Toward Climate Neutrality: Greenhouse Gas Emissions Inventory for Florida Atlantic University, 2005-2007

by

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This thesis was prepared under the direction of the candidate's thesis advisor, Dr. William E. O'Brien, and has been approved by the members of her/his supervisory committee. It was submitted to the faculty of the Honors College and was accepted in partial fulfillment of the requirements for the degree of Bachelor of Arts in Liberal Arts and Sciences.

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ABSTRACT

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Colleges and universities across the U.S. are working to reduce their environmental impact. Florida Atlantic University (FAU) has joined this nationwide collegiate effort through President Frank Brogan's recent signing of the American College and University Presidents Climate Commitment (ACUPCC). For my thesis, I estimated greenhouse gas emissions at FAU from 2005-2007 through collecting and analyzing data from different university departments and inputting this information into the Clean Air-Cool Planet Campus Carbon Calculator for further computations. This greenhouse gas emission inventory for FAU meets the ACUPCC requirements. Using this greenhouse gas emission baseline, a comprehensive plan can be produced to monitor progress toward creating a sustainable and climate neutral FAU.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

I. Introduction

Universities and colleges across North America have been taking the initiative on reducing their ecological footprint at this crucial period of the onset of global climate change. Many people predict climate change, along with its effects on the Earth and the human population, to be the defining characteristic of this century.[1] As was seen in the 1960s and 70s with the Vietnam War and the beginning of the environmental movement, calls for radical change have historically started at higher education institutions, and the call for action against climate change has followed suit.[2]

Higher education institutions are a $363 billion industry,[3] harboring the future generation of young people preparing to enter and influence the private and public sectors in our own country and beyond; what they think and do in terms of sustainability will matter. Education has the chance to shape the way students think and act in terms of sustainability and the environment. As David Orr states:

> The crisis we face is first and foremost one of mind, perception, and values; hence, it is a challenge to those institutions presuming to shape minds, perceptions, and values. It is an educational challenge. More of the same kind of education can only make things worse. This is not an argument against education but rather an argument for the kind of education that prepares people for lives and livelihoods suited to a planet with a biosphere that operates by the laws of ecology and thermodynamics.[4]

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[1] Marilyn Gilroy, "The Greening of Academia," *The Hispanic Outlook in Higher Education; Paramus* 17, no. 25 (2007): 30-32.

[2] Sarah Buttenwieser, "Greening the Ivory Tower," *Earth Island Journal* 22, no. 4 (2008): 34-38.

[3] "Digest of Education Statistics" in *National Center for Education Statistics* [database online] (Washington, DC: US Department of Education, Institute for Education Sciences, 2006, accessed 17 January 2008); available from http://nces.ed.gov/programs/digest/d06; Internet.2006 [cited 01/17/2008]. http://nces.ed.gov/programs/digest/d06.

[4] David W. Orr, *Earth in Mind: On Education, Environment, and the Human Prospect.* (Washington: Island Press, 1994), 27.

Florida institutions are no exception to this idea.

Florida Atlantic University is taking steps to join this nationwide collegiate effort toward sustainability. In August of 2007, President Frank Brogan signed the American College and University Presidents Climate Commitment (ACUPCC), putting FAU on the track toward climate neutrality. The ACUPCC defines climate neutrality as "having no net greenhouse gas (GHG) emissions, within a minimum scope of boundaries laid out in [the ACUPCC Implementation] Guide. This is to be achieved through such measures as conservation, renewable energy, and carbon offsets or other measures to mitigate the remaining emissions."[5]

Florida Atlantic University was established in 1961 as Florida's fifth public institution of higher education. It now includes seven campuses spanning the east coast of South Florida: Boca Raton, Dania Beach, Davie, Fort Lauderdale, Harbor Branch, Jupiter, and Port St. Lucie. FAU currently has a student population of about 26,000, including both graduate and undergraduate students.[6] Because FAU is still steadily growing, new buildings are planned and built every year and more students are admitted. With a constantly growing institution, having an effective climate neutrality plan is even more important: If new buildings can be built and students can be educated with sustainability in mind, not only will FAU stay on track toward becoming climate neutral, but FAU alumni will go out into the world knowing better how to live sustainable lifestyles.

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[5] Julian Dautremont-Smith, Anthony Cortese, Georges Dyer, and Judy Walton, "*ACUPCC Implementation Guide: Information and Resources for Participating Institutions*," American College and University Presidents Climate Commitment (2007).

[6] "Florida Atlantic University," in *Florida Atlantic University* [database online] (2008, accessed 17 January 2008); available from http://www.fau.edu/; Internet.

The ACUPCC was established in 2006 by college and university presidents at the inaugural Association for the Advancement of Sustainability in Higher Education (AASHE) conference at Arizona State University to help institutions design, outline, and implement a sustainability and greenhouse gas reduction plan so that universities and colleges can eventually become climate neutral.[7] The program is overseen by AASHE, ecoAmerica, and Second Nature.[8] As a non-profit marketing organization, ecoAmerica "shifts personal and civic choices with innovative consumer research & marketing."[9] Second Nature, an organization founded in 1993, seeks to make sure that educational institutions are teaching sustainability in all aspects of learning.[10]

As of April 27, 2008, presidents from 529 colleges and universities have signed the commitment and these institutions are currently at varied stages of achieving climate neutrality.[11] In Florida, nine colleges and universities have signed the ACUPCC:

Public

- Florida Atlantic University (Frank T. Brogan, President)
- Florida Gulf Coast University (Richard Pegnetter, Interim President*)
- Florida International University (Modesto A. Maidique, President)
- New College of Florida (Gordon E. Michalson, Jr., President)
- University of Central Florida (John C. Hitt, President*)
- University of Florida (Bernard Machen, President*)

Private

- Eckerd College (Donald R. Eastman III, President)
- Stetson University (H. Douglas Lee, President)
- University of Miami (Donna E. Shalala, President*)

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[7] "American College and University Presidents Climate Commitment" in *Presidents Climate Commitment* [database online] (Presidents Climate Commitment, 2008, accessed 17 January 2008); available from http://www.presidentsclimatecommitment.org/; Internet.

[8] ibid.

[9] "ecoAmerica," in *ecoAmerica* [database online] (ecoAmerica, 2008, accessed 27 February 2008); available from http://www.ecoamerica.net/; Internet.

[10] "Second Nature," in *Second Nature: Education for Sustainability* [database online] (Second Nature, 2006, accessed 27 February 2008); available from http://www.secondnature.org/; Internet.

[11] "American College and University Presidents Climate Commitment" [database online] 2008.

None of Florida's 26 community college presidents have signed the commitment. Of those presidents who have signed, four are part of the ACUPCC leadership circle (noted by the asterisks), which means they have chosen to actively "help lead the initiative, promote it, and recruit colleagues to join."[12] Florida higher education institutions are truly beginning to see the importance of emphasizing sustainability.

Signing the commitment requires that universities and colleges take definitive steps toward reaching goals. Within two months of signing the commitment, the university/college must create an internal body to "guide the development and implementation of the plan," such as the creation of a sustainability committee, and within one year a comprehensive greenhouse gas emissions inventory must be completed and updated every other subsequent year.[13] Within two years of signing, the institution must develop an institutional action plan for becoming climate neutral, which includes:

- A target date for achieving climate neutrality as soon as possible.
- Interim targets for goals and actions that will lead to climate neutrality.
- Actions to make climate neutrality and sustainability a part of the curriculum and other educational experience for all students.
- Actions to expand research or other efforts necessary to achieve climate neutrality.
- Mechanisms for tracking progress on goals and actions.[14]

While this plan develops, two of the following seven tangible action items must be initiated:

- Establish a policy that all new campus construction will be built to at least the U.S. Green Building Council's LEED Silver standard or equivalent.
- Adopt an energy-efficient appliance purchasing policy requiring purchase of ENERGY STAR certified products in all areas for which such ratings exist.
- Establish a policy of offsetting all greenhouse gas emissions generated by air travel paid for by our institution.

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[12] ibid.
[13] ibid.
[14] ibid.

- Encourage use of and provide access to public transportation for all faculty, staff, students and visitors at our institution.
- Within one year of signing this document, begin purchasing or producing at least 15% of our institution's electricity consumption from renewable sources.
- Establish a policy or a committee that supports climate and sustainability shareholder proposals at companies where our institution's endowment is invested.
- Participate in the Waste Minimization component of the national RecycleMania competition, and adopt 3 or more associated measures to reduce waste.[15]

All documents (action plan, inventory, and progress reports) must be made public by submitting them to AASHE for posting and distribution on the worldwide web.[16]

In accordance with the ACUPCC, FAU established a university-wide Sustainability Committee to create and carry out a climate neutrality plan. The Sustainability Committee at FAU was assembled in the summer of 2007 and has adopted the following mission statement:

> To create a culture of sustainability at Florida Atlantic University in which the entire FAU community is aware of, involved with and committed to advancing sustainability through education, operations and community engagement.[17]

Currently, there is no paid sustainability position at FAU, so all members of the committee are volunteering their time in addition to their other university commitments. Shannon Clounts, the Assistant Director of the Office of Space Utilization and Analysis, chairs the committee of approximately 30 faculty, staff, and students from various departments and colleges throughout FAU. The committee meets about once a month to carry out the necessary duties of fulfilling the ACUPCC. In the fall of 2007, the committee chose the university's two tangible actions—a LEED construction policy and

[15] ibid.
[16] ibid.
[17] "Florida Atlantic University" [database online] 2008.

an ENERGY STAR purchasing policy. The results of this thesis project will serve as FAU's greenhouse gas emission inventory. Once a greenhouse gas emission baseline is established by this study, a comprehensive plan will be produced to monitor progress toward creating a sustainable and climate neutral FAU. In creating this baseline assessment, my thesis will account for the greenhouse gas emissions of FAU from 2005-2007.

II. Methods and Limitations

The ACUPCC specifically recommends the use of the Clean Air-Cool Planet (CA-CP) Campus Carbon Calculator to assess greenhouse gas emissions on college campuses.[18] Clean Air-Cool Planet is a non-profit organization committed to solving global warming through partnering with "companies, campuses, communities and science centers throughout the Northeast to help reduce their carbon emissions."[19] The CA-CP calculator is an extensive set of Microsoft Excel spreadsheets adapted by CA-CP for institutional use from workbooks by the Intergovernmental Panel on Climate Change (IPCC). They allow a user to input specific data while preset formulas calculate the total greenhouse gas emissions for a college or university. While the calculator takes most aspects of greenhouse gas emissions into account, several are not included. For example, the emissions created from transporting food from its source to a dining hall are not calculated, along with emissions created or reduced by recycling and using "green" or "natural" cleaners. Included in the spreadsheet are many different input categories, but each institution may include only those categories that are relevant to its operation. Therefore, for instance, if an institution (like FAU) has no agriculture activities on campus then that section can be left blank without compromising the overall results.

Clean Air-Cool Planet calls the spreadsheet a "Carbon Calculator" because all greenhouse gases are translated into metric tonnes of carbon dioxide equivalents (MTCDE). A carbon dioxide equivalent "translates" any greenhouse gas into carbon dioxide by multiplying the emissions of that gas by its global warming potential (GWP), or radiative forcing. Carbon dioxide's GWP is set at 1. Therefore, if methane is 23 times

[18] Dautremont-Smith, "ACUPCC," 10.
[19] "Clean Air-Cool Planet," in *Clean Air-Cool Planet* [database online] (Clean Air-Cool Planet, 2008, accessed 17 January 2008); available from http://www.cleanair-coolplanet.org/; Internet.

more powerful as a greenhouse gas than carbon dioxide, then its GWP is 23. So if one metric tonne (2204.622 lbs) of methane is emitted, it is essentially counted in the inventory as 23 metric tonnes of carbon dioxide equivalents, or 23 MTCDE. Table 1 shows some greenhouse gases and their GWP relative to carbon dioxide. With all greenhouse gases expressed in terms of carbon dioxide, the results of the inventory become simpler to understand and to graphically display.

Table 1: Global warming potential (GWP) of common greenhouse gases

Chemical	100 Year GWP
CO_2	1
CH_4	23
N_2O	296
HFC-23	12,000
SF_6	22,200
CF_4	5,700
CH_3OCH_3	1
NF_3	10,800

Source: IPCC 2001

Collecting the data to insert into the calculator required contacting offices on each campus and attempting to find the correct person within the correct office with the information needed for the inventory. Below are the input categories for the inventory and from where the information was gathered:

- Budget
  - **Operating Budget**: *University Budget Office*
  - **Research Dollars**: *University Budget Office*
  - **Energy Budget**: *Engineering & Utilities*
- Population
  - **Full Time Students**: *FAU Factbook Online*
  - **Part-Time Students**: *FAU Factbook Online*
  - **Summer School Students**: *Office for Institutional Effectiveness & Analysis*
  - **Faculty**: *FAU Factbook Online*
  - **Staff**: *FAU Factbook Online*
- Physical size
  - **Total Building Space**: *FAU Factbook Online*

    - **Total Research Building Space**: *FAU Factbook Online*
- Purchased electricity: *Engineering & Utilities, Physical Plant, Housing*
- Purchased steam/chilled water: *Information Unavailable*
- On campus stationary sources
    - **On-Campus Cogeneration Plant**: *Not Applicable to FAU*
    - **Stationary Sources of Emissions on Campus**: *Engineering & Utilities, Housing*
- Transportation
    - **University Fleet**: *Physical Plant*
    - **Air Travel:** *Information Unavailable*
    - **Commuters**: *Office of Institutional Effectiveness & Analysis*
- Agriculture (*Not Applicable to FAU)*
    - **Fertilizer Application**: *N/A*
    - **Animal Agriculture**: *N/A*
- Solid waste: *Physical Plant, Solid Waste Authority*
- Refrigerants and other chemicals: *Engineering & Utilities*
- Offsets
    - **Renewable Energy Credits**: *Not Applicable to FAU*
    - **Composting**: *Not Applicable to FAU*
    - **Forest Preservation**: *Not Applicable to FAU*

Some of these categories are not applicable to FAU or have unavailable information and thus are not included in FAU's inventory. By not including information that was unavailable but applicable to FAU, the overall emissions will likely be less than if this information were available and included. As long as this is kept in mind, the areas that are included will still give a comprehensive baseline of emissions from which the Sutainability Committee can create a climate neutrality plan. Other categories have missing information and some values are thus estimated based on the values that were available; these values are noted by numbers in darkly shaded (green) cells on their respective tables in this section. A more detailed table of data acquisition is provided in Appendix III.

All information except population/enrollment statistics was included by fiscal year, where the year 2005 is actually July 2004 through June 2005. Enrollment and population were input by the dates of the respective term: Summer 2005 enrollment is

under the year 2005 and Fall 2005 enrollment is under the year 2006 to correspond with the fiscal year.

There exist some FAU-affiliated buildings that are not included in the inventory at this time. The Harbor Branch Oceanographic Institution (HBOI) has been partnering with FAU for over 10 years and has, as of January 2008, officially become a part of FAU. Because of these circumstances, Harbor Branch will not be included in the current inventory. It will, however, be included in any subsequent inventories now that is has been acquired by FAU. The Pine Jog Environmental Education Center is also not included in the inventory. Although Pine Jog has been a part of FAU since 1970, its budget is separate and it is not technically an FAU campus and therefore is not included in the inventory. The Gumbo Limbo Environmental Complex is also affiliated with FAU, but it is "owned and operated by the City of Boca Raton and funded by the Greater Boca Raton Beach and Park District," so it is also not included.[20]

i. Budget

Both the operating budget and research dollars were obtained from the University Budget Office. The operating budget is simply the yearly cost to run the institution and research dollars includes all financial backing for the university's research endeavors. Research dollars are included in the operating budget. These figures are university-wide as opposed to campus specific and were obtained as one figure for each year.

[20] "Gumbo Limbo," in *Gumbo Limbo Environmental Complex* [database online] (Gumbo Limbo, 2008, accessed 27 February 2008); available from http://gumbolimbo.org/; Internet.

Table 2: Budget totals (pre-inflation adjustment)

Budget totals (pre-inflation adjustment)			
	2005 (July 2004-June 2005)	**2006 (July 2005-June 2006)**	**2007 (July 2006-June 2007)**
Operating	$433,440,562.00	$447,487,266.00	$479,781,093.00
Research	$67,382,448.00	$53,578,047.00	$56,572,432.00

On the other hand, the energy budget, which includes all funds used for the purchase of electricity (including HVAC), had to be found at each campus by obtaining records for what was paid each year for electricity. All figures were found except for those in Housing. FAU has residential housing only on its Boca Raton and Jupiter campuses and both are under the direction of Jill Eckhardt, Director of Housing. She had records for kilowatt hours (kWh) used in each housing building, but did not have the corresponding budget numbers. Therefore, once all other figures were obtained from the other campuses, the Housing energy budget had to be estimated. The average cost per kWh per year for housing was estimated using the available figures.

- 2005: ~$0.08/kWh
- 2006: ~$0.09/kWh
- 2007: ~$0.10/kWh

This average was then multiplied by the kWh used in Housing to retrieve a total energy budget for Housing. The Housing estimates were then added to the other energy budgets to find the university-wide energy budget by year.

Table 3: Energy budget totals by campus (pre-inflation adjustment)

Energy budget totals by campus			
Campus/Area	**2005 (July 2004-June 2005)**	**2006 (July 2005-June 2006)**	**2007 (July 2006-June 2007)**
Boca	$6,508,767.00	$5,920,701.00	$6,034,353.00
Jupiter	$381,810.00	$527,535.00	$544,214.00
Davie	$427,573.66	$493,293.83	$546,150.48
Ft. Lauderdale	$301,597.67	$356,288.64	$392,927.90
Dania Beach	$115,905.12	$128,598.63	$140,710.71
Pt. St. Lucie	$156,099.00	$175,026.00	$189,692.00
Commercial	$57,160.35	$59,187.61	$46,641.99
Housing	$884,056.21	$1,099,465.56	$1,254,174.00
TOTAL	**$8,832,969.01**	**$8,760,096.27**	**$9,148,864.08**

To make sure that each year can be compared to the next, CA-CP provides a worksheet to adjust the budget entries for inflation. The numbers and calculations in the inflation adjustment worksheet are provided by NASA. Therefore, any dollar amounts seen in the tables here are not the numbers in the actual inventory because they are not adjusted until they are entered into the CA-CP spreadsheet.

ii. Population

Population consists of full-time, part-time, and summer school students, as well as faculty and staff. All of these numbers, except for summer school students, were acquired from the FAU Factbook Online. Summer school enrollment numbers were acquired from the Office of Institutional Effectiveness and Analysis (IEA). As previously stated, population/enrollment is the only category input by term to correspond with the correct fiscal year. It is important to note that even though the student population of FAU has stayed relatively the same, overall MTCDE has increased.

Table 4: Population totals by campus (full-time/part-time students only)

Population totals by campus (FT/PT students only)			
Campus/Area	**2005 (July 2004-June 2005)**	**2006 (July 2005-June 2006)**	**2007 (July 2006-June 2007)**
Boca	17,800	18,047	18,180
Jupiter	1,538	1,513	1,512
Davie	4,039	4,110	3,686
Ft. Lauderdale	825	827	701
Dania Beach	51	47	58
Pt. St. Lucie	785	850	865
Commercial	20	6	0
Off-Campus	604	594	655
FULL-TIME (FT)	**13,059**	**13,354**	**13,415**
PART-TIME (PT)	**12,603**	**12,640**	**12,242**
TOTAL	**25,662**	**25,994**	**25,657**

iii. Physical Size

Physical size includes total building space as well as total research building space. All of the data for these input categories was acquired from the FAU Factbook Online. Originally included in the FAU Factbook data was extra square footage under the title "Other Sites." Other Sites includes FAU partner buildings such as the Pine Jog Environmental Education Center, Gumbo Limbo Environmental Complex, and Harbor Branch Oceanographic Institution. Since these sites are not included elsewhere in the inventory, their square footage was subtracted from the total building space and research building space.

Table 5: Total building space (square feet)

Total building space (square feet)			
Campus/Area	**2005 (July 2004-June 2005)**	**2006 (July 2005-June 2006)**	**2007 (July 2006-June 2007)**
Boca	3,475,071	3,536,472	3,453,110
Northern Campuses	362,291	384,828	412,262
Jupiter Pt. St. Lucie			
Broward Campuses	666,506	685,030	665,363
Ft. Lauderdale Davie Dania Beach			
TOTAL	**4,503,868**	**4,606,330**	**4,530,735**

Table 6: Total research space (square feet)

Total research space (square feet)			
Campus/Area	**2005 (July 2004-June 2005)**	**2006 (July 2005-June 2006)**	**2007 (July 2006-June 2007)**
Boca	142,374	141,876	141,503
Northern Campuses	19,628	21,196	37,054
Jupiter Pt. St. Lucie			
Broward Campuses	40,312	37,088	36,744
Ft. Lauderdale Davie Dania Beach			
TOTAL	**202,314**	**200,160**	**215,301**

iv. Purchased Electricity

For purchased electricity, each campus or group of campuses had to be contacted separately for their respective data. The Boca Raton and Jupiter campuses are both run under the same Engineering and Utilities Department, meaning that the information from both campuses came from the same person. This is also the case with the Broward campuses (Davie, Ft. Lauderdale, and Dania Beach), but their information came from the Physical Plant. The Port St. Lucie campus has its own Engineering and Utilities Department, and the numbers for Housing came from the Director of Housing.

In order to calculate the emissions from purchased electricity, the sources of that electricity must be identified. All FAU campuses are supplied energy from Florida Power & Light (FPL). Within the CA-CP inventory, there is a separate worksheet to enter the specific fuel mix for an energy provider. If the fuel mix is unknown, the region of the campus(es) can be selected and an average fuel mix for that region is applied. Since all the energy for FAU is provided by FPL, a specific fuel mix was available via the FPL affiliate website. The fuel mix entered into the inventory was the average fuel mix used from January 1, 2007 to December 31, 2007: 52% natural gas, 19% nuclear, 15% purchased power, 8% oil, and 6% coal.[21] These percentages are their most recent fuel mix numbers (2006) and were used for all three years in the inventory. The emissions associated with each fuel are applied to the kWh based on the percentages input.

Table 7: Purchased electricity totals by campus (kWh)

Purchased electricity totals by campus (kWh)			
Campus/Area	**2005 (July 2004-June 2005)**	**2006 (July 2005-June 2006)**	**2007 (July 2006-June 2007)**
Boca	77,688,745	81,915,886	82,677,276
Jupiter	4,798,657	5,904,845	4,776,266
Davie	5,375,033	5,348,023	5,282,445
Ft. Lauderdale	3,882,940	3,817,640	3,986,120
Dania Beach	1,559,640	1,438,440	1,467,840
Pt. St. Lucie	1,944,175	1,914,381	1,945,266
Commercial	722,280	643,440	424,920
Housing	11,164,111	12,413,376	12,686,080
TOTAL	**107,135,581**	**113,396,031**	**113,246,213**

[21] "Florida Power & Light Company," in *FPL Group* [database online] (FPL Group, 2008, accessed 27 February 2008); available from http://www.fplgroup.com/about/contents/fpl.shtml; Internet.

v. Purchased Steam/Chilled Water

FAU does not have any purchased steam on campus and they are currently developing systems to measure chilled water used on campus.[22] Therefore, no data was entered into the chilled water category even though it exists on campus. Once the measuring system is complete, chilled water can and should be included in future inventories.

vi. On Campus Stationary Sources

The only on-campus stationary source that FAU uses is natural gas, and it is only used on the Boca and Jupiter campuses. Unfortunately, the numbers received for natural gas were astronomical and are currently being investigated and thus could not be part of this inventory. Once the discrepancies are sorted out, the amount of natural gas used at FAU should be part of future inventories.

vii. Transportation

The transportation category includes University Fleet, Air Travel, and Commuter Transport.

a. University Fleet

For the University Fleet, all data came from the Physical Plant on the Boca Raton campus. The CA-CP spreadsheet asks for gallons of both gasoline and diesel fuel used in university vehicles. Currently, there are only records for fuel dispensed on campus. Prior to September of 2006 there are no records for fuel dispensed off-campus. Because of the lack of data in this area, off-campus fuel numbers were not included in this inventory from 2005-2007, but they should be included in future inventories.

[22] Jeff Modlin, contact by author, e-mail, Jupiter, Fl., 6 February 2008.

Table 8: Fuel dispensing totals (gallons)

Fuel dispensing totals (gallons)			
On Campus	**2005 (July 2004-June 2005)**	**2006 (July 2005-June 2006)**	**2007 (July 2006-June 2007)**
Diesel	6708.90	5608.00	7017.10
Gasoline	41,705.70	43,287.33	48,082.40

b. Air Travel

Information regarding airline miles traveled by faculty and students was not available due to limitations in the system currently in place to track trips, and therefore is not included within the inventory. As of right now the system only generates a lump sum of money spent on each trip taken, meaning that there is no way to delineate between, say, money spent on airline tickets and money spent on hotel. There is also no way to tell exactly where each faculty member or student went, because the system only tracks budget entries. Since airline miles account for a significant portion of emissions in most cases, it would be ideal to implement a way to keep track of how much is spent on airline tickets alone, the location to which students and faculty are traveling, or both. Acquiring a new method of collection would greatly enhance the completeness of FAU's future inventories.

c. Commuter Transport

Commuter transport had to be estimated based on available information. Since there is no way to accurately track with precision the driving distances for all commuters to and from a certain campus on what days and in what type of vehicle, this information had to be gathered in a different way. For the students, faculty, and staff, spreadsheets were created by the Office of Institutional Effectiveness & Analysis that included the zip code of every person enrolled in classes or working on a specific campus by semester,

and they then calculated how many times during each day of the week that someone from that zip code was scheduled to be on campus.

The zip codes of students were acquired through FAU's administrative system, Banner, in which students are responsible for supplying their local and permanent addresses. Since some students only use their permanent address, which is at times not local, some discrepancies may occur. Only if a student's local address was unavailable was his/her permanent address's zip code used. This means that some zip codes are from as far away as New York and as close as Tallahassee, and had to be disregarded in calculating miles driven, as someone in Tallahassee clearly is not driving to Boca Raton six times per week. All zip codes outside of a sixty-mile radius of each respective campus were labeled as extraneous, and any trips in disregarded zip codes for a given campus and year were eventually attributed the average miles driven for that specific campus and year. The sixty-mile radius and attributing average values was decided upon after discussions with both Dr. William O'Brien and Dr. Terje Hoim.[23] All of the data was then prepared in Microsoft Excel to be input into ArcGIS for analysis.

Each spreadsheet (faculty, staff, and students all had separate files) was separated by campus and semester, but in order to input this data into ArcGIS, each campus and each fiscal year (summer through spring) had to have its own file. Within these separate campus/fiscal year files, the number of trips per week had to be totaled for each zip code, and the whole file had to be formatted to join correctly to specific files in ArcGIS.

Within ArcGIS, separate map files were made for each year being investigated (2005, 2006, and 2007) and each demographic (students, faculty, and staff). Each

[23] William O'Brien, contact by author, in person, Jupiter, Fl., 2 April 2008; Terje Hoim, contact by author, in person, Jupiter, Fl., 2 April 2008.

campus was given a separate data frame within a specific map file to keep the data consolidated by year. A map of Florida (delineated by zip code) was obtained, along with centroid points for each zip code. A center point was established for each campus and coordinates were taken via Google Earth to insert points on each map for the location of each respective campus. A buffer zone of 60 miles was applied to all campuses and zip codes outside of that zone were temporarily disregarded. The distance from each zip code centroid within the buffer zone to the specific campus was calculated and then multiplied by two to represent a full trip to campus and back home. This distance was then multiplied by the number of trips per week to that campus by a person or persons within a certain zip code. An average was calculated from these distances and applied to all extraneous zip codes for that campus and year.

Once all distances were calculated for a demographic, each campus's distance average had to be compiled with the other campuses' averages to ultimately calculate a yearly university-wide average distance traveled per trip. The estimated total average miles per trip for each year and demographic could then be entered into the inventory spreadsheet. In addition, the average trip per day per person for each year and each demographic had to be calculated and inserted into the inventory spreadsheet.

To enter all of this information into the spreadsheet, a few more assumptions had to be made. It was assumed that all faculty and staff drive alone in their personal vehicles to their respective campuses everyday with a CA-CP provided average fuel efficiency of 22.1 miles per gallon. The number of workdays and class-days per year was estimated based on the FAU Academic Calendar dates.[24] For students, the number of residential

[24] "Florida Atlantic University" [database online] 2008.

beds was subtracted from the percentage of total students who use their personal vehicles (for summer school, residential bed numbers were halved), leaving an assumed 89% of students who drive alone in their personal vehicles everyday to their respective FAU campus and 93-94% of summer school students who do the same.

Table 9: Student commuter transport

Student commuter transport				
Fiscal Year	**Students**	**Student fuel efficiency**	**Percent Commuting by personal vehicle**	**% TOTAL STUDENTS Driving alone**
	#	**mpg**	**%**	**%**
2005	19,361	22.1	0.89	0.89
2006	19,674	22.1	0.89	0.89
2007	19,536	22.1	0.89	0.89
Trips / Day	**Days / Year**	**Miles / Trip**	**Total Distance**	**Fuel Consumption**
			Miles	**Gallons**
1.49	148	30	114,980,089	5,202,719
1.47	148	30	114,020,863	5,159,315
1.47	148	29	110,216,521	4,987,173

Table 10: Summer student commuter transport

Summer student commuter transport				
Fiscal Year	Total Summer School Students	Student fuel efficiency	Percent Commuting by personal vehicle	% TOTAL STUDENTS Driving alone
	#	mpg	%	%
2005	16,153	22.1	93%	93%
2006	16,291	22.1	93%	93%
2007	17,020	22.1	94%	94%
Trips / Day	Days / Year	Miles / Trip	Total Distance	Fuel Consumption
			Miles	Gallons
0.54	61	28	13,836,153	626,070
0.50	61	32	15,107,447	683,595
0.50	61	30	14,337,856	648,772

Table 11: Faculty commuter transport

Faculty commuter transport				
Fiscal Year	Total Faculty	Student fuel efficiency	Percent Commuting by personal vehicle	% TOTAL STUDENTS Driving alone
	#	mpg	%	%
2005	1,291	22.1	100%	100%
2006	1,386	22.1	100%	100%
2007	1,260	22.1	100%	100%
Trips / Day	Days / Year	Miles / Trip	Total Distance	Fuel Consumption
			Miles	Gallons
0.24	209	27	1,771,773	80,171
0.23	209	27	1,771,773	80,171
0.25	209	27	1,771,773	80,171

Table 12: Staff commuter transport

Staff commuter transport				
Fiscal Year	Total Staff	Student fuel efficiency	Percent Commuting by personal vehicle	% TOTAL STUDENTS Driving alone
	#	mpg	%	%
2005	2,677	22.1	100%	100%
2006	2,594	22.1	100%	100%
2007	2,771	22.1	100%	100%
Trips / Day	Days / Year	Miles / Trip	Total Distance	Fuel Consumption
			Miles	Gallons
0.14	233	25	2,216,936	100,314
0.14	233	25	2,216,936	100,314
0.14	233	25	2,216,936	100,314

viii. Agriculture

FAU has no agriculture on any of its campuses, and thus no data was input for this category.

ix. Solid Waste

No records exist for the amount of solid waste generated per year on each campus. Therefore, solid waste capacity and frequency of pickup per week was used to estimate the cubic yardage of waste produced by FAU. These numbers had to be gathered by campus or campus group: Boca Raton and Jupiter (Physical Plant); Davie, Ft. Lauderdale, and Dania Beach (Physical Plant); and Port St. Lucie (Treasure Coast Enrollment Growth). Housing at this time has no way to estimate their solid waste totals, but this should be remedied for future inventories. The Davie campus partners with Broward Community College for their solid waste and thus have no records or estimates

of generated waste.[25] Once an estimate of cubic yardage per year was calculated, this value had to be multiplied by an average density (lbs/yd^3) to get a weight for the solid waste. The average municipal solid waste density of 134 lbs/yd^3 was obtained from the Solid Waste Authority of Palm Beach County.[26] This density was used for all three years in this inventory.

Table 13: Solid waste estimated totals by campus (short tons)

Solid waste estimated totals by campus (short tons)			
Campus/Area	**2005 (July 2004-June 2005)**	**2006 (July 2005-June 2006)**	**2007 (July 2006-June 2007)**
Boca	3104.244	3104.244	3104.244
Jupiter	557.44	557.44	557.44
Davie			
Ft. Lauderdale	111.488	111.488	111.488
Dania Beach	55.744	55.744	55.744
Pt. St. Lucie	55.744	55.744	55.744
Commercial			
Housing			
TOTAL	**3,885**	**3,885**	**3,885**

In addition to finding an average density, the CA-CP inventory also needs to know what happens to the waste once it arrives at the landfill. For this section there are four different categories: incinerated waste (waste to energy plant) not used for school power; landfilled waste with no CH_4 (methane) recovery; landfilled waste with CH_4 recovery and flaring; and landfilled waste with CH_4 recovery and electric generation. For the waste generated by FAU, half is incinerated in a Refuse Derived Fuel (RDF) Incinerator at a waste to energy plant not used for school power, and the other half is simply landfilled waste with no CH_4 recovery. Once the solid waste estimates were calculated, half of the weight for each year was input under incinerated waste (waste to

[25] Reid Morgan, contact by author, e-mail, Jupiter, Fl., 12 March 2008.
[26] Linda Moreno, contact by author, telephone, Jupiter, Fl., 8 April 2008.

energy plant) not used for school power and then in the subcategory for Refuse Derived Fuel (RDI) Incinerator, while the other half was input under landfilled waste with no CH_4 recovery. This allows the CA-CP spreadsheet to calculate more accurate MTCDE for solid waste.

x. Refrigerants and Other Chemicals

Information regarding refrigerants and other chemicals was not available in a manner that would be suitable to include in the inventory. Although refrigerant amounts for the chillers on each campus was given, these amounts do not count toward our emissions because the refrigerant is contained. Other than this, no specific chemicals or amounts for specific chemicals were recorded, and therefore could not be included. Each chemical has a specific emissions factor (how much of and what greenhouse gas is emitted), so unless the chemical is specified, its emissions factor is unknown and is useless in the inventory spreadsheet. If a better system of tracking the purchase and use of chemicals and refrigerants on each campus can be put in place, then this category can be included in subsequent inventories.

xi. Offsets

The three "Offsets" subcategories are Renewable Energy Credits, Composting, and Forest Preservation. Currently, FAU does not have any of these offsets, but efforts are being made to begin composting on the Jupiter campus.

III. Results and Discussion

Global climate change is quickly becoming an issue that simply cannot be ignored; its effects are already being seen in the United States and across the globe.[27] What we do in the United States to mitigate or increase our greenhouse gas emissions affects the world and vice versa, because greenhouse gases spread out evenly in the earth's atmosphere.[28] The United Nations Framework Convention on Climate Change Executive Secretary suggests that the countries of the world need to collectively lower their emissions 80% below 1990 levels by 2050 to avoid the most devastating effects of climate change, including dramatic sea level rise and temperature changes.[29]

Because a large percentage of the world's emissions come from the United States, the country is expected to be a leader in combating climate change, which is where the American Colleges and Universities Presidents Climate Commitment comes into play.[30] AASHE, the Association for the Advancement of Sustainability in Higher Education, decided in 2006 that America's climate leadership should start with higher education, and more specifically with the presidents of higher education institutions.[31] Every president who signs the ACUPCC commits his or her institution to becoming climate neutral—a huge feat for any person, business, or organization of any kind. The ACUPCC allows the United States and the world to see that real steps toward mitigating climate change are

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[27] Martin Parry et al., eds., "*Climate Change 2007: Impacts, Adaptation and Vulnerability*," Intergovernmental Panel on Climate Change, (Cambridge University Press, 2007), 23-78.

[28] Susan Solomon et al., eds., "*Climate Change 2007: The Physical Science Basis*," Intergovernmental Panel on Climate Change, (Cambridge University Press, 2007), 93-128.

[29] "UNFCCC Executive Secretary..." *United Nations Framework Convention on Climate Change*, Press Release, 2 February 2007.

[30] "Climate Change: Greenhouse Gas Emissions," in *United Nations Statistics Division* [database online] (2007, accessed 18 April 2008); available from http://unstats.un.org/unsd/ENVIRONMENT/air_greenhouse_emissions.htm; Internet.

[31] "American College and University Presidents Climate Commitment" [database online] 2008.

being taken, and if other entities see that large institutions can become climate neutral, and students are entering the job market with education in sustainability practices, then the country will begin to shift toward real and effective solutions to climate change. When FAU's president signed the ACUPCC, he made FAU a part of the budding climate leadership movement.

FAU's first step toward becoming climate neutral starts with this emissions inventory. The University must know where it currently stands if it wants to move forward with climate neutrality. The inventory allows FAU to see where the bulk of its emissions come from and thus where to first concentrate emissions reduction efforts. The CA-CP Campus Carbon Calculator, although an extremely helpful tool when attributing a general value to emissions, is only an estimate. As such, it should be made completely clear that this inventory is a reasonable approximation of FAU's greenhouse gas emissions used first and foremost as a tool to create a comprehensive plan for FAU to become climate neutral.

This is FAU's first greenhouse gas inventory, and therefore there were no systems in place to report all of the necessary data to a particular person or in a certain form suitable for the CA-CP spreadsheet. The fact that there are large amounts of missing and estimated data means the results should be analyzed with caution. Missing data means missing emissions that will not be accounted for in this inventory; therefore, FAU actually emits more than what is recorded here. We also know now what information gaps need to be mended before the next inventory, so that all future inventories can be more thorough than this one. Nevertheless, the inventory will present the emissions that

were included, and those values will be extremely useful in terms of creating FAU's climate neutrality plan and assessing where FAU stands in terms of emissions created.

i. Emissions Results

Without airline miles, purchased steam and chilled water, and refrigeration and chemicals numbers, FAU emitted 109,315 MTCDE in 2005; 112,616 MTCDE in 2006; and 110,797 MTCDE in 2007. Below is a graph and a table with a breakdown of how much and from what category the emissions came. At this time, purchased electricity and transportation account for the largest portion of FAU's emissions. This means that FAU's first steps in reducing emissions should be oriented toward electricity conservation and transportation initiatives, which should drastically and quickly reduce emissions.

Figure 3: FAU total emissions (metric tonnes of eCO_2)

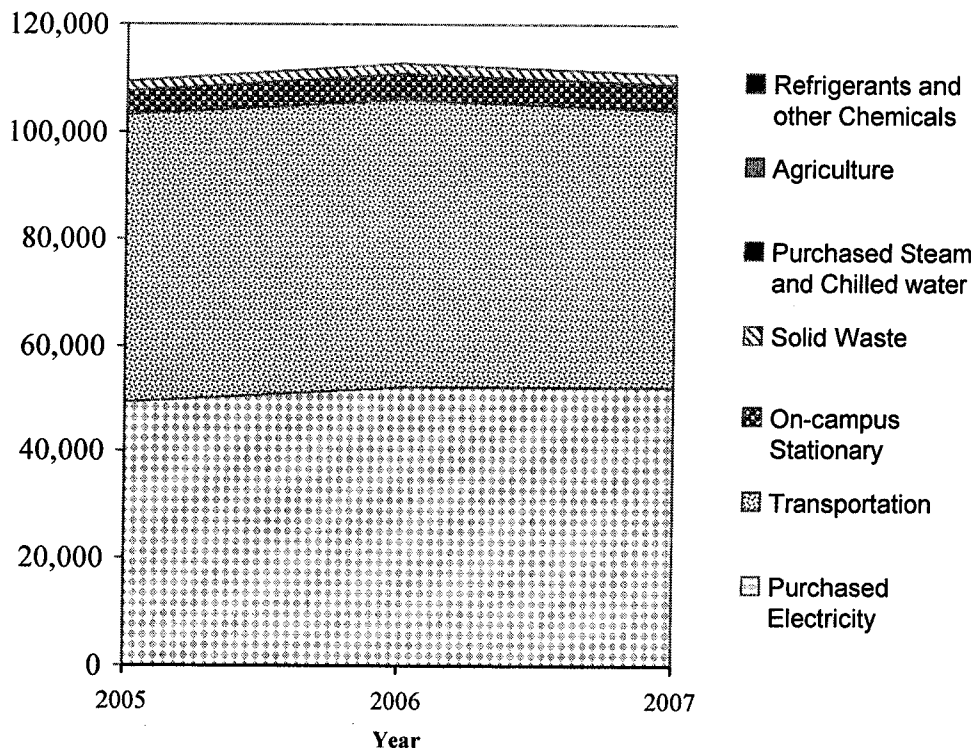

Table 14: FAU total emissions by sector (metric tonnes of eCO2)

Total emissions by sector (metric tonnes of eCO_2)			
FAU	2005	2006	2007
Purchased Electricity	49,058	51,991	51,907
Transportation	54,130	54,259	52,467
On-campus Stationary	4,275	4,514	4,571
Solid Waste	1,852	1,852	1,852
TOTAL	**109,315**	**112,616**	**110,797**

In order to fully understand what the numbers in this inventory represent, it is important to compare FAU with other institutions. For purposes of comparison, I chose a school comparable in population and size along with a school in this geographic area: Utah State University and Eckerd College, respectively.

Utah State University is located in Logan, Utah, about 85 miles north of Salt Lake City.[32] With a student population of about 23,000 and an operating budget of about $450 million, USU fits well as a comparison with FAU.[33] USU has about 1.5 million more square feet of building space and used, on average, 67 million kWh/year between 2005 and 2006, whereas FAU used an average of 109 million kWh/year from 2005 to 2007.[34] Keep in mind that in South Florida, air conditioning accounts for a significant portion of kWh usage and this is more than likely not the case in Northern Utah.[35] With this difference considered, 42 million kWh at FAU is noticeably more usage than USU,

[32] "Utah State University," in *Utah State University* [database online] (2008, accessed 18 April 2008); available from http://www.usu.edu/; Internet.

[33] Joe Dulin, "USU Greenhouse Gas Inventory Calculation, Summary, and Analysis Workbook," *Utah State University* (2007).

[34] ibid.

[35] "Florida Power & Light Company" [database online] 2008.

especially when FAU has far less building space. For a direct comparison in total emissions, all categories were deleted for USU that did not apply or were unavailable for FAU. This way, anything extra that USU might emit over FAU in categories that are not compatible between institutions did not hinder the comparison.

Figure 4: USU total emissions (metric tonnes of eCO2)

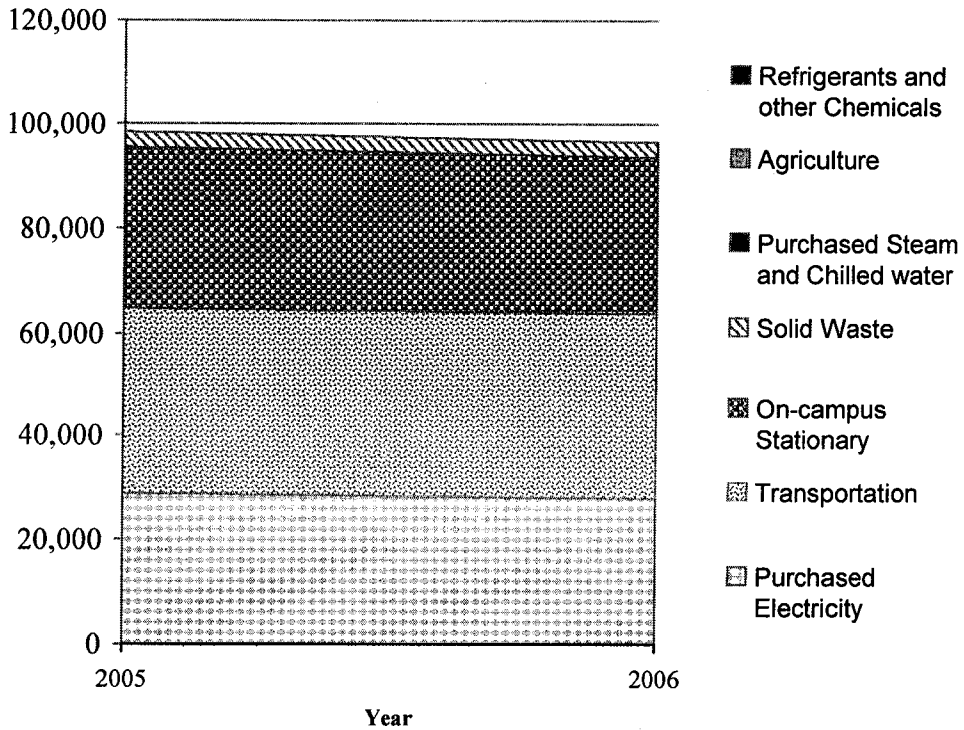

Table 15: USU total emissions by sector (metric tonnes of eCO2)

Total emissions by sector (metric tonnes of eCO_2)		
Utah State	2005	2006
Purchased Electricity	29,130	27,693
Transportation	35,673	35,928
On-campus Stationary	30,492	29,737
Solid Waste	3,086	3,049
TOTAL	**98,381**	**96,407**

On average, USU emitted 97,374 MTCDE and FAU emitted 110,909 MTCDE, with a difference of 13,535 MTCDE. The most notable differences are FAU's surplus emissions in Purchased Electricity and Transportation (mostly Commuter Transport). FAU actually had lower emissions in On-campus Stationary and Solid Waste, so the fact that FAU has higher emissions overall suggests that purchased electricity consumption and commuter transport should be take priority when attempting to reduce emissions throughout the university.

Another important comparison for FAU is one within Florida. Since Florida is a unique state in terms of climate, urban sprawl, and population, with the issues surrounding emissions reduction could be different from anywhere else in the United States. Eckerd College in St. Petersburg, Florida will be used for this in-state comparison.

Eckerd College only has about 1,800 students, so a direct number comparison will not be extremely helpful.[36] It will, however, be useful to compare what Eckerd has done since signing the ACUPCC to lower their emissions. After signing the ACUPCC, Eckerd decided to begin seeking LEED (Leadership in Energy and Environmental Design) certification from the U.S. Green Building Council for their Iota Residential Complex.[37] In contrast, FAU has already committed to building all new buildings to LEED standards.[38] Eckerd is also working on an Energy Star© purchasing policy, which will

[36] "Eckerd College," in *Eckerd College* [database online] (2008, accessed 18 April 2008); available from http://www.eckerd.edu/; Internet.
[37] ibid.
[38] ibid.

require all future appliances to be rated as an Energy Star© product.[39] FAU also has this policy already in place.

Although the following actions at Eckerd are not directly related to lowering reported emissions on the CA-CP spreadsheet, they are notable initiatives that FAU should consider. Currently, Eckerd's post-consumer recycled content in their purchased paper is 10% and they are trying to increase that percentage to 35%.[40] This action would indirectly reduce greenhouse gas emissions (from not having to cut down more virgin timber and having to do less processing to create the paper), though this action would not be reflected in Eckerd's emissions inventory. Additionally, Eckerd has instituted the "Yellow Bike" program on campus.[41] Yellow bikes are scattered across Eckerd College and are available for students, faculty, and staff to use to get around campus.[42] This program helps promote a sense of awareness regarding alternative transportation and encourages the Eckerd community to consider using alternative transportation to get to campus. This initiative could affect Eckerd's emissions reductions if it does in fact convince people to use other forms of transportation.

[39] ibid.
[40] ibid.
[41] ibid.
[42] ibid.

IV. Conclusion

Although much of the FAU community is still unaware of the institution's emissions reduction efforts, we are on the right track to eventually becoming climate neutral. This isn't to say that FAU does not have work to do—we could be changing more policies and starting more initiatives every day. Currently, as noted above, FAU has committed itself to building all future buildings to LEED standards and has an Energy Star© purchasing policy in place. The institution is also working on creating the sense of a sustainable FAU community, promoting more environmentally related events and making sure that events not centered on the environment are still considering sustainable practices.[43]

In terms of complete climate neutrality, FAU will have to begin conserving more electricity and thinking about creating a comprehensive alternative transportation plan, as these categories comprise the bulk of FAU's greenhouse gas emissions. Lowering electricity consumption may include retrofitting existing buildings in addition to building any future buildings to LEED standards. Transportation plans may include implementing more conducive bus routes and schedules, better access to train stations, and a carpool initiative. The ACUPCC is designed to continue helping institutions after their comprehensive plans have been established and encourages institutions to reach their goals, however high they may be. This inventory, as part of the ACUPCC, is just the beginning of FAU's journey toward climate neutrality.

[43] "Florida Atlantic University" [database online] 2008.

Appendix I: American College and University Presidents Climate Commitment

AMERICAN COLLEGE & UNIVERSITY
PRESIDENTS CLIMATE COMMITMENT

American College & University Presidents Climate Commitment

We, the undersigned presidents and chancellors of colleges and universities, are deeply concerned about the unprecedented scale and speed of global warming and its potential for large-scale, adverse health, social, economic and ecological effects. We recognize the scientific consensus that global warming is real and is largely being caused by humans. We further recognize the need to reduce the global emission of greenhouse gases by 80% by mid-century at the latest, in order to avert the worst impacts of global warming and to reestablish the more stable climatic conditions that have made human progress over the last 10,000 years possible.

While we understand that there might be short-term challenges associated with this effort, we believe that there will be great short-, medium-, and long-term economic, health, social and environmental benefits, including achieving energy independence for the U.S. as quickly as possible.

We believe colleges and universities must exercise leadership in their communities and throughout society by modeling ways to minimize global warming emissions, and by providing the knowledge and the educated graduates to achieve climate neutrality. Campuses that address the climate challenge by reducing global warming emissions and by integrating sustainability into their curriculum will better serve their students and meet their social mandate to help create a thriving, ethical and civil society. These colleges and universities will be providing students with the knowledge and skills needed to address the critical, systemic challenges faced by the world in this new century and enable them to benefit from the economic opportunities that will arise as a result of solutions they develop.

We further believe that colleges and universities that exert leadership in addressing climate change will stabilize and reduce their long-term energy costs, attract excellent students and faculty, attract new sources of funding, and increase the support of alumni and local communities.

Accordingly, we commit our institutions to taking the following steps in pursuit of climate neutrality:

1. Initiate the development of a comprehensive plan to achieve climate neutrality as soon as possible.

    a. Within two months of signing this document, create institutional structures to guide the development and implementation of the plan.

    b. Within one year of signing this document, complete a comprehensive inventory of all greenhouse gas emissions (including emissions from electricity, heating, commuting, and air travel) and update the inventory every other year thereafter.

    c. Within two years of signing this document, develop an institutional action plan for becoming climate neutral, which will include:

        i. A target date for achieving climate neutrality as soon as possible.

        ii. Interim targets for goals and actions that will lead to climate neutrality.

        iii. Actions to make climate neutrality and sustainability a part of the curriculum and other educational experience for all students.

        iv. Actions to expand research or other efforts necessary to achieve climate neutrality.

        v. Mechanisms for tracking progress on goals and actions.

2. Initiate two or more of the following tangible actions to reduce greenhouse gases while the more comprehensive plan is being developed.

    a. Establish a policy that all new campus construction will be built to at least the U.S. Green Building Council's LEED Silver standard or equivalent.

    b. Adopt an energy-efficient appliance purchasing policy requiring purchase of ENERGY STAR certified products in all areas for which such ratings exist.

    c. Establish a policy of offsetting all greenhouse gas emissions generated by air travel paid for by our institution.

    d. Encourage use of and provide access to public transportation for all faculty, staff, students and visitors at our institution.

    e. Within one year of signing this document, begin purchasing or producing at least 15% of our institution's electricity consumption from renewable sources.

f. Establish a policy or a committee that supports climate and sustainability shareholder proposals at companies where our institution's endowment is invested.

g. Participate in the Waste Minimization component of the national RecycleMania competition, and adopt 3 or more associated measures to reduce waste.

3. Make the action plan, inventory, and periodic progress reports publicly available by providing them to the Association for the Advancement of Sustainability in Higher Education (AASHE) for posting and dissemination.

In recognition of the need to build support for this effort among college and university administrations across America, we will encourage other presidents to join this effort and become signatories to this commitment.

Signed,

_____
President/ Chancellor Signature

_____
President/ Chancellor Name

_____
College or University

_____
Date

Please send the signed commitment document to:
Megan Begley
Second Nature
18 Tremont St., Suite 1120
Boston, MA 02108
or fax to: 320-451-1612
or scan & email to: mbegley@secondnature.org

Appendix II: Detailed E-mail, Phone, and Personal Contact for FAU Greenhouse Gas Emissions Inventory

8/17/07: E-mail from Angela Objio as per my conversation with Jeff Modlin. Sent **Utility Cost and Consumption Report.xls** for Boca and Jupiter.

- Jeff Modlin, Associate Director of Engineering & Utilities
  561-297-0239 jmodlin@fau.edu

10/03/07: Sent online request in to FAU Fact Book for additional budget data. Sharron Ronco sent e-mail back; need to contact University Budget Office.

- Sharron L. Ronco, Associate Provost, Institutional Effectiveness & Analysis
  561-297-2665 sronco@fau.edu

Sent e-mail to University Budget Office (to Dorothy Russell) in regards to more budget information.

- Dorothy Russell, Asst. VP for Fin.Affs./ Budget, University Budget Office
  561-297-3266 druss@fau.edu

Sent e-mail to Jill Eckardt regarding information on electricity usage in all residential housing. She e-mailed back immediately, we set up a meeting for October 4th at 10:30am.

- Jill Eckardt, Director of Housing
  561-297-3907 jeckardt@fau.edu

10/04/07: Meeting with Jill Eckardt. She gave me electricity records for residential housing from 2004-2007. I asked her for records from 2000-2007. She said she would e-mail them to me.

E-mail from Alan Levine regarding budget information as per Dorothy's request.

- Alan Levine, Asst. Univ. Budget Director
  561-297-3130 alevine@fau.edu

10/10/07: Called Alan Levine to explain exactly what I needed. Sending information via e-mail.

10/12/07: E-mail from Alan Levine. Sent operating budget requests for the past ten years by fund in **budget 1998-99 to 2007-08.xls**.

10/23/07: E-mailed Dennis Crudele regarding any transportation information he may have.

- Dennis Crudele, Assoc. VP Administrative Affairs, Associate VP of Finance
  561-297-3266 crudele@fau.edu

E-mailed Steven Saposnik regarding information on the university fleet of vehicles.

- Steven Saposnik, Purchasing Coordinator
  561-297-3045 saposnik@fau.edu

E-mailed John Singer with respect to fuel/maintenance records for the university fleet.

- John Singer, Director of the Physical Plant
  561-297-0193 singer@fau.edu

E-mailed Dennis Zabel regarding hazardous waste information.

- Dennis Zabel, Assistant Director, Environmental Health & Safety
  561-297-3106 dzabel@fau.edu

Reply from Dennis Zabel. Urged me to look at the EH&S website and said that "The amount of hazardous waste that is contracted out for disposal is approximately 20 tons per year. The types would be very difficult to list, because of the number, it could be up to 50,000 different chemicals."

E-mailed Jill Eckardt to check in and see where she was with finding electricity records for housing.

Reply from Jill saying she would get the information to me by the next week.

10/24/07: E-mail from Dennis Crudele. Parking capacities for all campuses and number of parking decals distributed for each campus. Attached "**FAU Enrollment Projections (May 2007)**" and "**SUS 2007 FTE Plans Format**" as Excel files.

10/30/07: E-mail from John Singer detailing the kind of information he has and asking if that is what I am looking for.

10/31/07: Replied to John Singer, saying that the information he has is what I am looking for.

11/14/07: E-mail from Steven Saposnik urging me to contact John Cutrone in the Transportation Area, as he would be of more help regarding university fleet information.

E-mail from William Robinson as per John Singer. William now answering questions regarding fuel/maintenance records for the university fleet. Explained the type of information he had and asked more specifically what I was looking for.

- William Robinson, Computer Programmer/Analyst, Physical Plant
  561-297-0051 wrobinso@fau.edu

11/27/07: E-mailed Judy Ferris and James Johnson in Traffic and Parking asking about obtaining zip codes for students, faculty, and staff.

- Judy Ferris, Director of Traffic and Parking
  561-297-2771 jsferris@fau.edu
- James Johnson, Coordinator, Administrative Services, Traffic and Parking
  561-297-2771 jjohn185@fau.edu

Reply from Judy Ferris. Traffic and Parking does not have zip code information. She said to try contacting the Office of Institutional Effectiveness & Analysis, the Registrar's Office (student information) and Human Resources (faculty and staff information).

12/04/07: E-mailed Jill Eckardt to ask again about the electricity records for housing.

Reply from Jill saying that I moved to the top of her to-do list.

12/07/07: E-mail from Jill Eckardt saying she is still working on finding utility records and that they may not be available.

12/13/07: Replied to Jill thanking her and letting her know that as soon as she gets the utility records to send them my way.

Replied to William Robinson to let him know he has the information I am looking for and to send over what he can via e-mail.

E-mailed Evan Cross regarding solid waste information.

- Evan Cross, Assistant Director of the Physical Plant
  561-297-3876 ecross@fau.edu

12/14/07: Reply from Evan Cross regarding solid waste. He said that the figures that I could get through Waste Management will not include housing and dining services. He put me in contact with FAU's representative at Waste Management, Lee Chayet, and told me to contact him as well.

Reply from Jill Eckardt with attached "**Utility history by usage**" Excel file. No records exist for utility consumption before 2004.

Replied to Jill's e-mail, thanking her for her help and asking her about solid waste figures for housing.

12/17/07: Reply from Jill Eckhardt regarding solid waste for housing. She said the information comes to her from the Physical Plant once a year based on a three-year average, meaning I should contact the Physical Plant instead. I replied and told her I'd let her know if I needed more help finding the figures.

1/17/08: E-mailed Christine Smith regarding zip code and schedule information.

- Christine Smith, Manager of the Department of Human Resources

561-297-2556 csmith@fau.edu

1/31/08: E-mailed Christine Smith a second time. She promptly replied and told me to contact Traffic & Parking for the zip code information. From contact with Judy Ferris of Traffic & Parking, I already know they don't have the information.

E-mailed Sharron Ronco and Yanhua Chen regarding zip code and schedule information.

- Sharron Ronco, Associate Provost, Office for Institutional Effectiveness & Analysis (IEA)
  561-297-2665 sronco@fau.edu
- Yanhua Chen, Statistical Research Coordinator, Office for Institutional Effectiveness & Analysis (IEA)
  561-297-4507 ychen17@fau.edu

E-mailed Reid Morgan regarding energy consumption on Broward campuses (Davie, Dania Beach, and Fort Lauderdale).

- Reid Morgan, Physical Plant Director, Broward Campuses
  954-762-5033 rmorgan@fau.edu

Immediate reply from Reid Morgan with attached spreadsheets of energy consumption on Broward campuses ("**Energy Use KWH BROWARD.xls**"). He put me in contact with Jim Baker for energy consumption on Jupiter and Treasure Coast campuses.

2/04/08: E-mailed Jim Baker regarding energy consumption on Jupiter and Treasure Coast campuses.

- Jim Baker, Director, Engineering & Utilities
  561-297-2894 jbaker@fau.edu

E-mailed William Robinson a second time regarding university fleet information with same e-mail as before.

Received e-mail from Yanhua Chen regarding student schedules and zip codes. Yanhua is working on compiling the information.

2/06/08: E-mailed John Singer a second time regarding University Fleet information. John immediately e-mailed back, having forwarded my request to William Robinson for the second time.

E-mailed Lee Chayet regarding solid waste information for all campuses.

- Lee Chayet, FAU Waste Management Representative
  lchayet@wm.com

E-mailed Jeff Modlin regarding purchased steam and chilled water records.

Jeff replied immediately stating that we have no purchased steam on campus and that we're developing systems to measure chiller water on the campus.

E-mailed Alan Levine regarding FAU's energy budget.
Alan immediately replied stating that I should contact the University Architect's office for the energy budget.

2/07/08: Reply from Jim Baker telling me to contact Mamie Jones or Jeff Modlin with regards to Jupiter electricity information. He also told me to contact Bev Sargent with regards to Treasure Coast electricity information.

- Mamie Jones, Office Manager, Engineering & Utilities
  561-297-2746 mjones@fau.edu
- Bev Sargent, Director, Academic Support Services, Treasure Coast
  772-873-3335 bsargent@fau.edu

2/08/08: E-mailed both Mamie Jones and Bev Sargent regarding Treasure Coast information. Immediate reply from Mamie urging me to contact Lucy Mueller for Treasure Coast information.

- Lucy Mueller, Senior Fiscal Assistant, Treasure Coast Enrollment Growth
  772-873-3303 lmueller@fau.edu

Reply from William Robinson with attached file: **Fuel Dispense Record.xls**. "I have basically given you month by month number of gallons of diesel and gasoline used, from the fuel tank on campus, and from 9/2006 to present, off-campus fuel gallons."
I e-mailed him back thanking him for his help.

Update from Yanhua Chen with attached file:
Stu_zipcode_by_camp_day_Spr08.rtf. Replied, thanked Yanhua and asked if I could have the information in Excel format. Immediate reply with attached Excel spreadsheet: **StuZip_by_campus_day_faculty_spr08.xls**.

2/11/08: Reply from Bev Sargent re: Treasure Coast, telling me that Indian River Comm. College pays part of FAU TC's electric bill since they share a campus, making the information a little harder to find. She copied Lucy Mueller on the e-mail.
Sent Bev an e-mail thanking her for her help.

2/13/08: E-mailed Yanhua Chen again asking if there is a way to separate faculty and staff within the zip code spreadsheet.
Immediate reply stating that student assistants were also included within faculty/staff and asking if I wanted to include them in the delineation.
I replied, stating that if student assistants were already counted within the student section, then separate all three categories so I can make the call later.

2/20/08: E-mailed William Robinson again to ask for a simple list of all University vehicles on all campuses.

Re-sent e-mail to Lee Chayet regarding solid waste information. Then e-mailed Evan Cross to see if he could help with getting in touch with Lee. Immediate reply from Evan saying that he'd sent Lee another e-mail and left him a message.

E-mailed Lucy Mueller about Treasure Coast electric records.
Immediate reply from Lucy asking for me to tell her exactly what I was looking for.
E-mailed back telling her what I wanted.

Reply from Yanhua Chen with the new delineated faculty, staff, and student assistant zip code spreadsheet: **Faculty_staff_zip_camp.xls**.

E-mailed Tom Donaudy asking about FAU's energy budget.
He replied and told me to contact Jim Baker (he also cced Jim on the e-mail).
Jim e-mailed me telling me to contact Mamie, Bev, and Reid for the budget information.
I replied to Jim telling him I thought there might be an overarching FAU energy budget figure.

- Tom Donaudy, University Architect & VP for Facilities
  561-297-2663 tdonaudy@fau.edu

E-mailed Alan Levine to ask about faculty/staff/student business air travel records.

E-mailed Shannon Clounts for help with finding more specific hazardous waste information and finding summer school enrollment statistics.
She immediately replied asking for more details on the enrollment numbers I want.
I replied, stating that I need the "number of summer school students enrolled at FAU yearly from 2000-2007."

- Shannon Clounts, Asst. Director, Space Utilization & Analysis
  561-297-2211 sclounts@fau.edu

2/21/08: Reply from Lee Chayet saying he's forwarded my request to Randy Johansen.

- Randy Johansen, Waste Management Account Manager
  954-734-4708(c) 954-917-1617(o) rjohanse@wm.com

E-mail from Randy Johansen telling me that Solid Waste Authority is really who I should speak with. Gave me two contacts for SWA information: Gary King and Linda Moreno.

- Gary King, Solid Waste Authority
  561-329-8249
- Linda Moreno, Volunteer Coordinator, Solid Waste Authority
  561-236-8826

Called both Gary and Linda and left messages for both of them.

Reply from Shannon Clounts stating that Jim Baker is working on refrigerant and chemical information and included a table of **summer school enrollment** from Kevin Doherty (in e-mail text).

- Kevin Doherty, Coordinator of Statistical Research, Office of Institutional Effectiveness & Analysis (IEA)
  561-297-2718 kdoherty@fau.edu

I replied, thanking her and asking if the summer school numbers I was given were factored in to the full-time/part-time numbers I already have from the FAU Fact Book.
She replied with a question from Kevin about where I got my enrollment numbers.
I e-mailed back with the link to the FAU Fact Book page and where within the Fact Book archives I got them.

Reply from Jim Baker telling me I have to contact each campus for how much they spend on purchased energy.
I replied, stating that I had assumed there was an overall figure and that I would contact each campus to find what I need.

E-mail from Mamie Jones telling me to contact her for missing Boca and Jupiter electricity information.
Replied, telling her I need the energy purchasing budget for both Boca and Jupiter.

E-mail from William Robinson with an attached detailed report on all University vehicles: **vehicle insurance report by department.pdf**.
I replied, thanking him for all his help.

Received call back from Linda Moreno. She told me that there are no records or numbers of how much solid waste FAU generates, but that all the waste is sent to a waste to energy plant where the waste is incinerated into energy.
I will be e-mailing a fax number to her so she can fax me some documents and she'll be e-mailing me back with a contact at the Ft. Lauderdale facility where the rest of the waste goes.

E-mailed Reid Morgan to ask if he had electricity records beyond 2005 and if he could give me any energy budget information for the southern campuses.
Immediately reply asking for more details as to what I want.
Replied to say I wanted both the kWh and dollars from 2002-present.

Received confirmation from Kevin Doherty (via Shannon Clounts) that the summer enrollment information is separate from the information I have from the FAU Fact Book.
E-mailed back to thank her.

Received e-mail from Mamie Jones with attached costs of electricity for Boca and Jupiter: Carbon footprint-Sarah Fannin.xls.
E-mailed back to thank her.

2/22/08: Reply from Alan Levine forwarding my request regarding faculty/student business travel to Wendy Stephens.

- Wendy Stephens, Asst. Dean for Administration, Schmidt College of Science
  561-297-3302 wstephen@bertjr.fau.edu

E-mail from Mamie Jones stating that she's going to send me a revised worksheet with the electrical costs of auxiliary buildings.
E-mail from Mamie Jones with attached corrected worksheet: **Carbon footprint-Sarah Fannin.xls**. I was told to disregard the previous worksheet she sent with the same name.

2/25/08: E-mail from Jim Baker with **refrigerant amounts for the Boca campus** (information in e-mail text).

E-mail from Kelly Gazo (as per Reid Morgan) with attached spreadsheet of Broward kWh and cost: **KWH Annual Totals for Broward Campuses.xls**.

- Kelly Gazo, Physical Plant Executive Secretary, Broward Campuses
  954-762-5040 kgazo@fau.edu

E-mail from Dianne Owen (after Wendy Stephens e-mailed her for help) regarding faculty/student business travel. The e-mail was a forwarded question from Dianne to Rosanna Berzok.
Received forwarded e-mail from Rosanna Berzok to Dianne Owen asking for my telephone number so I could speak with Adam Matheson.
Replied to Dr. Berzok, giving her my phone number to forward to Adam Matheson.

- Dr. Dianne Owen, Dept. of Biological Sciences, Davie
  954-236-1085 dowen@fau.edu
- Dr. Rosanna Star Berzok, Associate Controller, Controller's Office
  561-297-2932 rberzok@fau.edu

2/26/08: Phone call from Adam Matheson regarding business air travel miles for faculty and students. He'll be calling me back when he's compiled the information from the WOLF system they use to track travel.

- Adam Matheson, Coor. Computer Applications, Controller's Office
  561-297-2917 amatheso@fau.edu

E-mail from Kelly Gazo with attached corrected version on Broward kWh: **KWH Annual Totals for Broward Campuses.xls**. Disregarded previous attachment from her with the same name.
Replied to thank her.

2/29/08: E-mail to Shannon Clounts letting her know I only had refrigerant amounts for Boca and that I still didn't know exactly what chemicals those refrigerants consisted of.

3/01/08: E-mail to Kelly Gazo asking if Broward uses any propane gas on site.

E-mail to Jeff Modlin asking what the units are on the Boca and Jupiter gas records.

E-mail to Lucy Mueller asking if electricity records were available for Treasure Coast yet and if she knew about propane gas use at Treasure Coast.

3/03/08: Reply from Kelly Gazo stating that she'll ask Reid Morgan regarding propane use in Broward.

Reply from Shannon Clounts saying that she spoke with Jim Baker and to contact Reid Morgan and Beverly Sargent for refrigerant information for the other campuses.

E-mail from Jim Baker (as per Shannon Clounts) stating that none of the chemicals on the CA-CP list are in the refrigerants we use.

E-mail from Jim Baker with **refrigerant amounts for Jupiter** (in e-mail text). The numbers came through Greg Washburn, then to Jeff Modlin, and then to Jim Baker.

- Greg Washburn, Maintenance Mechanic, Engineering & Utilities
  567-799-8249 washburn@fau.edu

E-mail from Shannon Clounts asking what specific solid waste information I need so she can forward it on to the correct person.
Replied, giving Shannon the exact input column from the CA-CP spreadsheet.

Reply from Lucy Mueller with average cost and kWh use per year and stating that no propane gas is used at Treasure Coast.
Replied, asking if there were more specific year to year information for kWh and cost.
Reply back from Lucy stating that that's all she has for now.

3/05/08: E-mail from Shannon with attached information on solid waste for Boca and Jupiter from Evan Cross: **Total Volume SW Recycling 030408.xls**.

E-mail from Lucy Mueller with more **detailed records of kWh use and cost** for the past five years (in e-mail text).
Immediate subsequent e-mail with corrections on the last year.

3/12/08: Called Kelly Gazo from Broward to ask about electricity records prior to 2004 and about propane use in Broward. She said she'd get back to me no later than Friday.

Reply from Reid Morgan stating that he can give me the same solid waste information from the Broward campuses that Evan Cross gave me for Boca and Jupiter, except that "Davie is a contract with BCC to just take our solid waste and recycle at a lump sum" so the Davie campus solid waste information is unavailable.

Replied to Shannon's e-mail with the attached solid waste information for Boca and Jupiter. Told her that it was very helpful, but I'll need those numbers for the Broward campuses and Pt. St. Lucie campus as well.

3/14/08: E-mail from Shannon Clounts with forwarded information from Evan Cross regarding updated solid waste information from Boca and Jupiter: **Total Volume SW Recycling 030408.xls**. Disregarded old file with the same name.
Replied to Shannon thanking her for her help.

3/24/08: E-mail to Jeff Modlin again requesting units on propane use at Boca and Jupiter for the second time.

E-mail to Adam Matheson to see if he had compiled the air travel records with the WOLF system.

E-mail to Linda Moreno from SWA regarding percentages of what happens to waste when it gets to the landfill.

E-mail to Terje Hoim asking help with estimating values that I don't have in the inventory.

- Terje Hoim, Assistant Professor of Mathematics, Honors College thoim@fau.edu

E-mailed Reid Morgan, Kelly Gazo, Bev Sargent, and Lucy Mueller asking them to get their respective campus's solid waste capacity and frequency of pickup information.

3/25/08: E-mail from Bev Sargent saying she would get me the information by 3/27.

3/26/08: Reply from Adam Matheson with attached spreadsheet: **Mileage_History.xls**. He gave me information about faculty miles DRIVEN instead of FLOWN because he did not have access to air travel miles.

I forwarded this e-mail to Shannon Clounts to ask for her help in finding someone who does have access to the air mile information.

Reply from Bev Sargent with **Port St. Lucie's solid waste information** (in e-mail text).

3/27/08: Reply from Dr. Hoim regarding a meeting to discuss estimating numbers within the inventory. She gave me her office hours and told me to stop by during any of those times.

3/31/08: I replied to thank Bev Sargent for the solid waste information and make sure that Port St. Lucie has had the same containers and frequency of pickup since 2004.

E-mail to Yanhua Chen to ask about residential versus local addresses in the zipcode spreadsheet.
Series of replies that ends in Yanhua letting me know that local addresses were chosen if available and me asking for this same data back to Fall 2003.

E-mail to Shannon Clounts for help with getting in touch of Jeff Modlin for units on the Boca & Jupiter propane gas figures and reminding her about the needed help with air miles.
Immediate reply stating that some universities don't keep track of the air travel data but there may be a way to estimate it. She also CCed Jeff Modlin, asking him to get me the propane information.

4/01/08: Reply from Bev Sargent assuring me that Port St. Lucie has had the same containers and frequency of pickup for their solid waste since 2004.

E-mail to Reid Morgan asking where he is with compiling the solid waste information and letting him know that I would explain the circumstances with the Davie campus in the written portion of my report.

E-mails back and forth between Yanhua and me. Ends with Yanhua saying the data will be gathered ASAP.

4/02/08: Met with Dr. Hoim to discuss estimating within the inventory. With her guidance, we decided that the most accurate way to go about missing numbers would be to not include 2004 (all hard to estimate numbers were in this year). We also spoke about the ArcGIS project to determine miles commuted by students, faculty, and staff. She said that the way Dr. O'Brien (my advisor) and I already decided to go about it was fine. She also said to come back at any time if I have more questions.

- Dr. William O'Brien, Associate Professor of Environmental Studies, Honors College
  561-799-8033 wobrien@fau.edu

4/03/08: Reply from Yanhua Chen with attached spreadsheet:
Stu_zip_by_campus_day_sum03_fall07.xls. This includes the same zip code data as before except now it goes back to 2003.
Replied to say thanks.

E-mail from Shannon Clounts asking if I had received the propane information from Jeff Modlin and she told me that air travel information appears not to be available, but she's still trying to find something.
I replied stating that I hadn't heard from Jeff and to give me any updates on air miles.

CC-ed on e-mail from Dr. O'Brien to Tobin Hindle regarding the transportation GIS project and the problems we were having joining the zip code spreadsheets to the map.
Tobin replied, giving us the solution to our issue in ArcMap.

- Tobin Hindle, Ph. D., Assistant Scientist, Department of Geosciences
  561-297-2846 thindle@fau.edu

4/04/08: Reply from Shannon Clounts saying that she's spoken with Jim Baker and that he will talk to Jeff.

E-mail from Jeff Modlin with **propane information** in e-mail text. Propane usage is in Therms.

4/06/08: E-mailed Jeff Modlin and Mamie Jones to ask if what is labeled as propane use is actually propane use, because propane is usually expressed in gallons and natural gas in Therms.

4/07/08: Reply from Mamie stating that what is labeled as propane on the Boca and Jupiter utility cost and consumption report is actually natural gas.

E-mail to Reid Morgan, Kelly Gazo, Bev Sargent, and Lucy Mueller to see if the Port St. Lucie campus or the Broward campuses use any natural gas.
Immediate reply from Reid Morgan and Lucy Mueller confirming that neither the Broward campuses nor the Port St. Lucie campus use(s) natural gas.

4/08/08: Called Linda Moreno at Solid Waste Authority to see if they had an average density for their solid waste and to ask about what happens to the waste once it gets to them. She told me that the average density is 134 lbs/cy and that they burn half and bury half of the waste they receive. The half that is burned is turned into electricity in a Refused Derived Fuel Incinerator and the half that is buried is not used for any electric generation.

E-mailed Shannon Clounts to ask if she had heard any updates regarding the natural gas issue or air travel.

Immediate reply from Shannon stating that she is scheduled to meet with Jeff Modlin tomorrow and she's still working on air miles.

E-mail to Reid Morgan, Kelly Gazo, Bev Sargent, and Lucy Mueller to see if the Port St. Lucie campus or the Broward campuses have information on refrigerants or chemicals.
Immediate reply from Reid Morgan asking me to call him.
Called Reid Morgan and left a message.

4/09/08: E-mail to Jennifer Schroeder of Clean Air-Cool Planet to clear up some final questions regarding the inventory as a whole.
Immediate out-of-office reply from Jennifer stating she wouldn't be back in the office until 4/11/08.

- Jennifer Schroeder Andrews, Campus Program Manager, Clean Air-Cool Planet
  603-570-7503 jschroeder@cleanair-coolplanet.org

4/11/08: E-mailed Jennifer Schroeder Andrews for the second time with the same e-mail since she was out of the office before.

Spoke with Reid Morgan via phone and he told me that the Broward campuses didn't have a breakdown of chemicals used, but he could get me the amount of refrigerant used in the chillers on his campuses.

4/21/06: Called Jennifer Schroeder Andrews and left a message.
Immediate call back. She answered all my questions and helped me fix a couple of bugs in the spreadsheet.

4/25/06: E-mail conversation back and forth between me, Shannon Clounts, and Jeff Modlin regarding natural gas numbers. Ended with realizing that all Boca natural gas numbers needed to be divided by 100 and then converted to MMBTUs.

Appendix III: Data Acquisition Table

Data Acquisition Table

Contact	Position	Department	Data	File	Date
Jeff Modlin	Associate Director	Engineering & Utilities	Boca and Jupiter electricity, cost, and natural gas information	Utility Cost and Consumption Report.xls	8/17/07
Alan Levine	Assistant University Budget Director	University Budget Office	Operating budget spreadsheet	budget 1998-99 to 2007-08.xls	10/12/07
Jill Eckhardt	Director	Housing	Residential electricity usage	Utility history by usage.xls	12/14/07
William Robinson	Computer Programmer/ Analyst	Physical Plant	Fuel (gasoline and diesel) dispensed on campus and through Voyager cards	Fuel Dispense Record.xls	2/8/08
Yanhua Chen	Statistical Research Coordinator	Office of Institutional Effectiveness & Analysis	Faculty/Staff frequency of daily travel to all campuses by zipcode	Faculty_staff_zip_camp.xls	2/20/08
Kevin Doherty	Statistical Research Coordinator	Office of Institutional Effectiveness & Analysis	Summer school enrollment	in e-mail text	2/21/08
Mamie Jones	Office Manager	Engineering & Utilities	Electricity cost for Boca and Jupiter	Carbon footprint-Sarah Fannin.xls	2/22/08
Kelly Gazo	Executive Secretary	Broward Physical Plant	Broward electricity & cost information	KWH Annual Totals for Broward Campuses.xls	2/26/08
Jim Baker	Director	Engineering & Utilities	Refrigerant amounts for the Jupiter campus	in e-mail text	3/3/08
Evan Cross	Assistant Director	Boca/Jupiter Physical Plant	Total volume of solid waste containers and frequency of pick-up	Total Volume SW Recycling 030408.xls	3/5/08
Lucy Mueller	Senior Fiscal Assistant	Treasure Coast Enrollment Growth	Detailed records of kWh use and cost for Pt. St. Lucie	in e-mail text	3/5/08
Bev Sargent	Director	Academic Support Services, Treasure Coast	Pt. St. Lucie solid waste information	in e-mail text	3/26/08
Yanhua Chen	Statistical Research Coordinator	Office of Institutional Effectiveness & Analysis	Student frequency of daily travel to all campuses by zipcode	Stu_zip_by_campus_day_sum03_fall07.xls	4/3/08

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Modlin, Jeff, Associate Director of Engineering and Utilities, Florida Atlantic University. Contact by author, 6 February 2008, Jupiter. E-mail.

Moreno, Linda, Volunteer Coordinator, Solid Waste Authority. Contact by author, 8 April 2008, Jupiter. Telephone.

Morgan, Reid, Broward Campuses Physical Plant Director, Florida Atlantic University. Contact by author, 12 March 2008, Jupiter. E-mail.

O'Brien, William, Associate Professor of Environmental Studies, Harriet L. Wilkes Honors College. Contact by author, 2 April 2008, Jupiter. In person.

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