Introduction

The University of Central Florida is one of the fastest growing universities in the country. Located in the heart of Orlando, Florida, UCF's growth has made a significant impact on the surrounding community. UCF recognizes the need to conserve our natural resources and create a more sustainable environment with which the community can learn, live, and work. The Center for Energy and Sustainability was created to promote understanding and support of this need and to implement programs that put UCF at the forefront of the sustainability effort in our region. Comprised of a team of engineers, technicians, mechanics, and marketing professionals, the Center for Energy and Sustainability consistently works toward the goal of a more energy efficient and sustainable campus.

A comprehensive energy plan is applied to each project and program that is implemented at the university. This plan consists of seven steps: commitment, performance assessment, goal setting, action plan creation, action plan implementation, progress evaluation, and achievements recognition.

Many people are aware that carbon dioxide (CO_2) is a byproduct of nature and normal everyday human behavior, while few understand the serious repercussions it can have on our environment. Carbon dioxide is not only the result of respiration, but of the burning of fossil fuels (oil, natural gas, and coal) and deforestation. When just a single gallon of gasoline, weighing only 6.31 lbs, is burned, 20 lbs of carbon dioxide is created. Gasoline is 87% carbon and 13% hydrogen. When burned, gasoline undergoes a chemical change where the carbon and hydrogen split, reacting with oxygen to form two

new products: water (H_2O) and carbon dioxide (CO_2).[1] Since the Industrial Revolution, carbon dioxide concentrations in our environment have risen over 30%. As a greenhouse gas, carbon dioxide traps heat in our atmosphere, creating a warm, habitable environment. However, the effects of this excess carbon dioxide on our environment, created by human activity, are unclear. [2] For this reason, the university is compiling data on its CO_2 output and reevaluating its impact on our environment.

Notable achievements:

Creation of the Energy Task force- In January 2006, an energy and sustainability task force was created by President Hitt. The task force is headed up by Special Assistant to the President, Vice Admiral Al Harms, and UCF Physical Plant Energy Manager, David Norvell.

Center for Energy and Sustainability Team Tripled - The Center for Energy and Sustainability has nearly tripled its team members to include a more comprehensive group which has expanded energy sustainability efforts throughout the university.

Building Commissioning Team – Creation of this team gives UCF the ability to put each building on a 4-year commissioning cycle. This will assure that all campus buildings are operating as efficiently as possible.

[1] http://www.fueleconomy.gov/feg/co2.shtml
[2]Global Warming and Our Changing Climate (EPA booklet)
http://yosemite.epa.gov/OAR/globalwarming.nsf/UniqueKeyLookup/SHSU5BUN59/$File/gw_faq.pdf

LEED Silver Rating - UCF is committed to building and renovating all buildings to meet a minimum LEED silver rating, in accordance with the United States Green Building Council (USGBC). This LEED silver rating will create a better environment for students, staff, and faculty to learn, work, and live.

Green Seal Certified cleaning materials – Green cleaning materials are replacing regular cleaning products throughout campus. The goal is to use Green Seal Certified products for all of the daily cleaning services.

Biodiesel fuel - In January 2007, UCF replaced traditional petroleum diesel fuel with biodiesel fuel. Along with this replacement, a vehicle replacement program has been implemented at the university. Currently, 12 vehicles per year are being replaced with vehicles that are compatible with the use of this alternative fuel.

Hybrid Vehicle - A 2007 Hybrid Toyota Prius was purchased to generate interest and conversation on the advantages of using alternative fuel vehicles. The vehicle is currently undergoing major renovations to make it a “one-of-a-kind” vehicle. Upon completing all major renovations, the vehicle will become a plug-in hybrid. At campus speeds, the Prius will run solely off battery power. However, the gasoline engine is still available for highway travel. There are currently only a handful of plug-in hybrids throughout the world.

Energy Conservation Competitions – Throughout the university, housing energy conservation competitions have been implemented. These yearly competitions focus on a one month competition involving all students in UCF housing facilities. The goal is to see which Residence Hall can reduce its energy

consumption by the greatest percentage, compared to a previous baseline average. The most recent campus-wide competition, held in February 2007, resulted in a decrease of 136,000 kWhs. This successful program allows students to become even greater stewards of energy in their home-lives.

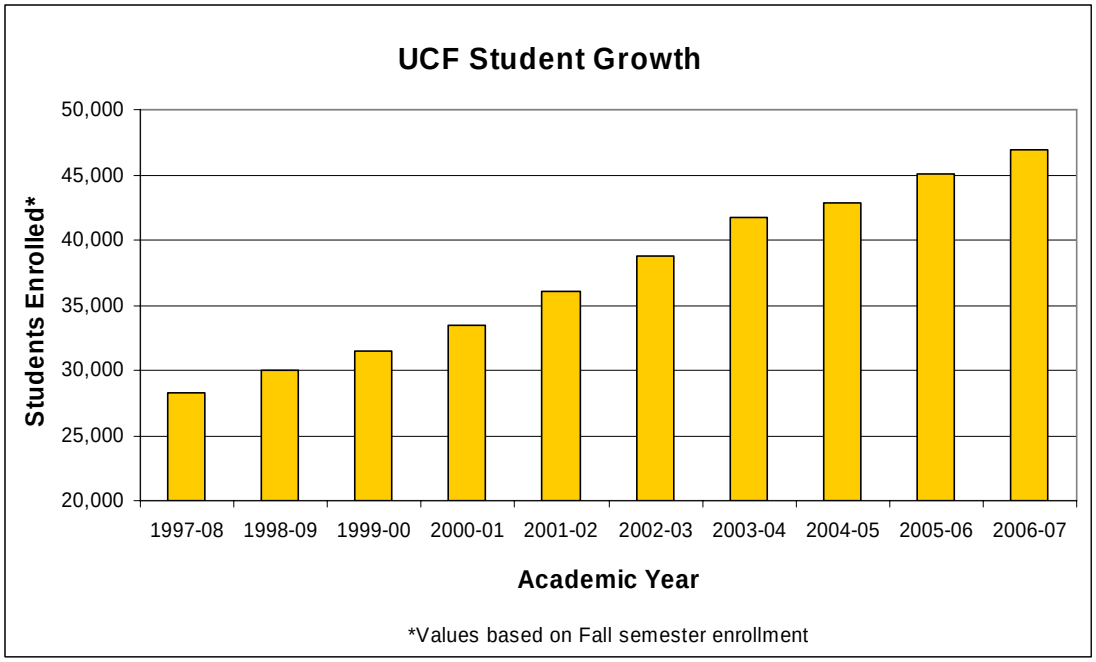
Grants - Several grants have been awarded to the Center for Energy and Sustainability. These grants include a grant from the EPA, focusing on energy education and a grant from Rebuild America, kicking off the re-commissioning for each campus building.

Goals

UCF has committed to reduce energy consumption by 20% in existing Educational and General Facilities within a five year period (no later than 2011). The baseline year will be the 2005/2006 fiscal year. With a 20% reduction in energy consumption, UCF will save more than 32 million kWhs annually, resulting in cost avoidance in excess of 2 million dollars per year (using 2005-2006 energy costs). Additionally, attainment of a 20% reduction in energy consumption will result in annual carbon dioxide emissions being reduced by approximately 50 million lbs. Together, attainment of these goals will both enhance our efforts to achieve energy sustainability and significantly improve our environment.

Campus Growth

Since its first class in 1968, UCF has been growing exponentially. In the fall of 2007, UCF enrolled over 48,000 students, making it the 6th largest university in the nation.



The university employs close to 10,000 people, houses 6,000 students on campus, and has approximately 4,000 students living within a one mile radius of the campus in affiliated housing. The sprawling main campus contains 5,886,072 gross square feet of space and 144 permanent buildings over 1,415 acres. UCF not only expands across eastern Orlando but also has four regional campuses. There are 12 colleges within UCF, the largest of which is the College of Business Administration.[3] UCF's growth over the last few years has been tremendous. Further growth includes a new College of

[3] Facts About UCF
http://www.iroffice.ucf.edu/character/current.html

Medicine and a 45,000-seat on-campus football stadium. UCF's continued commitment to research in the last 15 years has tripled research funding, drawing in more than $100 million annually. With the addition of UCF's Psychology Building, research at UCF will only increase.[4] UCF's improvements inherently benefit the surrounding community as a whole, furthering UCF's creed of Integrity, Scholarship, Community, Creativity, and Excellence.

Land Use

Out of the 1415 acres that comprise the main campus, approximately 200 acres have been designated as conservation area. This includes the UCF arboretum and the Lake Claire Conservation area. There are 144 permanent buildings at UCF, which are categorized as either Education & General (E&G) or Auxiliary. The map on the following page denotes the categories of our current land use on the main campus:

[4] "State of the University" University of Central Florida President John C. Hitt

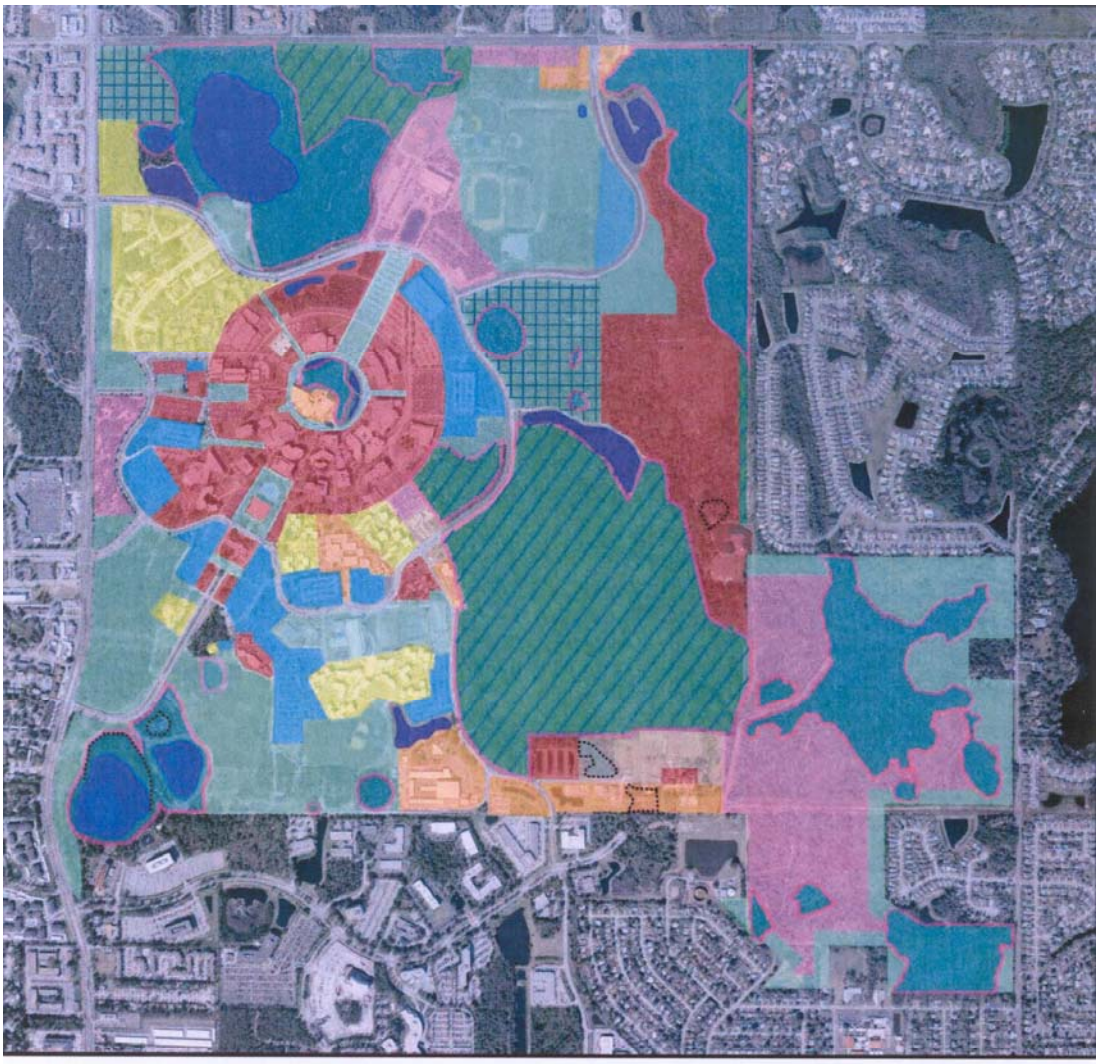


Figure 4-1

LAND USE

Comprehensive Master Plan Update

University of Central Florida

Orlando, Florida

2005 -2015

All maps are diagrammatic and conceptual. The various areas shown are approximate and not to survey accuracy. The intent of these maps is to illustrate general areas of existing or potential use.

0 400' 800' 1600'

LEGEND

- Academic/Research
- Residential
- Utility
- Parking
- Support
- Conservation (Wetland)
- Conservation (Upland)
- Conservation Easement Lands
- Recreation/Open Space
- Lakes
- Mixed Use
- Wetland

Electricity Consumption

Electricity consumption is responsible for the vast majority of greenhouse gas emissions at UCF, constituting 88% (105,950 tons CO_2) of the greenhouse gases emitted by the university in 2006. All of UCF's electricity is purchased from the state-designated energy company Progress Energy, with no electricity presently being generated on-site. The majority of Progress Energy's electricity is generated from fossil fuel sources (coal, gas and oil), tying UCF to the release of tons of CO_2 into the atmosphere each year. Coal is used to generate more than half of today's electricity, depositing sulfur, nitrogen, and mercury pollutants into the environment.[5]

The sources of this electricity consumption can be broken down into three functional categories: heating, ventilation, and air conditioning (HVAC); lighting; and plug-load appliances. The university is committed to reducing electricity consumption in all three of these categories and is currently implementing numerous energy conservation initiatives to further this commitment.

[5] DOE "Electric Power"
http://www.doe.gov/energysources/electricpower.htm

	kWhs	TONS of CO2
January	9,772,846	7,574
February	9,679,616	7,502
March	11,486,383	8,902
April	10,443,733	8,094
May	11,486,918	8,902
June	11,786,495	9,135
July	11,429,109	8,858
August	12,494,720	9,683
September	13,045,482	10,110
October	11,803,225	9,147
November	11,593,707	8,985
December	11,687,927	9,058
TOTAL	**136,710,161**	**105,950**

The university's geographic location results in HVAC usage being the largest portion of overall electricity consumption. As detailed in Figure 1, electricity consumption peaks in the summer months, especially August and September. The cause for this peak is largely related to the heat during these months and the associated spike in HVAC usage.

Natural Gas

Natural gas provides for only a small portion of the university's energy needs. Natural gas is a non-renewable fossil fuel. The natural gas consumed at the university comes from wells in Louisiana and is transported through the Florida Gas Transmission

Pipeline to our central Florida campus. Unlike many fossil fuels, natural gas is clean burning and emits low levels of greenhouse gases to our environment.

Natural gas is a combustible mixture of hydrocarbon gases. The composition of natural gas can vary widely. While natural gas is formed primarily of methane, it can also include ethane, propane, butane and pentane.

Just under 5% of the UCF greenhouse gases emitted are due to the consumption of natural gas. Unlike electricity, natural gas is a de-regulated energy commodity in the state of Florida. Here at UCF, natural gas is primarily used to heat water for domestic purposes in our residence halls and sports complexes. Hot water from natural gas is also used to produce steam for campus research and in laboratory spaces as a disinfectant and sterilizer.

	Therms	**kBTUs**	**TONS of CO2**
January	101,851	10,185,100	664
February	92,129	9,212,900	601
March	84,240	8,424,000	549
April	74,327	7,432,700	485
May	63,453	6,345,300	414
June	60,562	6,056,200	395
July	58,759	5,875,900	383
August	58,802	5,880,200	383
September	60,969	6,096,900	398
October	75,804	7,580,400	494
November	87,640	8,764,000	571
December	76,651	7,665,100	500
TOTAL	**895,187**	**89,518,700**	**5,837**

Shuttle Service

UCF provides a free shuttle service for students, faculty and staff to utilize as an alternate means of transportation. The shuttle fleet consists of approximately 28 shuttle buses that service numerous routes, including 15 off-campus stops at nearby apartment communities and several on-campus stops. A shuttle also runs between the UCF main campus and the satellite Rosen College of Hospitality Management campus, which is located approximately 35 miles from the main campus. Most shuttles run from the morning to the evening on all school days, with some routes being serviced on Saturdays and others not being serviced on Fridays.

	Riders	Bus Mileage	Tons of CO2 from Buses
January	178,479	63,952	102
February	193,570	79,940	128
March	155,539	71,946	115
April	151,945	83,937	134
May	34,555	51,961	83
June	47,410	87,934	141
July	43,406	79,940	128
August	125,388	31,976	51
September	274,290	79,940	128
October	209,727	87,934	141
November	200,347	75,943	121
December	39,509	23,982	38
TOTAL	**1,654,165**	**819,385**	**1,310**

Assumptions

- 7 miles per gallon average fuel consumption for buses
- 22.384 pounds of CO2 per gallon of diesel
- 19.564 pounds of CO2 per gallon of unleaded gasoline

Fleet Fuel on Campus

The state vehicles which service the campus consume either regular unleaded fuel or biodiesel fuel. All diesel fuel has been replaced with B-20 biodiesel fuel at the university. The following table lists the fuel which was dispensed on campus each month for all campus vehicles.

	Gasoline Purchased (Gallons)	Diesel Purchased (Gallons)	CO2 (TONS)
January	0	3,056	34.2
February	8,363	0	81.8
March	8,456	3,105	117.5
April	0	2,993	33.5
May	8,316	1,000	92.5
June	8,385	0	82.0
July	8,268	2,376	107.5
August	8,270	978	91.8
September	7,695	0	75.3
October	7,321	1,310	86.3
November	8,321	300	84.8
December	0	0	0.0
Total	**73,395**	**15,118**	**887.2**

Biodiesel

Biodiesel fuel is produced from domestic, renewable sources, such as vegetable oil, making it a cleaner option for our environment compared to pure petroleum diesel. Biodiesel is authorized as an alternative fuel by the Department of Energy (DOE) and the

U.S. Department of Transportation (DOT) and can be combined with petroleum diesel in any concentration and can be substituted in diesel engines, requiring few, if any, adjustments to the vehicles. In addition to its environmental advantages, biodiesel is also cost effective, as it has the highest "energy balance" of all transportation fuels.[6]

In January 2007, UCF received its first shipment of biodiesel fuel. Today, UCF fuels all diesel equipment and vehicles with B20 (a blend of 20% biodiesel and 80% petroleum diesel). B20 exhibits a number of advantages for our air quality, as well as reducing carbon dioxide emission by 15%.[7] To extend biodiesel's emissions benefits throughout the UCF campus, a vehicle replacement program has been instituted and is expected to replace 12 vehicles per year. UCF is also investigating opportunities to fuel its shuttle services with B20. This would have a tremendous impact on its CO_2 emissions, as it emitted approximately 1,300 tons of CO2 in 2006. With the implementation of biodiesel within the UCF vehicle fleet, UCF can anticipate a 20% reduction in carbon emissions from campus vehicles and equipment.

Faculty and Staff Travel

Faculty and staff travel to attend conferences and complete research is a major part of enhancing UCF's collaboration with other universities and private corporations. The Finance and Accounting Travel Department compiles a report containing all travel information, including destination city, date, travel method, and mileage (if available). Each trip that is completed, whether it is local, in-state, out-of-state, or out-of-country, must be filed with the Travel Department. This allows for a one source collection of all

[6] National biodiesel Board "Commonly Asked Questions" http://www.biodiesel.org/pdf_files/fuelfactsheets/CommonlyAsked.PDF
[7] National Biodiesel Board "Biodiesel For Decision Makers" http://www.biodiesel.org/usda/pdfs/BiodieselDecisionMaker.pdf

travel data for the university. The following table reflects data from 2006, with corresponding emissions computations.

	Trips Completed	Automobile Travel (miles)	Train Travel (miles)	Air Travel (miles)	CO2 Emissions (TONS)
January	3,436	273,577		1,102,302	381.8
February	1,967	157,781		994,138	300.8
March	2,487	227,659		1,081,169	354.6
April	2,637	209,833		1,342,061	404.5
May	4,322	396,488		1,481,632	527.2
June	4,935	387,046		2,206,310	685.6
July	1,546	205,029		1,280,072	388.2
August	2,016	231,902		1,632,429	480.7
September	1,997	180,341		3,113,372	788.6
October	2,505	206,599		1,710,556	485.9
November	3,405	167,020		1,417,769	400.6
December	3,736	292,617		1,726,625	531.5
Total	**34,989**	**2,935,892**	**29,499**	**19,088,435**	**5,731**

Solar Energy

UCF has committed to demonstrating the economic benefits of solar energy in high usage facilities, such as dormitories, for heating domestic water. Using the sun's clean renewable energy as a heat source is beneficial for the environment because it reduces several forms of air pollutants and helps to reduce demand for an already limited refinery capacity and generation plants.

Installing solar water heating systems in an existing, low-rise, 500-student residence hall building that consumes an average of 12,000 gallons of hot water per day will prevent 170 tons of greenhouse gas emissions each year. This represents a reduction in greenhouse gas emissions of over 30%. An emissions reduction of this size is the equivalent of 637,500 miles per year of pollution free driving (assuming an average car gets 25 miles per gallon). Solar power drastically reduces the use of expensive and strategic natural gas. Solar water heating systems can be used in the three similar residence halls and in future new construction.

The President's Climate Commitment

UCF is a part of the elite Leadership Circle of the American College & University Climate Commitment Challenge. The Climate Commitment Challenge provides a framework and support for America's colleges and universities to go climate neutral. Upon President Hitt signing the commitment, UCF pledged to dramatically reduce our campus greenhouse gas emissions over time. This involves:

- Completing an emissions inventory;
- Setting a target date and interim milestones for becoming climate neutral;
- Taking immediate steps to reduce greenhouse gas emissions by choosing from a list of short-term actions;
- Integrating sustainability into the curriculum and making it part of the educational experience; and
- Making the action plan, inventory and progress reports publicly available.

Open Energy Information System

As part of UCF's commitment to environmental stewardship, the Center for Energy and Sustainability is devoted to monitoring and reducing the energy consumption of all campus buildings. In the past, individual building managers had no way of knowing the actual utility costs of their buildings. Studies[8] indicate that knowledge of energy consumption can lead to energy reductions of about 10% through voluntary behavior changes. Therefore, the university developed a web-based Energy Information System that allows building managers to access live data feeds on the amount of energy their buildings consume at any particular time. Realizing that commercial Energy Information Systems were highly expensive, the university created a low-cost, alternative system for its own purposes, dubbed the "Open Energy Information System" (OEIS). OEIS is designed to match or exceed the quality of commercial Energy Information Systems. Each building operating under OEIS has a remote network engine installed to collect data from the building's energy meters and to relay it to a network where it can be accessed from personal computer databases. This information is readily available to each building manager and the UCF Energy Manager, and is also published on the Center for Energy and Sustainability website for access by the general public. There are currently 26 on-campus buildings that are part of the OEIS, and the university has made plans to add additional buildings over time. All future campus construction projects are required to include OEIS installation requirements in their design, and older buildings are continually being retrofitted to become OEIS accessible.

[8] http://www.rebuild.org/sectors/SectorPages/PartnershipView.asp?MktID=2&OrganizationID=1169

Leadership in Energy and Environmental Design

As a leader in higher education, UCF has made a commitment to be an excellent steward of our natural environmental resources. As the nearly explosive growth of the campus continues, the construction of new facilities and renovation of existing facilities must demonstrate high standards of environmental stewardship and sustainability.

In January 2007, the University formally mandated that all new construction and major renovations to campus buildings will achieve a minimum performance level of a LEED silver rating. At the time of the mandate, there were a number of new projects under construction, and since sustainable practices need to be incorporated early in the design development process, these projects could not be converted to LEED standards.

The US Green Building Council (USGBC) has formulated the foremost green building rating system which is widely accepted as a benchmark for new construction and major renovations. The LEED standard rating system is designed to assist building owners in designing and constructing high performance, highly functional buildings. LEED promotes a holistic approach to building design and construction.

This is an exciting time at UCF, with the creation of the medical campus at Lake Nona. The timeliness of the LEED mandate should allow the UCF Medical School at Lake Nona to be recognized as the first LEED certified medical campus in the world. In addition to the many financial, environmental and health benefits associated with this endeavor, the LEED certification of the entire campus will help to enhance the marketability of the Medical School.

A project must first be registered with the USGBC before it can attempt certification under the LEED rating system. UCF currently has five projects registered and in some state of documenting the performance level. The projects are: the Physical Science Building, the Student Union Expansion, the Recreation and Wellness Expansion, the College of Medicine, and the Burnett School of Bio-molecular Science.

The rating system has a number of credits which can be achieved on a particular project. At the completion of a project, the total number of credits which have been achieved determines the performance level of the building and the corresponding certification level which is achieved. The Center for Energy and Sustainability has identified 14 of the 69 credits as mandatory for each new construction project. The 14 mandatory credits illustrate the university's commitment to its goals of energy conservation and sustainable practices.

Once the project is completed and the documentation is reviewed and accepted by LEED, the project may receive an appropriate certification. The certification levels are: Certified, Silver, Gold and Platinum. Among all four certification levels, there are nineteen certified LEED projects in the entire state of Florida.

The LEED rating system recognizes performance in five key areas of human and environmental health, including: sustainable site development, water savings, energy efficiency, material selection and indoor environmental quality.

In-House Building Commissioning Team

A major focus of the Center for Energy and Sustainability has been the creation of UCF's in-house building commissioning team. The team has recently completed re-commissioning the first three buildings at the main campus. The building commissioning team is comprised of engineers, mechanics and technicians who are working to make a more efficient UCF. Building commissioning consists of discovering and implementing innovative techniques of energy saving methods within a building. Each building at UCF has been placed on a four year commissioning cycle, with the first three buildings being the Classroom Building, Colbourn Hall, and the Student Union. Inspections, testing, and data gathering were performed at each building in order to identify opportunities for energy savings. The electricity and chilled water energy savings for each building are measured in daily five minute intervals, and then normalized to outdoor weather conditions. This data is collected in UCF's Open Energy Information System (OEIS). The data is then screened in order to identify any apparent data collection problems (errors), disaggregating the data into weekend days, weekdays, holidays, etc., when building occupancy and use are varied.

Initial building re-commissioning has been extremely successful. Calculated savings in the Classroom Building are a 19.7% reduction in building electricity use and 13.8% reduction in Chilled Water use. The projected annual energy cost savings for the Classroom Building resulting from the performed re-commissioning is $43,700. The calculated savings in Colbourn Hall show a 28% reduction in building electricity use and 14.4% reduction in Chilled Water use. The projected annual energy cost savings for Colbourn Hall resulting from the performed re-commissioning is $42,100. Plans are already underway for the next set of buildings to enter into the re-commissioning phase.

Recycling

In an effort to reduce waste and become a more environmentally friendly university, UCF has developed a comprehensive recycling program. There are numerous recycling bins around campus that are easily accessible to students, staff, and faculty. Campus housing residents are now able to participate in a nation wide recycling competition called "Recyclemania." Through this competition, UCF students are presented with knowledge on the benefits of recycling, as well as the opportunity to exercise that knowledge by competing against other universities. The university plans to expand its recycling practices in an effort to decrease the negative effects on the surrounding environment.

ENERGY STAR

ENERGY STAR is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy. Consumer products and buildings that have been certified by ENERGY STAR meet strict energy efficiency guidelines and are marked with the ENERGY STAR logo. Thousands of products have been certified by ENERGY STAR, and more products are continually meeting certification requirements as they are produced.[9] UCF is currently establishing a policy that will require all new products purchased by the university to be certified by ENERGY STAR, when certifications for such products exist. In addition, UCF committed in 2007 to ensure that all new on-campus buildings will be ENERGY STAR certified. Complimentary to LEED, a building certified with ENERGY STAR will use significantly less energy than comparable non-certified buildings, with an average energy consumption reduction of about 35% or more.

[9] History of ENERGY STAR. http://www.energystar.gov/index.cfm?c=about.ab_history (accessed June 8, 2007).

Only buildings that rate in the top 25% of energy-efficient buildings in the nation may be qualified for ENERGY STAR certification.[10]

Community Education and Awareness

An educated campus is a proactive campus, and that is the stance the Center for Energy and Sustainability has taken for the UCF community. A comprehensive education and awareness plan was created and implemented at the University. By educating our students, staff, and faculty about energy conservation and sustainability, we arm them with the ability to make a difference by making the small changes in their life that make a big difference in our environment. Educational videos, newsletters, residence hall energy conservation reminders, and workshop sessions have made the UCF community more aware of what they are consuming in their everyday life. In order to maintain the mission statement of, "achieving energy efficient operation and sustainable development for the campus of today...and the future," education and awareness has become a major factor of the campus culture at UCF.

Total Greenhouse Gas Emissions

The following table outlines the various known sources of our carbon dioxide emissions. Grouped by building utilities and transportation, the 2006 calendar year total was 119,715 tons of CO2. The power to cool and light our buildings is responsible for 88.5% of our total emissions, while all transportation combined is only responsible for 6% of our total emissions.

[10] The ENERGY STAR for Buildings. http://www.energystar.gov/index.cfm?c=business.bus_bldgs (accessed June 8, 2007).

Source	Total CO2 (TONS)
Building Utilities	
Electrical Consumption	**105,950**
Natural Gas Consumption	**5,837**
Transportation	
Shuttle Service	**1,310**
Travel	**5,731**
Fleet Fuel on Campus	**887**
Total	**119,715**

Future Reporting

The University of Central Florida will complete an annual Greenhouse Gas Inventory Report. This report will include a thorough investigation and calculation of all greenhouse gas emissions that are omitted from UCF. As UCF faces continued growth, it is our hope that we will still experience a decrease in our emissions. The university is working diligently to abide by all commitments made in the President's Climate Commitment. UCF also hopes that all other higher education institutions throughout the country complete a report of this nature in order to create a more cohesive effort nation-wide. In conjunction with efforts to be the nation's leading metropolitan research university, recognized for its intellectual, cultural, technological, and professional

contributions and renowned for its outstanding programs and partnerships, UCF can be distinguished as a leader in efforts to decrease greenhouse gas emissions.