improved parking management strategy, and increased access to the transit system.

Future Inventories and Next Steps

UNCW will continue to conduct GHG inventories to track progress toward reducing emissions. These inventories will be carried out using methodologies

and tools that will remain consistent with inventory trends among academic institutions.

Based on this inventory and other considerations, UNCW will be evaluating next steps with respect to GHG emissions and sustainability. These next steps may include signing ACUPCC; participating in the Association for the Advancement of Sustainability in Higher Education (AASHE) Sustainability Tracking, Assessment & Rating System™ (STARS); or independently developing plans for energy, GHG emission, and sustainability management.

1 INTRODUCTION AND BACKGROUND

1.1 Climate Change and Greenhouse Gases

Climate change refers to the wide range of impacts resulting from the increase in accumulated concentrations of greenhouse gases (GHGs) in the atmosphere as a result of human activity, primarily the combustion of fossil fuels and deforestation. Globally, these impacts include changes in temperature, precipitation, sea level, ice melt, frequency and severity of storms, and changes to species and habitats, which ultimately affect human health and economies.

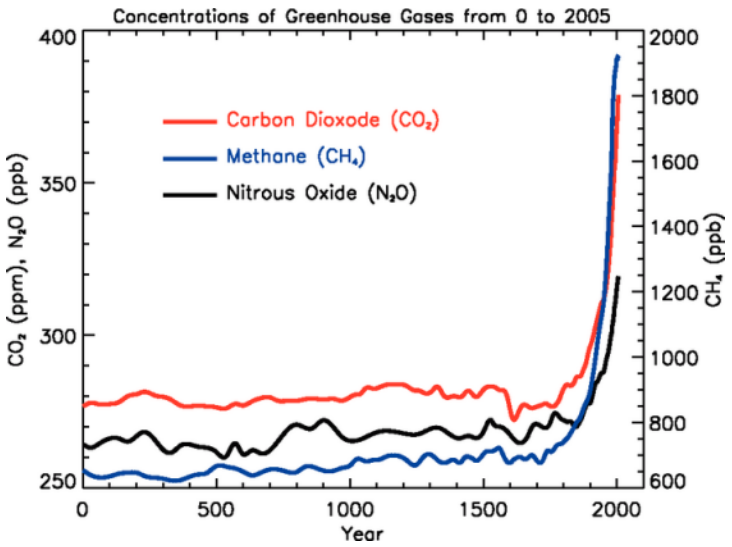


Figure 4. Concentrations of Greenhouse Gases (IPCC)

According to the Intergovernmental Panel on Climate Change (IPCC), the leading international scientific body for assessing climate change, global atmospheric concentrations of GHG gases, including carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years[1]. The global increases in CO_2 concentration are caused primarily by fossil fuel use and land use change, while those of CH_4 and N_2O are primarily caused by agriculture.

[1] IPCC, Fourth Assessment Report: Climate Change 2007, FAQ 2.1, Figure 1. Atmospheric concentrations of important long-lived greenhouse gases…, http://www.ipcc.ch/publications_and_data/ar4/wg1/en/faq-2-1-figure-1.html

According to the IPCC's 2007 Fourth Assessment Report on the state of climate change, warming of the climate system is unequivocal as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and a rising global average sea level. Continued GHG emissions at or above current rates will cause further warming and induce many changes in the global climate system during the 21st century that will very likely be larger than those observed during the 20th century.

In addition to these global trends, a number of potential climate change impacts on North Carolina have also been identified by the North Carolina Climate Action Plan Advisory Group[2], which has conducted regional models of climate change:

- Sea level rise could lead to flooding of low-lying areas, erosion of beaches, loss of coastal wetlands, intrusion of salt water into water supplies, and increased vulnerability of coastal areas to storms and hurricanes.

- As climate changes, this could cause some plants and animals to go extinct, some to decline or increase in population, and others to migrate to areas with more favorable conditions. For example, along the coast, fish that need colder temperatures to survive could migrate north, while more tropical varieties could move up the coast into North Carolina.

- Diseases and pests that thrive in warmer climates could spread into North Carolina, such as the West Nile virus that used to be confined to the Mid-East and only recently has spread to the United States.

- Crops and trees that need cooler climates may not grow as well in North Carolina, while more tropical varieties might do better. For example, the spruce and fir trees growing at high altitudes in North Carolina's mountains could die out if temperatures increase.

- More severe storms and droughts could affect crop production, pests, and growth rates of vegetation.

While the Earth's climate has already changed, helping reduce GHG emissions now can help mitigate further future changes. In addition to minimizing the impact of climate change, reducing GHG emissions can have many additional benefits. These include, but are not limited to, improved air quality, less susceptibility to volatile energy costs, reduced vulnerability to federal and state energy regulations, and water security. Protecting the climate also minimizes a

[2] North Carolina Climate Action Plan Advisory Group, http://www.ncclimatechange.us

range of potential impacts, such as extreme weather events, insect outbreaks, climate-sensitive diseases, and agricultural impacts, to which response or adaptation could be very costly.

1.2 UNCW's Sustainability Initiatives

In response to the risks of global climate change and the opportunities presented by some actions that mitigate GHG emissions, UNCW has already undertaken many sustainability initiatives on campus. Some recent initiatives are described in the following sections.

1.2.1 Performance Contracting

Building upgrades are underway in ten of the oldest buildings on campus under a performance contract with an energy service company. These upgrades include connection to the university's central plant, new controls or assurance that existing controls are functioning through retrocommissioning, demand control ventilation that adjusts room conditioning based on occupancy, daylighting, and lighting retrofits.

These upgrades are scheduled to be completed in July 2011 and will lead to significant energy and GHG emission reductions.

1.2.2 Green Building for New and Renovated Facilities

The Student Recreation Center is being renovated and expanded and the new facility is aiming to achieve the green building certification of Leadership in Energy and Environmental Design (LEED) Silver. Energy improvements, including connection to the central plant, upgraded lighting and HVAC equipment, and possibly solar thermal heating for the new lap pool, will reduce the energy consumption of the new facility and associated GHG emissions. Three other buildings that will be LEED certified include the Teaching Laboratory Building, Seahawk Crossing, and McNeil Building.

1.2.3 Expanded Transportation Options

UNCW has taken a number of actions to increase transportation options, reduce single occupant vehicle use on campus, and decrease traffic on campus. Parking permits for students residing within a 1-mile radius of campus have been limited to evening and weekend students, increased parking enforcement has been instituted, shuttles now run bi-directionally, and a residential shuttle loop has been added on campus. These actions resulted in a 23 percent increase in fiscal year 2011 shuttle ridership.

Bicycle infrastructure has been improved by adding 50 bicycle racks to the academic corridor and constructing a cross-city trail that will run partially through campus. The cross-city trail is becoming a significant transportation option for students biking on and off campus with 3 of the 13 miles of trail within UNCW's campus.

Incentives are also available for carpooling, including discounted parking permits and free drive days.

1.2.4 Improved Recycling Initiatives

The recycling infrastructure available has been improved both in buildings and around campus. Existing office trash receptacles have been relabeled as recycling bins and new smaller containers have been made available for trash. By increasing the size of the recycling container, at least one building has doubled the quantity of recyclables collected.

UNCW has also increased the number of outside recycling bins from 15 to 35.

A new recycling vendor is providing services to UNCW that will offer expanded material options, including electronics, and convert UNCW's recycling program to a profit-center for the University.

1.3 Sustainability Committee

The UNCW Sustainability Committee is a cross-departmental group charged with prioritizing and facilitating sustainable practices in all aspects of UNCW's institutional culture, including operations, academic programs, and community relationships. The Sustainability Committee has been the driver behind a number of successful initiatives and is also the force behind the completion of this inventory.

2 INVENTORY METHODOLOGY

The following section provides UNCW's methodology for the inventory completed for fiscal years 2007 to 2010.

2.1 Protocol

This inventory was assembled by collecting and analyzing utility data, compiling university records, and conducting discussions with staff. Figure 5 presents a visual outline and description of the methodology used to organize the inventory process.

Fundamentally, this inventory was developed in accordance with the GHG Protocol – Corporate Accounting and Reporting Standard embodied in the Clean Air-Cool Planet Campus Carbon Calculator™ (CA-CP) tool. The GHG Protocol provides guidance on what emissions sources to include in a GHG inventory and how to address situations such as partial ownership, leases, etc.

This approach is compatible with both American College & University President's Climate Commitment (ACUPCC) and Association for the Advancement of Sustainability in Higher Education (AASHE) Sustainability Tracking, Assessment & Rating System™ (AASHE STARS) programs should UNCW elect to participate in either of these initiatives in the future.

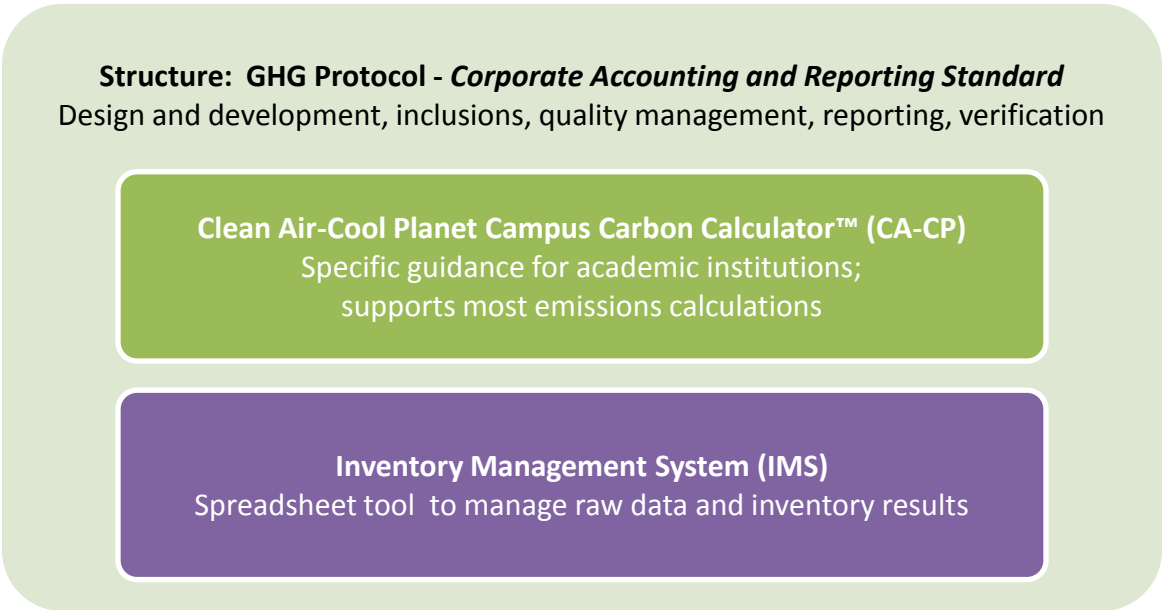


Figure 5. GHG Inventory Protocol and Tools

Table 2 describes the key requirements of the GHG Protocol and the alignment of this inventory's approach.

Table 2. Alignment with Key GHG Protocol Requirements

GHG Protocol Requirement	Alignment
Organizational Boundary GHG emissions shall be consolidated based on an organization's equity share, operational control, or financial control of the source.	UNCW has decided to define its organizational boundary based on operational control, including leased space (i.e., Airlie Commons). This decision was based on the assumption that the university will be able to best influence those facilities/resources that it directly operates. Any spaces UNCW owns but does not operate or occupy are *not* been included.
Operational Boundary GHG emission sources shall be identified and categorized as direct or indirect and the scope for indirect emissions defined.	Section 2.4 identifies the GHG emission sources included in this inventory and their respective scopes.
Choosing a Base Year The organization shall select and quantify emissions for a base year for which data are available and specify reasons for choosing that year.	The UNCW inventory was completed for fiscal years 2007 through 2010. No particular base year has been selected at this time. As UNCW proceeds with establishing reduction goals and a climate action plan, it will select from these inventory years the one most appropriate to the selected goal and/or most representative of a typical year's emissions. Since emissions were fairly constant between 2007 and 2010, it is likely that any of these years could be a reasonable baseline for UNCW without too much impact of weather or infrastructure/operational changes. The fiscal year was selected as it is the format in which many activities at the university are reported and evaluated. The fiscal year starts July 1st and ends June 30th.
Calculating GHG emissions The organization shall identify emission sources, select a calculation approach, collect activity data and choose emission factors, apply calculation tools, and roll up emissions data to the organization level.	Section 4 provides a narrative for each emission source in UNCW's inventory, including a discussion of the selected calculation methodologies and activity data.

2.2 Greenhouse Gases

The GHG Protocol requires reporting six different GHGs: CO_2, CH_4, N_2O, perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), and sulfur hexafluoride (SF_6). The majority of UNCW's climate change impact is a result of emissions of the first three gases, as documented in the following sections. PFCs and HFCs are primarily released during normal operation and maintenance of refrigeration, air conditioning, and fire suppression systems, and though they are a minimal contributor to the overall inventory, they are documented here to align with ACUPCC requirements. SF_6 is found primarily in large electrical equipment, such as transformers. Most, if not all, of UNCW's transformers do not use SF_6.

2.3 Global Warming Potential and Carbon Dioxide Equivalent

Each of the GHGs reported in this inventory has a different level of impact on global warming. For example, the emission of 1 ton of N_2O has a global warming potential (GWP) 310 times larger than that of the emission of 1 ton of CO_2. Similarly, the emission of 1 ton of CH_4 has a GWP 21 times that of CO_2. To avoid confusion between emissions of the different types of gases and their respective GWPs, all emissions are reduced to the common unit of CO_2e, or carbon dioxide equivalent. Thus, the emission of 1 ton of N_2O is expressed as the emission of 310 tons of CO_2e. All results in this report will be presented in units of metric tons of CO_2e unless otherwise noted and will be labeled as $MTCO_2e$.

2.4 Scopes and Emission Sources

All emissions are categorized into three scopes as defined in the GHG Protocol. The purpose of scopes is to prevent double counting emissions between reporting entities. For example, a power plant would report emissions from generating electricity as Scope 1 and consumers using that electricity would report their responsibility to those emissions as Scope 2. By segregating these emissions, they are allocated accurately and not added together.

In general, Scope 1 emissions are direct emissions occurring at the university, Scope 2 emissions are those resulting from energy that is purchased by the university but generated elsewhere (i.e., electricity), and Scope 3 emissions are other indirect emissions that occur outside of the university as a result of the activities or demand generated by the university. These scopes are outlined graphically in Figure 6.

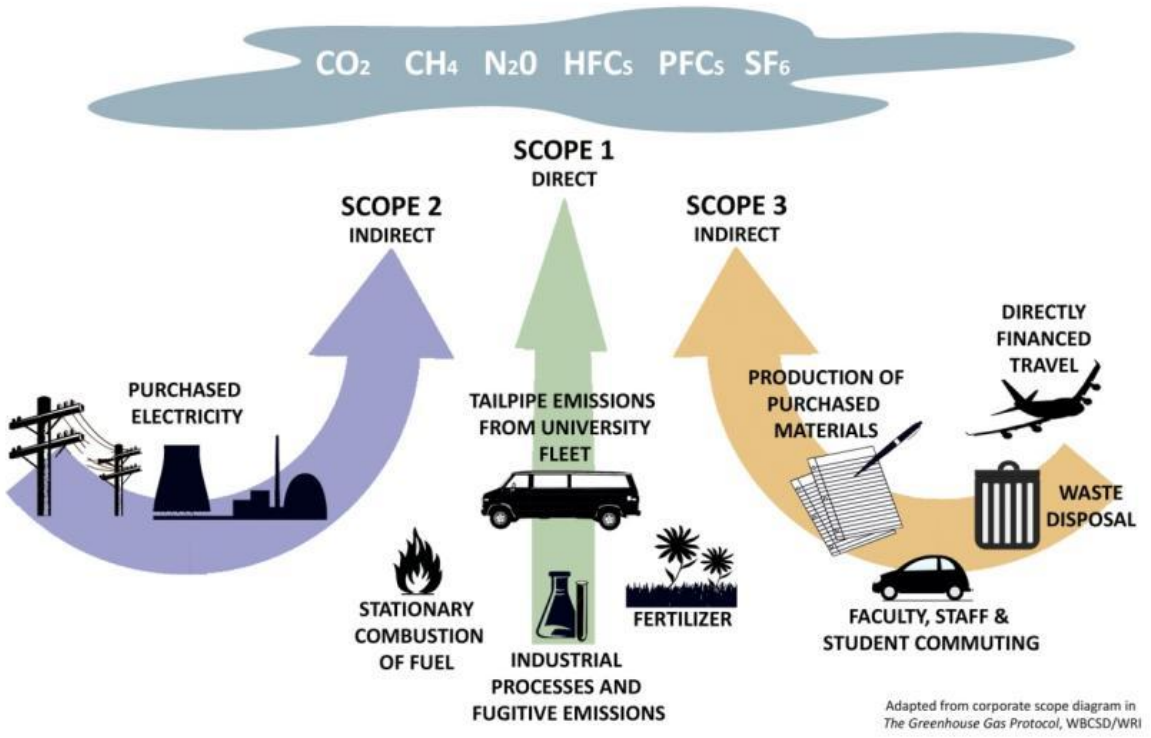


Figure 6. Emission Scopes[3]

Most GHG protocols, including ACUPCC guidance for signatories in that program, require all direct (Scope 1) and energy indirect (Scope 2) GHG emissions are inventoried. ACUPCC further requires that Scope 3 emissions from commuting and directly financed air travel be inventoried "to the extent that data are available." All other Indirect (Scope 3) emissions are reported at the discretion of the entity but reporting is encouraged by ACUPCC, especially from sources that are large or "can be meaningfully influenced." UNCW has elected to include all university financed travel, solid waste disposal, wastewater treatment, and embodied emissions from purchased paper.

2.5 Data Collection, Calculations and Tools

This section provides an overview of the process for managing data for the UNCW GHG inventory. Data collection and handling for individual emission sources is described by source in Section 4.

To help manage all of the raw data from the many emission sources at UNCW, an Inventory Management System (IMS) was developed. The IMS is a Microsoft Excel-

[3] Modified from World Resources Institute GHG Protocol graphic

based spreadsheet that collects the original data and performs the calculations necessary to prepare the data for input into the CA-CP tool. The IMS also provides a platform for exporting results from the CA-CP tool and creating an array of summary tables and figures of the emissions inventory results.

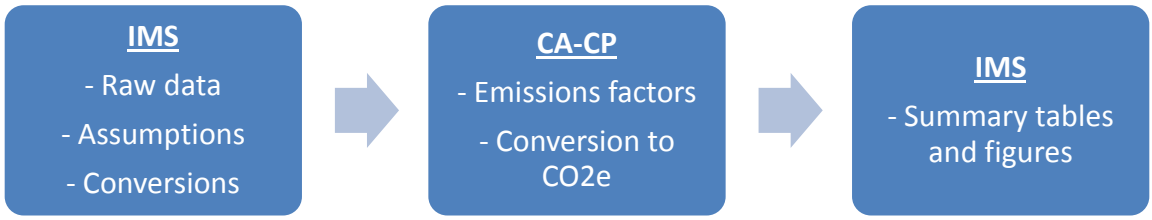


Figure 7. Relationship of IMS and CA-CP

To translate the IMS inventory data to GHG emissions, the CA-CP Version 6.6 was used. This tool is based on well-reviewed methodologies and provides an accessible and well-documented platform for maintaining a GHG inventory. The CA-CP tool was developed specifically to provide higher education institutions with a consistent approach to calculating campus GHG emissions and is recognized as an acceptable tool by the ACUPCC. The CA-CP tool supports forecasting emissions and generating reports and graphs. However, to achieve greater transparency and flexibility in these activities, the IMS also provides output summary and graphing capabilities.

Aside from this written report, the UNCW inventory includes the IMS and CA-CP spreadsheet files necessary for ongoing maintenance of the inventory.

3 CAMPUS OVERVIEW

UNCW is the state's coastal university located in Wilmington, North Carolina. UNCW is organized around the College of Arts and Sciences, the College of Health and Human Sciences, the Cameron School of Business, the School of Nursing, the Watson School of Education, and the Graduate School.

In Fall 2010, there were 11,743 undergraduate and 1,328 graduate students enrolled and supported by 842 faculty and 1,255 staff members.

UNCW's facilities include the main campus pictured in Figure 8 as well as the Center for Marine Science and a number of other distributed facilities. These facilities encompass 3.20 million square feet of building space.

UNCW's Campus Master Plan is considering some growth in facilities and infrastructure in the future.

Figure 8. Aerial Photo of Main Campus

4 GREENHOUSE GAS EMISSIONS

UNCW's GHG emissions in fiscal year 2010 were estimated to be 69,621 $MTCO_2e$. These emissions result from a number of sources as portrayed in Figure 1. Emissions from energy consumption in buildings accounted for 65.1 percent of the inventory, transportation emissions accounted for 26.4 percent, and other sources made up the remaining 8.5 percent.

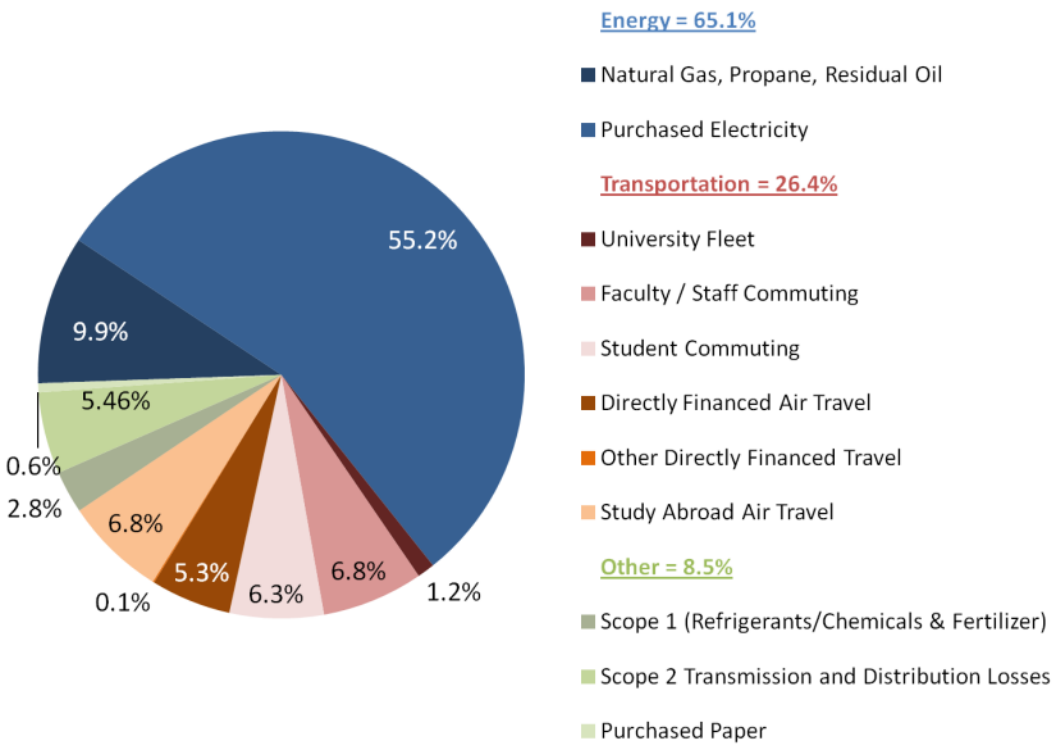


Figure 9. Fiscal Year 2010 GHG Emissions by Sector

The emissions at UNCW were fairly constant over the period from fiscal year 2007 to fiscal year 2010 as portrayed in Figure 2. Study abroad travel data was not available for FY'07 or FY'08 resulting in lower emissions shown for those years.

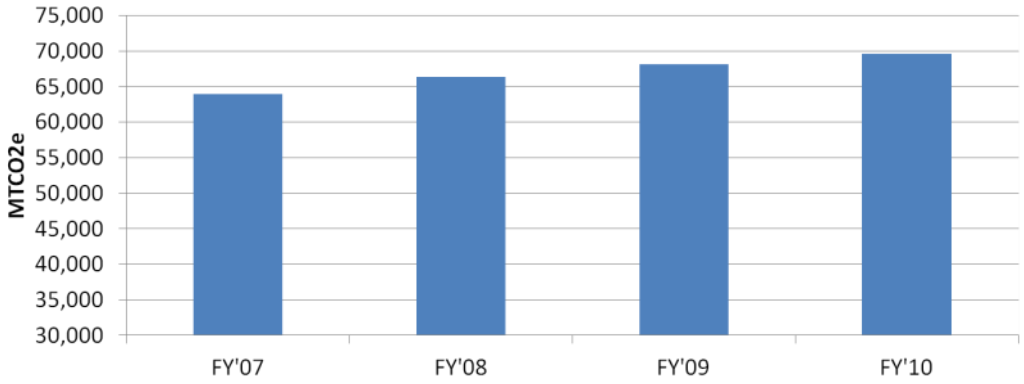


Figure 10. Fiscal Year 2007 to Fiscal Year 2010 GHG Emissions

The emissions sources that make up the inventory are identified by scope in Table 1. The following sections explore each of these emission sources in more detail.

Table 3. Fiscal Year 2010 GHG Emissions

		Scope	eCO_2 *(metric tons)*	Percent
Building Energy	Natural Gas, Propane, Residual Oil	1	6,910	9.9%
	Purchased Electricity	2	38,422	55.2%
Transportation	University Fleet	1	812	1.2%
	Faculty / Staff Commuting	3	4,708	6.8%
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	Fertilizer	1	24	0.03%
	Solid Waste	3	-328	-0.5%
	Wastewater	3	41	0.06%
	Paper Purchasing	3	417	0.6%
	Scope 2 Transmission and Distribution Losses	3	3,800	5.5%
TOTAL			**69,621**	**100.0%**

4.1 Building Energy

4.1.1 Natural Gas, Propane, and Residual Oil

Natural gas, propane, and residual oil are the primary fuels used in stationary combustion on campus. Natural gas is the dominant fuel and is used for space heating, water heating, and cooking. Small amounts of propane and residual oil are used for emergency backup generators.

GHG emissions from consuming these fuels are direct (Scope 1), occurring at the site when the fuel is combusted.

Data Collection

For this inventory, natural gas (thousand cubic feet), propane (gallons), and residual oil (gallons) consumption records were provided by Facilities Administration.

Natural gas for the majority of UNCW operations is purchased from Piedmont Natural Gas.

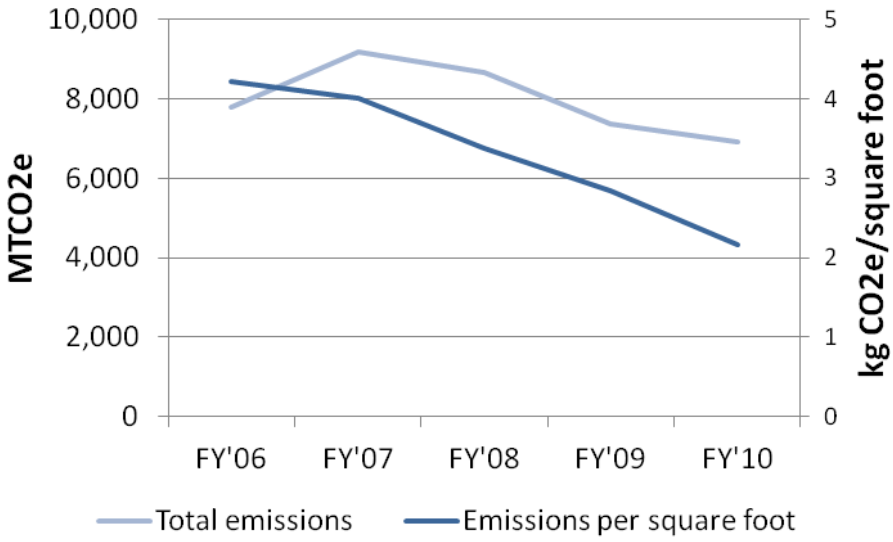


Figure 11. Stationary Fuels Emissions Trend

Calculation Approach

The default emissions factors in CA-CP were applied to calculate the GHG emissions for these sources.

Contribution to Total Emissions

The combustion of these fuels resulted in emissions of an estimated 6,910 $MTCO_2e$ in fiscal year 2010. This was 9.9 percent of the total inventory. There has been a downward trend in total and per square foot emissions from these sources from fiscal year 2006 to fiscal year 2010.

Next Steps

As the second largest source of emissions in the inventory, the consumption of natural gas will be a significant opportunity for reduction through improved efficiency in buildings.

4.1.2 Purchased Electricity

Electricity provides lighting, cooling, process energy, and energy for many of the end-uses like computers and small electronics on campus.

GHG emissions from electricity consumption are indirect (Scope 2) − occurring at the source of the electricity generation − but are attributed to the consumer of the electricity. CA-CP also includes a calculation of emissions associated with the Scope 3 distribution and transmission losses for electricity delivered to the campus. These emissions are included in previous tables and figures but not in Figure 12.

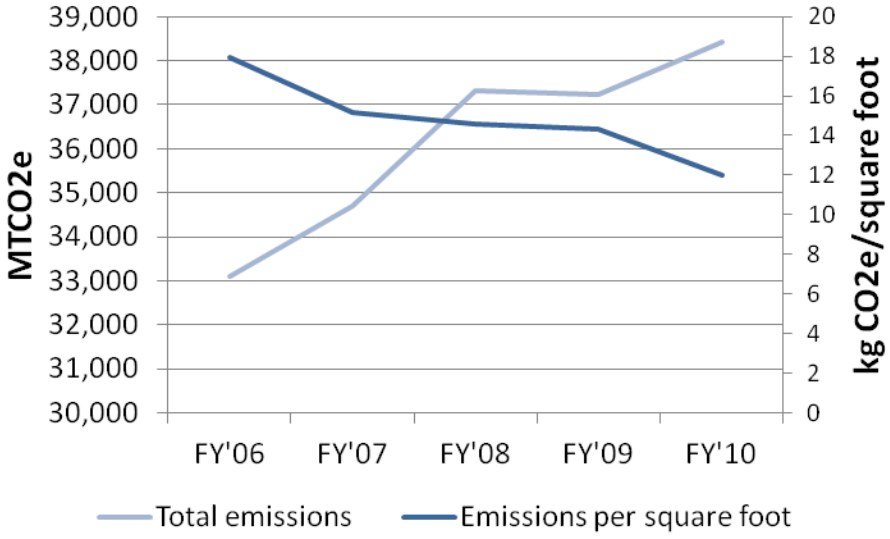


Figure 12. Electricity Emissions Trend

Data Collection

For this inventory, electricity (kWh) consumption records were provided by Facilities Administration.

Electricity is purchased from Progress Energy Carolinas.

Calculation Approach

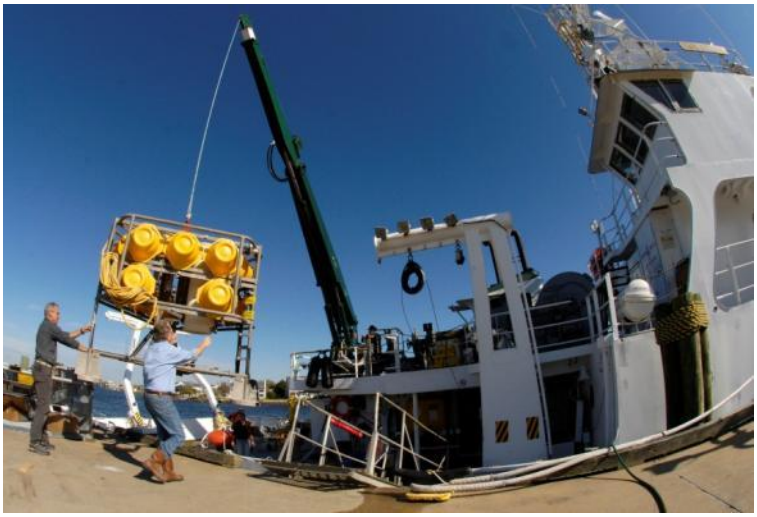
The default grid emission factor for electricity produced in the Southeast Reliability Corporation (SERC) Virginia/Carolina (SRVC) region, as available in CA-CP, was applied to calculate the GHG emissions from electricity. This factor accounts for the sources of electricity that are under the control of the local grid region to determine the carbon intensity of that mix of resources.

Contribution to Total Emissions

The consumption of electricity resulted in emissions of an estimated 38,422 $MTCO_2e$ in fiscal year 2010. This was 55.2 percent of the total inventory. There has been an upward trend in total and per square foot emissions from these sources from fiscal year 2007 to fiscal year 2010.

Next Steps

As the largest source of emissions in the inventory, the consumption of electricity will be a significant opportunity for reduction through improved efficiency and conservation in buildings.



4.2 Transportation

4.2.1 University Fleet

UNCW's fleet consists of gasoline and diesel vehicles, including service vehicles, police vehicles, marine vessels and boats, and small equipment. There are also seven small electric vehicles at the university whose emissions are included in the purchased electricity portion of this inventory.

GHG emissions from UNCW's transportation fleet are direct, occurring at the tailpipe of a vehicle as the result of fossil fuel combustion in the vehicle's engine.

Data Collection

For this inventory, fuel consumption records for gasoline and diesel (gallons) at on-campus pumps were provided by Facilities Administration. Fuel purchases also occur offsite when these vehicles travel off-campus, and these emissions are separately accounted for under university financed travel.

The total cost of fuel consumed by marine vessels was provided by Marine Operations at the Center of Marine Science.

Calculation Approach

The default emission factor for these fuels in CA-CP was applied to calculate the GHG emissions from diesel and gasoline. To estimate the quantity of fuel consumed in marine vessels where only the total cost of fuel was available, the average retail price in the southeast region for gasoline and diesel in each year was applied based on historical data from the Energy Information Administration.

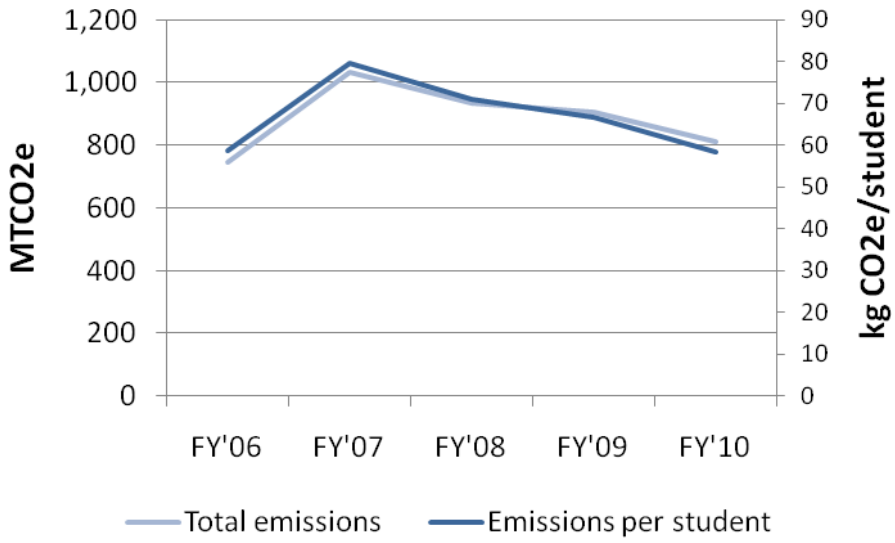


Figure 13. Vehicle Fleet Emissions Trend

Contribution to Total Emissions

The consumption of fuel in fleet vehicles resulted in emissions of an estimated 812 $MTCO_2e$ in fiscal year 2010. This was 1.2 percent of the total inventory. There has been a downward trend in total and per student emissions from these sources from fiscal year 2007 to fiscal year 2010. Fleet emissions are normalized per student since they relate more to population than to building square footage.

Next Steps

Recording the quantity of fuel consumed in the marine fleet in Wilmington and Key Largo would improve the quality of emissions estimates for the marine vehicle fleet.

4.2.2 Student and Faculty/Staff Commuting

GHG emissions from commuting by UNCW students and faculty/staff are considered indirect (Scope 3) as this activity is not under the direct control of the university. However, these emissions are included in case UNCW elects to become a signatory of ACUPCC.

UNCW's commuting is considered in three components: faculty/staff vehicle commuting, student vehicle commuting, and student bus commuting.

Data Collection

Faculty/staff and student vehicle commuting was estimated using records of vehicle permits issued that were provided by Auxiliary Services and Parking and Transportation Services. Using the ZIP codes of the addresses to which the permits were issued, the typical daily vehicle commute distance was estimated. A significant number of student permits were issued to addresses outside North Carolina that likely represent their home addresses. For all addresses outside of a likely daily commute (greater than100 miles) it was assumed that the average commuting distance was the same as for the set of permits issued within the 100-mile radius. It was assumed that students commuted 4 days per week, 35 weeks per year. Faculty and staff were assumed to commute 5 days per week, 50 weeks per year. Parking permit data were only available for fiscal year 2011, so commuting data for the previous years were extrapolated based on the populations of faculty/staff and students in each year.

Commuting by the Seahawk Shuttle (bus operation) was estimated by ridership data provided by Auxiliary Services and estimated route lengths from the 2010-2011 schedules. It was assumed that the average length of ride was half the total length of the route. Ridership data did not distinguish students and faculty/staff so it is assumed that students are the primary users of the shuttle.

Calculation Approach

The default emission factors for these means of transportation in CA-CP were applied to calculate the GHG emissions.

Contribution to Total Emissions

Faculty/staff and student commuting resulted in emissions of an estimated 4,708 and 4,370 $MTCO_2e$, respectively, in fiscal year 2010. This was 6.8 and 6.3 percent, respectively, of the total inventory.

Next Steps

Conducting a full commuter survey would allow UNCW to refine this estimate of commuting by better identifying vehicle commuters that do not purchase permits (off-campus parking), carpooling, and frequency of commute during the week. It would also better define non-motorized commuting methods like biking and walking.

4.2.3 University Financed Travel

Following the requirements of ACUPCC for ease of comparison with peer institutions and possible signing of the ACUPCC commitment, the inventory also includes the emissions from all air and ground travel by faculty/staff and students that is financed by UNCW. This includes reimbursements for fuel and mileage, air travel, train, taxi/ferry/rental car, and bus travel.

GHG emissions from UNCW's directly financed travel are indirect (Scope 3) emissions, which are typically the direct responsibility of a transportation provider such as an airline or taxi service.

Data Collection

Data used to estimate the GHG emissions from university financed travel were provided by the Business Affairs Division. The data provided and assumptions applied to convert them to miles are outlined in Table 4.

Table 4. University Financed Travel Data

CA-CP Classification	Raw Data Units	Assumptions Applied
Airfare Travel – Faculty/Staff	Count of travelers by destination	Estimated prime leg mileage using Great Circle calculation (distance by air) from Charlotte, NC to destination. Added Great Circle distance from Charlotte to Wilmington to each trip.
Airfare Travel – Students	Count of travelers by destination	Estimated prime leg mileage using Great Circle calculation (distance by air) from Charlotte, NC to destination. Added Great Circle distance from Charlotte to Wilmington to each trip.
Train	Dollars	Cost per mile estimated for trains ($0.27 in 2009) and commuter trains ($0.20 in 2009) from Bureau of Transportation Statistics data.
Taxi/Ferry/Rental Car	Dollars	*Taxi*: used average cost per mile for major U.S. cities from www.taxifarefinder.com. *Ferry*: assumed 20 miles per fare purchased based on descriptions that indicated ferry trip was made. *Rental Car*: Assumed 250 miles per instance (10 gallons @ 25 miles per gallon). Additional fueling shows up under fuel category.
Fuel	Dollars	Average annual fuel prices in U.S. from Energy Information Administration used to convert to gallons. Assumed 25 miles per gallon.
Bus	Count of fares	Assumed 10 miles per fare purchased.
Alternative Fuel Bus	n/a	n/a
Personal Mileage Reimbursement	Dollars	Federal Standard Mileage Rates by year applied in $ per mile.
Study Abroad Travel	Count of students by destination	Estimated prime leg mileage using Great Circle calculation (distance by air) from Charlotte, NC to destination. Added Great Circle distance from Charlotte to Wilmington to each trip. Assumed destination was largest airport in destination country.

Calculation Approach

The default emission factors for these methods of transportation in CA-CP were applied to calculate the GHG emissions.

Contribution to Total Emissions

Directly financed air travel and other travel (e.g., bus, taxi, rental car, ferry) resulted in emissions of an estimated 3,724 and 64 $MTCO_2e$, respectively, in fiscal year 2010. This was 6.3 and 0.1 percent, respectively, of the total inventory.

Next Steps

Through the travel authorization system, UNCW has good records of air travel destinations – better than many institutions that have to estimate airline miles based on cost alone. There are no recommended next steps for this aspect of the inventory.

4.3 Other

4.3.1 Refrigerants

HFCs and PFCs are refrigerant gases used in air conditioning, refrigeration, and sometimes fire suppression systems that are also GHGs. Under normal operations, some of these gases are lost to the environment through leaks and maintenance activities. GHG emissions from refrigerant gases are a direct emission (Scope 1), which occurs at the university.

Data Collection

Facilities Administration provided records of refrigerant purchases for the inventory. It is assumed that refrigerant purchases are for replacing lost gas (i.e., gas emitted to the atmosphere) from existing equipment.

Calculation Approach

The default emission factors for these gases in CA-CP were applied to calculate the GHG emissions.

Contribution to Total Emissions

Refrigerant gases resulted in emissions of an estimated 1,943 $MTCO_2e$ in fiscal year 2010. This was 2.8 percent of the total inventory.

4.3.2 Fertilizers

Applying nitrogen as a fertilizer leads to the emission of the GHG N_2O by a couple of mechanisms. A portion of the nitrogen fertilizer converts to N_2O on application before uptake and is then directly emitted. An additional portion can volatilize and be re-deposited elsewhere before being emitted as N_2O.

GHG emissions from fertilizers are a direct emission (Scope 1), which occurs at the university.

Data Collection

Landscape Services provided records for each of six fertilizer applications that were conducted during fiscal year 2010 in total pounds and pounds nitrogen per 1,000 square feet, as well as the total application area in acres.

Calculation Approach

The total pounds of nitrogen were calculated from the provided data and entered into CA-CP as 100 percent nitrogen. The default emission factor for fertilizer application in CA-CP was applied to calculate the GHG emissions.

Contribution to Total Emissions

Applying fertilizer resulted in emissions of an estimated 24 $MTCO_2e$ in fiscal year 2010. This was 0.03 percent of the total inventory.

4.3.3 Solid Waste

GHG emissions from solid waste disposal are considered indirect and typically occur offsite at the point of disposal. For the duration of this inventory, UNCW's solid waste was disposed of at the New Hanover County Waste to Energy Conversion Facility (WASTEC). This mass burn facility incinerated the waste, excluding some recyclable materials such as ferrous metals, and produced electricity and steam from the combustion process.

Data Collection

All solid waste from UNCW is collected by Waste Industries, Inc. Facilities Administration provided records of solid waste collection.

Calculation Approach

The default emission factor for mass burn solid waste in CA-CP was applied to calculate the GHG emissions. CA-CP uses an emission factor from the Environmental Protection Agency which estimates that the mass burn process is slightly carbon positive, in other words, more GHG emissions are avoided generating energy (and thereby avoiding electricity generation elsewhere) and by the recycled materials than are emitted by the incineration process.

Contribution to Total Emissions

Solid waste disposal resulted in emissions of an estimated -328 $MTCO_2e$, an emission reduction, in fiscal year 2010.

4.3.4 Wastewater

GHG emissions from wastewater treatment vary depending on the type of treatment process used. Both Cape Fear Public Utility Authority facilities employ anaerobic digestion and that type of process was selected for this calculation.

Data Collection

Facilities Administration provided records of wastewater discharge.

Calculation Approach

The default emission factor for wastewater treatment with anaerobic digestion in CA-CP was applied to calculate the GHG emissions.

Contribution to Total Emissions

Refrigerant gases resulted in emissions of an estimated 41 $MTCO_2e$ in fiscal year 2010. This was 0.06 percent of the total inventory.

4.3.5 Purchased Goods

Many inventories are starting to consider the embodied emissions from extracting, producing, and transporting purchased goods. The CA-CP tool has recently included paper purchases in its inventory calculator.

GHG emissions from paper purchases are an indirect emission (Scope 3), which occurs in the supply chain for the paper products.

Data Collection

Purchasing Services provided records of spending for paper products at the university. These dollar values were converted to quantities of paper based on typical costs provided by Purchasing Services.

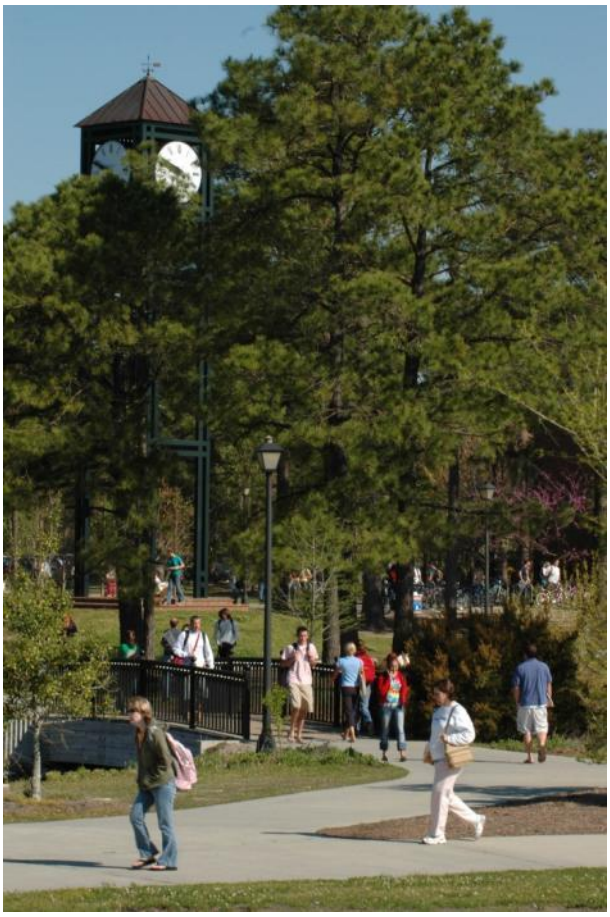
Calculation Approach

The default emission factors for paper purchases in CA-CP were applied to calculate the GHG emissions.

Contribution to Total Emissions

Paper purchases resulted in emissions of an estimated 417 $MTCO_2e$ in fiscal year 2010. This was 0.6 percent of the total inventory.

5 BENCHMARKING



Another way to provide context for a university's GHG emissions is to benchmark against other universities and colleges that are similar in size and/or structure. However, benchmarking is challenging for a number of reasons. Though protocols exist for carrying out GHG inventories, covering topics from establishing boundaries to quantifying emissions from a particular source, there is little standardization among these protocols.

Each institution makes assumptions based on its unique circumstances and the data available with which to construct the inventory. Benchmarking is further complicated by the inherent differences in climate, demographics, economies, and geographic location that inevitably influence how each university or college uses resources and emits GHGs. Ultimately, the best comparison for UNCW as it strives to reduce its GHG emissions will be itself.

In order to account for some of these factors, a number of potential peer universities and colleges were identified from the list of schools UNCW typically benchmarks itself against. The schools presented here were selected based on the availability of GHG inventory data. All comparison data were collected from the ACUPCC's Reporting System[4].

Since all of the comparison schools used CA-CP to conduct their inventories, the variation in approach is minimized. Furthermore, comparisons are made only based on gross Scope 1 and Scope 2 emissions since these are relatively straight forward and much of the variation in approaches is introduced with the variety of data available for estimating Scope 3 emissions. A summary of the schools is presented in Table 5.

[4] ACUPCC Reporting System, http://rs.acupcc.org/

Table 5. GHG Inventories of Peer Higher Education Institutions

College/University	Fiscal Year of Inventory	FTE Student Population in Inventory Year	Total Building Square Footage (x1,000)	Gross Scope 1 & 2 GHG Emissions (MTCO2e)
UNCW	2010	11,976	3,196	48,112
College of New Jersey	2009	6,161	3,270	30,388
James Madison University	2008	17,339	5,035	67,339
Rowan University	2007	10,091	2,500	48,181
Towson University	2009	18,860	4,296	54,318
University of Wisconsin - Eau Clair	2010	10,003	2,461	26,805
Appalachian State University	2009	15,749	5,090	64,106
UNC Charlotte	2009	19,664	6,848	86,197

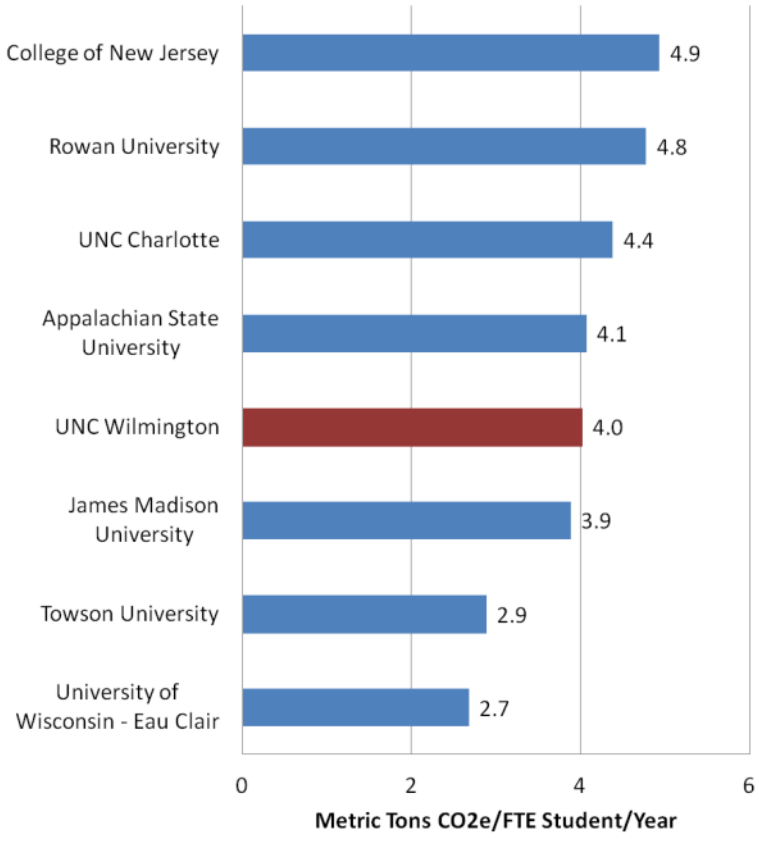


Figure 14. Gross Scope 1 and 2 Emissions per FTE Student

Figure 14 compares the total emissions presented in each respective inventory divided by each school's reported FTE student equivalent population for that year to identify per capita emissions.

Figure 15 compares the total emissions per square foot of building space for each school.

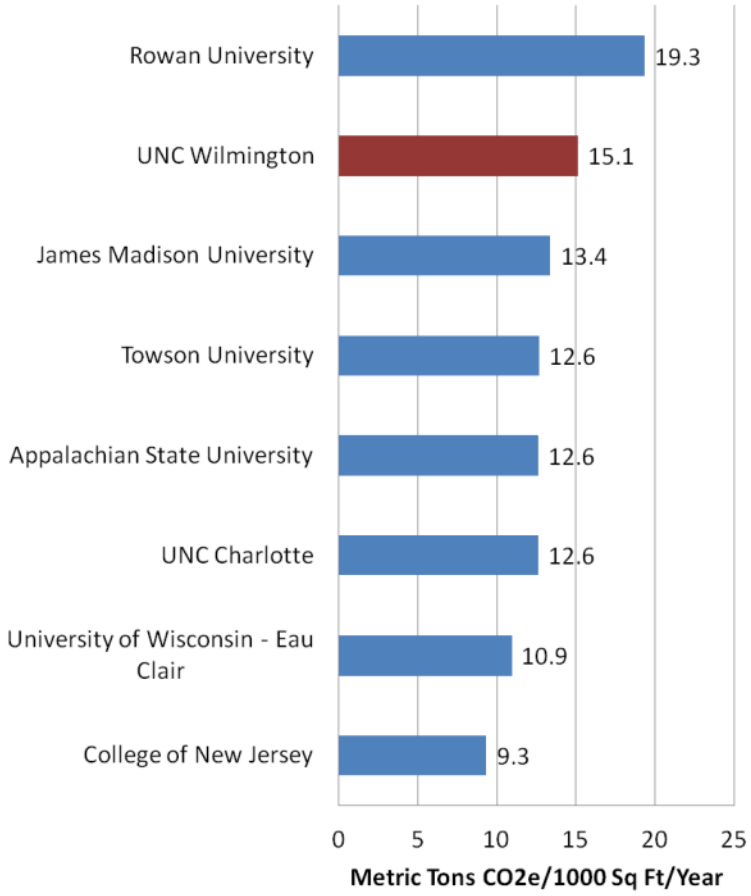
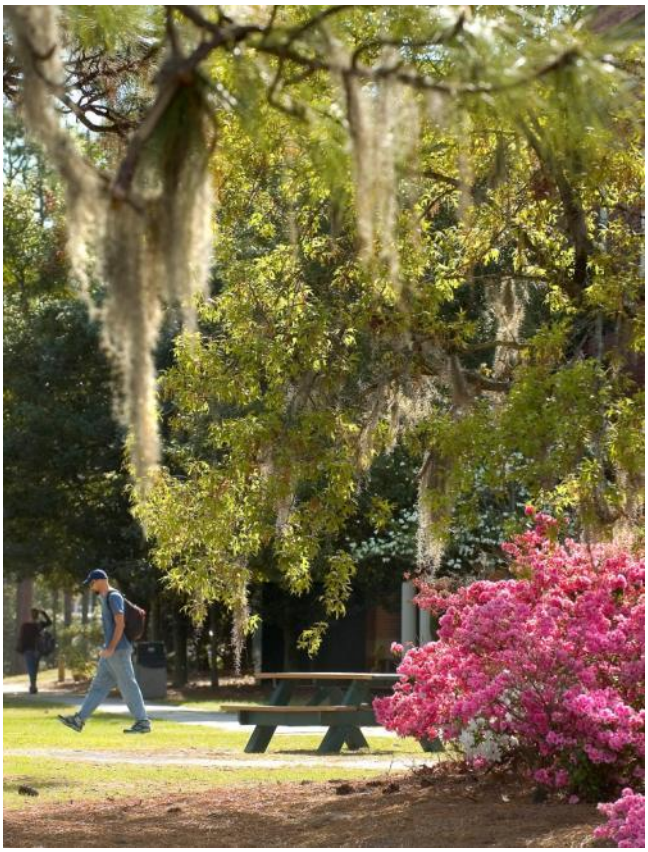


Figure 15. Gross Scope 1 and Scope 2 Emissions per Square Foot



6 NEXT STEPS

Based on this inventory and other considerations, UNCW will be evaluating next steps with respect to GHG emissions and sustainability. These next steps may include signing ACUPCC; participating in the AASHESTARS program; or independently developing plans for energy, GHG emission, and/or sustainability management.

Over 660 colleges and universities have signed ACUPCC at the time of this inventory. These schools are required to update GHG inventories on a biennial basis and to create a plan, also with biennial updates, for achieving climate neutrality for their school.

The STARS program provides a standardized means of measuring sustainability at colleges and universities through a transparent, self-reporting framework. This program allows better comparison of sustainability efforts and progress between schools.

Whether UNCW chooses to participate in either of these programs or not, the university and the Sustainability Committee will continue to pursue GHG reductions and greater sustainability on campus as they have already done with the projects described in Section 1.2. Independent of the requirements of the above programs, UNCW may also consider developing a sustainability action plan to guide the efforts of the Sustainability Committee and other campus organizations and ensure continued progress toward a more sustainable UNCW.

CONTACT INFORMATION

Stan Harts

Environmental, Health & Safety Director

910-962-3108

hartss@uncw.edu

ACRONYMS

ACUPCC – American College & University President's Climate Commitment

AASHE – Association for the Advancement of Sustainability in Higher Education

CA-CP – Clean Air-Cool Planet Campus Carbon Calculator™

CH_4 – Methane

CO_2 – Carbon dioxide

GHG – Greenhouse gas

GWP – Global warming potential

HCFC – hydrochlorofluorocarbon

IMS – Inventory Management System

IPCC – Intergovernmental Panel on Climate Change

kWh – kilowatt-hour

LEED – Leadership in Energy and Environmental Design

$MTCO2_e$ – Metric tons carbon dioxide equivalent

N_2O – Nitrous oxide

PFC – Perfluorocarbon

SF_6 – Sulfur hexafluoride

STARS – Sustainability Tracking, Assessment & Rating System™ from AASHE

UNCW – University of North Carolina – Wilmington