



TAKING ACTION NOW

UCF's Climate Action Plan

UNIVERSITY OF CENTRAL FLORIDA
ORLANDO, FLORIDA



UCF STANDS FOR OPPORTUNITY



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UCF *is a Catalyst for Positive Change*

THE UNIVERSITY OF CENTRAL FLORIDA (UCF) is committed to providing the Central Florida community and beyond with high-quality educational experiences, groundbreaking research, and practical solutions to some of the world's most urgent issues.

At UCF, we know that the stabilization of the earth's climate is one of those issues—and that's why UCF has a plan for sustainability and has pledged to be climate neutral by 2050.

In 2009, the university grew to become the largest university in the state of Florida and the 3rd-largest in the nation.¹ With more than 53,000 students enrolled at its main campus and 11 regional campuses throughout the Central Florida region, the opportunity to make a significant impact on the environment and on our communities—and the chance to protect that environment for future generations—is stronger than ever.

Defining Sustainability and Climate Neutrality

The UN has defined sustainability as the integration of economic, social, and environmental interests which address both the needs of the current and of future generations.²

The American College and University Presidents Climate Commitment (ACUPCC), of which UCF President John Hitt is a founding member of its Leadership Circle, encourages universities to pursue climate neutrality and integrate sustainability into their curriculum. ACUPCC defines climate neutrality as having no net greenhouse gas (GHG) emissions—or gases that cause the greenhouse effect—by minimizing these emissions as much as possible and using carbon offsets, or other measures, to mitigate the remaining emissions.

UCF's Promise At-A-Glance

UCF isn't alone in recognizing that one of the most critical issues facing the global community today is climate change—prominent leaders across the globe have joined forces to confront it together.

In February 2007, UCF President John Hitt took a stand on climate change and pledged that UCF would become climate neutral by year 2050 at the latest. The university's timeline is to reduce its carbon dioxide emissions by at least 17 percent by 2020 and by 42 percent by 2030.

UCF's plan is to reduce its environmental footprint and integrate sustainability into core aspects of the university, including:

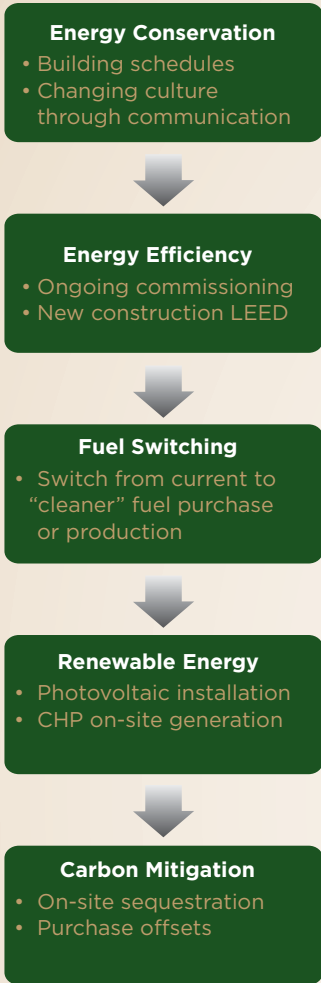
- Educating students and our community members about their impact and creating valuable solutions
- Minimizing the university's footprint through conservation, efficiency, the use of cleaner fuels, renewable energy, and carbon mitigation and offsets
- Research into products, methods, technology, and policies to advance sustainability



¹ "UCF Now Third Largest University in Country," WFTV, August 25, 2009. <http://www.wftv.com/news/20552601/detail.html>.

² United Nations General Assembly. Report of the World Commission on Environment and Development: Our Common Future. 1987. Transmitted to the General Assembly as an Annex to document A/42/427. United Nations General Assembly. 2005 World Summit Outcome Resolution A/60/1. 2005.

UCF Has a Long-term Plan



THREE AREAS OF FOCUS

- **EDUCATE** about impact, strategies, and opportunities
- **MINIMIZE** campus footprint
- **ADVANCE** research

In order of magnitude, UCF's main sources of emissions are: buildings, transportation, waste, and natural resources management. The long-term plan to lessen the university's environmental footprint focuses on these key goals:

- Designing, building, and maintaining facilities which meet or exceed the Leadership in Energy and Environmental Design (LEED) system's Silver certification
- Seeking to certify all existing major education buildings to the level of LEED Existing Building: Operations & Maintenance (EBOM)
- Reducing its energy consumption in buildings by an additional nine percent by 2013³
- Producing 15 percent of its energy needs with renewable energy by 2020
- Increasing the number of commuters who use environmentally preferred methods of transportation to 40 percent by 2020
- Recycling 75 percent of its waste by 2020
- Managing its lands and waters in a sustainable manner with xeriscaping (or landscaping which minimizes water use), planting Florida-friendly vegetation, removing invasive species, and reducing nitrogen levels in fertilizers used on campus

The long-term plan to integrate sustainability into UCF's academic and research areas focuses on these key goals:

- Offer innovative, interdisciplinary course work and activities to provide educational opportunities on sustainability for undergraduate and graduate students
- Foster the application of skills learned in the classroom to real-world situations and challenges so that, by 2014, all graduating students will have at least 15 hours of applied learning to improve the well-being of the community
- Advance basic and applied research in green and clean technology industries
- Work to create an academic research center that engages in top notch research and prepares well-qualified professionals to meet the demands of the green and clean technology industries.

We're Just Getting Started

The future is always uncertain—the outcome depends on many factors. There are uncertainties with regards to the prediction of stakeholders' future circumstances and behaviors. There are inevitable shifts in elements such as the economy, including the budgetary challenges UCF faced during the time this plan was compiled. Therefore, the strategies and targets in this document are based upon what is currently feasible. UCF's plan will be continually updated as new data, markets, technologies, regulations, and opportunities emerge.

With this uncertainty in mind, the university established a leadership team that was tasked with coordinating and harmonizing the UCF community's collective knowledge and experiences. Successful communication and collaboration depends upon leadership to connect all of UCF's disciplines, teams, and institutions.

But whatever the challenges, UCF will continue to bring to bear the talents of the individuals, communities, businesses, organizations, and governmental agencies with which it partners to create real-world solutions to the problem of climate change. As an example, in 2009, thanks to the hard work of its community, UCF surpassed a goal of reducing energy consumption by 20 percent—a year ahead of schedule. UCF is taking action now—and making plans for future generations.

3 Normalized by floor area (energy units per-square-foot of floor area).



Students enjoy the tranquility of Lake Claire at UCF.

UCF Has Solid Goals

2008

- All new buildings, at a minimum, were to be LEED Silver certified with a mandatory 14 points for air quality, water usage, and energy efficiency
- Existing buildings were placed on a four-year re-commissioning cycle
- UCF sought out alternative fuel, flex fuel, or hybrid fueled vehicles when replacing or adding to its fleet

2009 - 2010

- Energy consumption to drop 20 percent below 2005's per-square-foot levels
- Obtain a 30 percent recycling rate
- Develop and implement a Landscape Master Plan
- Offer a sustainability undergraduate minor
- Pledge to convert one existing building to a LEED Existing Building: Operations & Maintenance (EBOM) certified building each year

2012

- Irrigate 95 percent of the main campus with stormwater and reclaimed water

2013

- Energy consumption to drop 30 percent below 2005's per-square-foot levels

2014

- At least 14 buildings are to be LEED Silver certified or higher
- Achieve 100 percent rate for graduating students to have engaged in 15 hours or more of applied learning in an experiential learning course during their academic program, contributing to the well-being of the university's community

2015

- Research and generate feasible options to regulate car volumes and increase pedestrian, cyclist, and transit use

2020

- Produce 15 percent of its energy needs with renewable energy sources
- Establish ridesharing and carpooling programs with local governmental agencies
- Study the effectiveness of incentivizing high-occupancy vehicle parking through preferential treatment
- Achieve a 40 percent rate for environmental, multi-modal transportation usage among commuters to campus
- Obtain a 75 percent recycling rate
- CO₂ emissions to drop by 17 percent below 2005's levels

2030

- CO₂ emissions to drop by 42 percent below 2005's levels

2045

- All major education buildings to be LEED EBOM certified

2050

- **Ultimate Goal: Climate Neutrality**



Ongoing Goals

- Eventually reach 100 percent of solid waste sorted and processed on campus with no more than 25 percent of non-recyclables sent to landfills
- New office equipment must meet or exceed ENERGY STAR requirements
- Use Green Seal cleaning products
- Develop a comprehensive, sustainable purchasing policy and a green computing initiative
- Reduce potable water usage in new construction to 30 percent below conventional baseline
- Continually develop and implement land management practices that increase biodiversity in the campus natural lands
- Increase availability of alternative fuels on campus
- Explore best management practices for man-made and natural stormwater systems
- Continually investigate methods to reduce the nitrogen levels in fertilizers applied on campus
- Reduce or remove all non-native invasive plants, which are identified by the Florida Exotic Pest Plant Council, from the campus grounds and natural lands
- Establish several sustainability graduate programs
- Create sustainability modules for curriculum inclusion and discussion
- UCF seeks to create an academic research center at the university that engages in top notch research and prepares well-qualified professionals to meet the demands of the green and clean technology industries
- Support the university's major initiatives towards climate neutrality through current and future research

UCF's Climate Action Plan: *The Full Report*

When President Hitt first made the pledge to become more sustainable in 2005, the university immediately began its journey to climate neutrality and raised the bar high—by 2010 its energy consumption would drop to 20 percent below 2005's numbers. The plan was estimated to save UCF more than \$2 million a year in energy costs and 32 million kilowatts of electricity.⁴

So far, the university is actually ahead of schedule—thanks to the hard work of its commissioning team, as well as its students, faculty, staff and partners. By 2008-2009, UCF had already reached its goal with a 25 percent decrease in energy consumption per-square-foot.

Yearly Progress Reports

In accordance with the ACUPCC, UCF began producing an annual GHG emissions report in 2006, and continues to do so. The university calculates its emissions using the Clean Air Cool Planet emissions calculator, which is the most widely used standard for emissions calculations for higher education institutions.⁵

The first report was generated in 2006 and reported:

- Nearly 106,000 metric tons of CO₂—81 percent of the emissions measured—originated from electricity usage for heating, ventilation, air conditioning (HVAC), lighting, and appliance use
- Approximately 19,000 metric tons CO₂—15 percent—came from various modes of transportation and another 5,800 metric tons CO₂—five percent—came from natural gas use for water heating, lab disinfectant, and lab sterilization

As more data are collected, and more information is gathered from direct and indirect sources, UCF's year-to-year CO₂ emissions calculations may require adjusting. With this in mind, the university will often report its results in percentages or on a per-unit-basis such as per-square-foot of space or per student.

UCF's In-house Commissioning Team

Once the university had its first inventory, it also formed an in-house commissioning team of engineers, mechanics, and technicians, who conduct energy audits, optimize equipment, update control systems, upgrade lighting systems and controls, and perform other analyses. This team was a rare approach at the time.

⁴ "UCF to Save \$2 Million Annually through Energy Management Initiative," UCF News & Information, The University of Central Florida, June 18, 2009, <http://news.ucf.edu/UCFnews/index?page=article&id=00240041037381429012136c33d790054e8&subject_id=0024004102975ad83011b2b83251c0ae6>.

⁵ Each of the required components from scope 1, 2, and 3 are tracked and totaled. To achieve climate neutrality under the terms of the Commitment, all Scope 1 and 2 emissions, as well as those Scope 3 emissions from commuting and from air travel paid for by or through the institution, must be neutralized.



Students congregate near the Reflecting Pond at UCF's main campus.

CO₂ Emissions *in 2008—a Snapshot*

As of 2008, UCF's CO₂ emissions had dropped from 2007's 150,205 to 146,573 metric tons of CO₂ equivalent (MtCO₂e)—a 2.4 percent decrease. While the university continued to grow in student enrollment and square footage, it still continued to reduce its CO₂ emissions.

The greatest decrease by percentage was seen in agriculture, where a 92 percent decrease in CO₂ emissions had been reported due to a decrease in fertilizer use and a conversion to organic fertilizer.

The 2008 GHG report assessed UCF's main campus, which included 157 buildings and nearly 8.9 million square feet of space. Though the university's plans had only begun in 2005 with a single promise, evidence showed that, across the university, improvement was substantial in just three years.

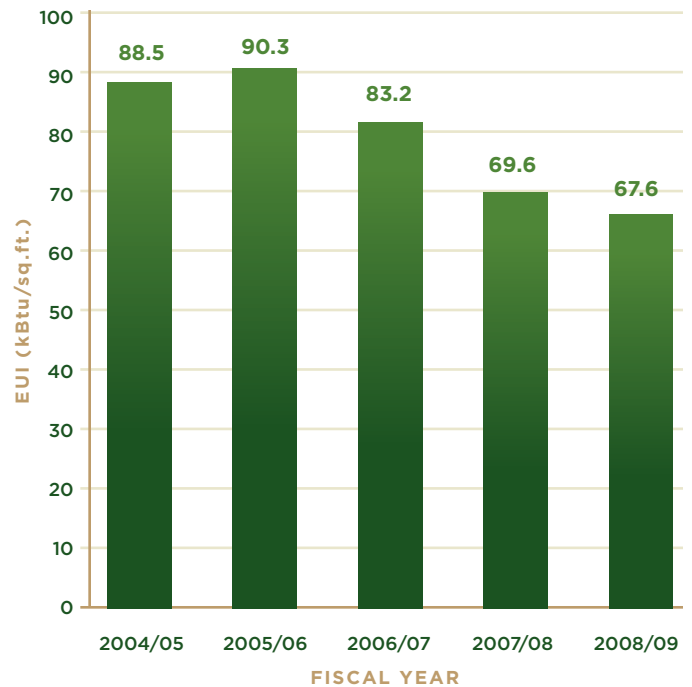
Buildings—The primary source of UCF's CO₂ emissions—building electricity and natural gas usage—had increased from 2007's 93,365 MtCO₂e to 94,152 MtCO₂e, which was due to a five percent increase in building space. However, the energy utilization index decreased by about three percent, which is evidence UCF is building more-efficient buildings.

In 2008, the in-house commissioning team modified 17 buildings and saved approximately \$565,000, reduced 44 million kilowatts of electricity, and avoided 2,719 tons of CO₂.

Transportation—The second-largest source of emissions was transportation, which includes the university's vehicle fleet and business travel, as well as student, faculty, and staff commuting.

- **Vehicle Fleet:** As of 2008, UCF's vehicle fleet consumed 149,433 gallons of gasoline and 11,028 gallons of diesel fuel and the shuttle service used 142,268 gallons of mixed diesel with biodiesel fuel for a total of 160,461 gallons of fuel⁶—the total emissions were calculated to be 2,878 MtCO₂e. However, approximately 1.7 million students used the 34 shuttle buses on 12 different routes, and this had allowed UCF to avoid 20 percent of all off-campus commuting.
- **Commuting:** With 90 percent of its student population living off campus, UCF is a commuting school. UCF estimated that students commuted 29.3 million miles and faculty and staff commuted 16.1 million miles—a total of approximately 11,815 MtCO₂e emitted from students and 6,534 MtCO₂e from faculty and staff.⁷
- **University-related Travel:** Faculty and staff traveled nearly 24 million miles in 2008—a decrease from 2007's numbers by 784,000 miles and 668 tons of CO₂.

UCF Energy Utilization Index (kBtu/sq.ft.)



Solid Waste and Recycling—The university sent 3,551 tons of waste to a landfill and recycled 684 tons. The recycling rate rose to 18 percent, an increase of almost 5 percent. Therefore, the university attributed 3,850 MtCO₂e from the amount of solid waste produced by the campus.

Grounds and Land Management—UCF maintains its lands and waters through prescribed burns, invasive species management, restoration, and species conservation and management. In 2008, UCF also planted more than 1,500 trees on campus and another 2,000 trees in its natural lands.

Water and fertilizer usage also improved, as the university irrigated more than 40 percent of the main campus with reclaimed water, decreasing fertilizer amounts by 50 percent while replacing that fertilizer with organic, low-nitrogen fertilizer. A total of 2,398 pounds of synthetic fertilizer with 7.15 percent nitrogen and 1,037 pounds of organic fertilizer with three percent nitrogen were used in 2008—a total of 0.80 MtCO₂e produced.

⁶ Fuel information gathered from UCF Central Stores and Voyager Fleet cards for the 2008 calendar year.

⁷ Assumed that 72% of students commuted by personal vehicle driving 6 miles roundtrip with 5% of students carpooling. Assumed each student traveled to campus 3.5 times per week for 30 weeks per year giving us 105 trips to campus. Assumed 99% of faculty and staff commute with 5% carpooling, with an average of 10 miles roundtrip. Faculty was estimated to do 105 trips to campus while staff was estimated at 250 trips per year.

UCF's Structures, Plans, and Policies for Sustainability

In preparation for joining the ACUPCC as a signatory and to developing the Climate Action Plan, the university brought together a strategic team of senior executives to guide the plan through all phases. The team included representatives from operations, academics, and research.

But a grassroots movement was needed to unite the UCF community under a cause. To this end, several alliances were formed to engage, inform, and coordinate the efforts of students, faculty, and operational staff.



Unifying Theme

Concurrently, UCF's administration asked students through surveys, focus groups, and one-on-one consultations what they cared about, and the undergraduates expressed passion for a just and sustainable future. From these efforts, administration adopted the "Unifying Theme" of environment and global climate change in the summer of 2006. The Unifying Theme encourages UCF's students and faculty to engage in an interdisciplinary, academic discussion about the environment and global climate change, potential solutions, and opportunities for direct student action.

STARS

Since that time, UCF has compiled several reports that give a snapshot of the incorporation of sustainability on campus. UCF compiled the Sustainability, Tracking, Assessment, and Rating System (STARS) report in 2009 as part of a pilot project for the Association for the Advancement of Sustainability in Higher Education (AASHE). Staff from the Office of Undergraduate Studies and students in the Service Learning Systems Sustainability course collected the data for this report during the 2007-2009 school years.

Carnegie Foundation for the Advancement of Teaching

Additionally, UCF gathered information about its extensive community outreach, engagement, and impact with partners for the Carnegie Foundation for the Advancement of Teaching. With its goal of being America's leading partnership university, UCF is dedicated to sustaining the economic, environmental, and social well-being of its community with partners such as:

- Corporations
- Chamber of Commerce
- Disney Entrepreneurial Center
- Junior Achievement
- The Nature Conservancy
- United Arts of Central Florida

The Carnegie Foundation recognized UCF for its commitments to "Curricular Engagement" and to "Outreach & Partnership"—UCF was only the second public university in Florida to gain such recognition in two categories.

UCF IS CLASSIFIED AS A UNIVERSITY THAT HAS MADE SUBSTANTIAL COMMITMENTS IN "CURRICULAR ENGAGEMENT," AS WELL AS "OUTREACH & PARTNERSHIP" BY THE CARNEGIE FOUNDATION.

As a result of UCF's commitment to sustainability, the university added the following to its policies:

1. All new construction or major renovations will be registered with the U.S. Green Building Council (USGBC) and meet a minimum Leadership in Energy and Environmental Design (LEED) Silver rating utilizing the LEED NC 2.2 rating or the most current certification
2. All new construction or major renovations are required to have 14 mandatory credits within the LEED certification related to specified guidelines on air quality, water usage, and energy efficiency
3. All new office equipment must meet or exceed ENERGY STAR ratings
4. Housekeeping is encouraged to use Green Seal cleaning products
5. Buildings are placed on a four-year re-commissioning cycle to recover energy losses from system degradation and utilize new and improved technologies
6. Energy consumption will be tracked and monitored in real-time using an open energy information system
7. Building temperatures will be maintained between 60 and 82 degrees, depending on season and occupancy hours
8. Interior and exterior lighting standards were outlined, which included type of fixture and wattage
9. Discouragement of staff from using personal appliances such as refrigerators, space heaters, and fans
10. Consolidation of office space to use fewer buildings
11. Investment in alternative fuel vehicles

UCF will continue to embed sustainability within its strategic plans—for example, the preliminary University of Central Florida's Strategic Plan: 2009, which is currently being developed, includes leveraging UCF's strengths in innovative partnerships, interdisciplinarity, and a culture of sustainability.

Additionally, UCF's Campus Master Plan Update 2010-2020 clearly outlines the importance and value of a pedestrian-friendly core space on campus, good air quality, energy efficiency, water conservation and protection, environmental considerations in land-use development, multi-modal transportation, protection of ecosystems, and good stewardship of campus lands and resources.



The new Physical Sciences building recently earned LEED Gold Status Certification.



The Florida Solar Energy Center's SunSmart Schools program involves the selection of 25 schools to receive solar panel demonstration or shelter units.

Becoming a Sustainable Campus

As the 3rd-largest university in the nation, the University of Central Florida has significant impact and influence as a leader and catalyst for positive change. UCF will use its technical and operational strengths to demonstrate practical solutions to achieve climate neutrality.

Better Buildings

**BY 2014, UCF INTENDS TO HAVE
14 BUILDINGS ON CAMPUS THAT WILL BE
LEED SILVER OR HIGHER CERTIFIED.**

All previous GHG reports showed that UCF's main campus buildings were the primary source of CO₂ emissions, producing up to 79 percent of the total emissions measured. Pareto's principle, or the 80-20 rule, has inspired the university to focus on operating and maintaining efficient buildings to yield the greatest emissions reductions. UCF believes it can further reduce its energy consumption by three percent per-square-foot a year for the next three years. UCF will seek to focus its attention on the most effective strategies to make the greatest impact possible and will:

- Focus on constructing new buildings that attain a minimum LEED Silver Certification—totaling 14 by 2014—as new construction is often more cost-effective and easier than retrofitting. In addition, all new buildings are required to have 14 mandatory credits within the LEED certification related to air quality, water usage, and energy efficiency. Their buildings are estimated to save 20 to 40 percent of their energy and water consumption compared to a baseline building.
- Conduct continuous commissioning of existing buildings since, even with proper maintenance, their energy performance will degrade over time. Each building will be placed on a four-year cycle to capitalize on improved best practices and technologies that maximize the efficient operation of the building. Re-commissioning at UCF usually results in an energy and water consumption rate drop by ten to 40 percent.
- Enroll one major educational building in the LEED Existing Building: Operations and Maintenance (LEED EBOM) program each year, starting in 2010, until every major educational building is certified. The university estimates that, by 2045 at the latest, all of its major educational buildings will be LEED EBOM certified.

- Expand feedback mechanisms to enable users to make informed decisions about their energy use. UCF created an Open Energy Information System that tracks the energy consumption of each major building at five-minute intervals and alerts facility managers to anomalies for immediate attention. Using that data, proposals include providing informational “bills” with energy utilization and costs to building coordinators and a publicly available energy-use scorecard for each building.
- Collaborate with UCF research centers such as the Florida Solar Energy Center (FSEC), and consider costs and return on investment to include innovative technologies and products and continually minimize its buildings' environmental footprint.

The commissioning team currently prioritizes projects based upon a payback period of five years or less and a life cycle analysis. However, as these projects are completed, adjustments may be made according to other economic and benefit analyses.

**IN FISCAL YEAR 2008, THE UNIVERSITY
PERFORMED 17 RE-COMMISSIONING
PROJECTS, WHICH SAVED MORE THAN
4.4 MILLION KWH OF ELECTRICITY,
REDUCED MORE THAN 2,700 TONS OF CO₂,
AND SAVED MORE THAN \$565,000 IN ENERGY
COSTS — EQUIVALENT TO 57,000 TREES!**

New constructions may save at least 20 percent on energy costs and water savings.

Arts Complex:

32 percent energy savings, 46 percent water savings

Physical Science building:

42 percent energy savings, 21 percent water savings

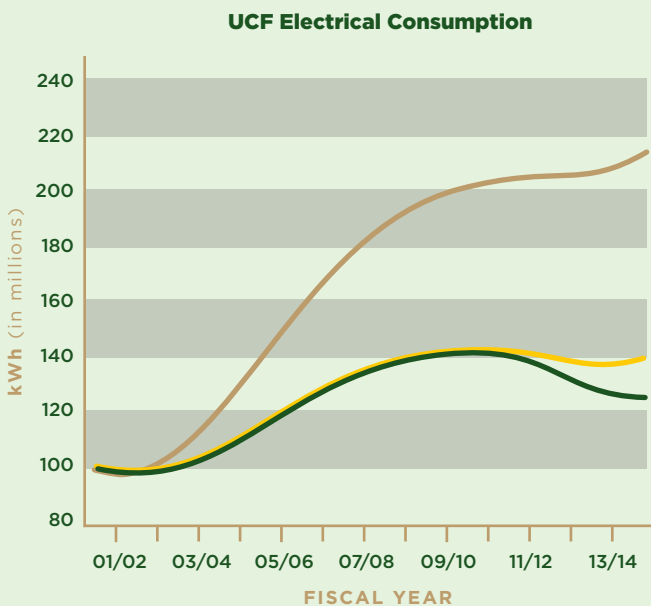
College of Medicine:

22 percent energy savings, 28 percent water savings

Lessen Chilled Water Needs—Approximately one-third of UCF's electricity usage is used to cool and condition buildings on campus, costing the university \$5 million a year. To address this issue and to save at least \$685,000 a year, UCF is:

- Placing buildings on an energy usage schedule, cooling only when needed and within a set temperature range
- Using more energy-efficient equipment and maintenance techniques
- Constructing a thermal energy storage tank that will chill three million gallons of water during off-peak hours using off-peak rates for daytime usage

**UCF SEEKS TO HAVE ALL MAJOR
EDUCATIONAL BUILDINGS LEED EBOM
CERTIFIED BY 2045 AT THE LATEST.**



Forecast electricity consumption with business as usual in gold line, with implementation of energy efficiency measures in yellow, and with implementation of renewable energy production in green

Cleaner and More Renewable Energy Consumption—As it stands, UCF’s primary energy source is electricity from local utilities, which is generated mainly by coal. The university will work with these utilities to investigate switching to “cleaner” energy sources. In addition, UCF plans to:

- Investigate producing energy on-site—research has shown that 63 percent of primary energy is lost during the conversion from fossil fuel to electricity with an additional five percent lost due to energy plant and transmission losses⁸
- Consider constructing a cogeneration facility on campus, which generates electricity but also recaptures and utilizes the waste heat to produce additional power—this facility could save the university an estimated \$2 million a year in energy costs, produce 5,500 kW of electricity at peak performance and capture 70 percent of the primary energy potential
- Aim to produce at least 15 percent of its electricity consumption from renewable energy sources by 2020

- Examine the results of the photovoltaic solar panels installed on the Engineering and the Harris Engineering buildings. The array on the Engineering building is rated to generate 11.2 kW of power at its peak, which is enough to power two residential homes. The panels, on average, generate 45 kWh per day and reduce carbon emissions by 34 tons per day. The array on the Harris Engineering building is estimated to generate 22 kW of power at its peak
- Examine the results of the solar thermal system placed at Tower 2 residence hall, which currently provides hot water for its 500 residents and has three arrays of 10 collector panels that have the capacity to heat 3,400 gallons of water daily—about 50 to 80 percent of the residents’ demand—for a 30 percent reduction in CO₂ produced and a savings of \$65,000 annually
- Install photovoltaic solar panels on more buildings

More Green Roofs—In June 2005, FSEC, UCF’s Stormwater Management Academy, and Landscape and Natural Resources created a green roof pilot project on top of the Student Union with the support of a Department of Environmental Protection grant, converting 1,600 square-feet to a green roof with an adjacent, equivalently spaced, ENERGY STAR roof for comparison purposes. The green roof system has multiple benefits, including:

- Reducing heat lost through the roof. The green roof reduced summertime heat flux by 18 percent in the first year and 44 percent in the second compared to an energy efficient roof. It reduced wintertime heat flux by 49 percent in first and second years
- Reducing energy consumption, given certain assumptions, by approximately 489 kWh/yr
- Extending the life of the roof
- Decreasing stormwater pollutants such as phosphorus, nitrate, and ammonia in runoff with its natural filtration
- Lessening runoff volume by 70 to 75 percent, occasionally up to 87 percent and peak water load by 50 percent
- Capturing rainwater for re-use
- Absorbing carbon dioxide
- Creating a natural habitat for birds, lizards, insects, and butterflies⁹

The green roof’s success is grounds to continue investigating the installation of additional roofs. It is possible that green roofs would lessen the need for more extensive stormwater retention ponds and provide more usable land, but UCF would need to advocate that inclusion into current building codes. Another challenge will be the utilization of roof space for other environmental purposes. Green roofs can also be utilized together with photovoltaic solar arrays to regulate the ambient temperature on the roof, which will increase the energy efficiency of the arrays.

⁸ Brown, Nathan. “Performance by Design: An Energy Analysis of AIA/COTE Top Ten Projects,” 2009, <http://info.aia.org/aiarchitect/thisweek09/1030/1030p_cotetop10.cfm>.

⁹ Wanielista, M., Hardin, M., Kelly, M. “The Effectiveness of Green Roof Stormwater Treatment Systems Irrigated with Recycled Green Roof Filtrate to Achieve Pollutant Removal with Peak and Volume Reduction in Florida”, April 1, 2007. Sonne, J., Parker, D. “Energy Performance Aspects of a Florida Green Roof, Part 2”, Sixteenth Symposium on Improving Building Systems in Hot and Humid Climates, December 15-17, 2008, Dallas, TX.

Better Transportation

With nearly 90 percent of its student body living off campus, UCF is a commuter school with numerous opportunities for positive change such as:

- Reducing single occupant vehicles
- Utilizing cleaner fuels
- Minimizing commute and traffic congestion
- Increasing pedestrian, transit, and cyclist use
- Regulating car volumes
- Modifying academic scheduling
- Employing distance learning
- Utilizing its regional campuses for a more effective parking and transportation system
- Having up to 40 percent of those who come on to campus use an environmentally preferred mode of transportation such as walking, biking, carpooling, mass transit, or a vehicle that uses alternative fuels

UCF WILL ENCOURAGE MULTI-MODAL TRANSPORTATION SO THAT UP TO 40 PERCENT OF THOSE WHO COME TO CAMPUS WILL USE AN ENVIRONMENTALLY PREFERRED MODE OF TRANSPORTATION.

A Pedestrian and Bike-Friendly Campus—UCF's campus core consists of three concentric circles that radiate out from the Student Union with radius of 400, 800, and 1,200 linear feet. The 1,000-foot Apollo Circle will be devoted to educational buildings, with parking structures primarily starting outside that ring.

The Landscape and Natural Resources team plans to plant additional trees along the sidewalk to provide pedestrians with shade to promote more walking, to reduce the heat island effect on campus, and to increase community space. More on-campus bike racks and shower facilities are available to promote alternative methods of transportation as part of the university's commitment to building LEED Silver or higher buildings. UCF is exploring the creation of bike trails, as well.

Travelling En-masse—UCF Parking and Transportation Services manages more than 16,500 parking spaces, a carpool program for employees, and its 34 shuttle buses. The university plans to add another multi-level parking garage with 1,400 spaces. However, it still advocates for mass transit and carpooling as eco-friendly and economical options to help manage congestion and the costs of new parking structures.

UCF instituted a complimentary shuttle service for students, faculty, and staff. The university has 34 shuttles that travel on 12 routes around campus, to affiliated student housing, to the Rosen School of Hospitality Management, and to the College of Medicine. Currently, 17 of UCF's 34 shuttles run on biodiesel—all will run on alternative fuels as the older shuttles are replaced. The shuttles are run by American Coach Lines, a contractor, which estimated in 2008 that nearly 1.7 million students utilized the shuttles. UCF estimates this resulted in approximately 4,100 fewer cars driven, avoiding 20 percent of UCF's off-campus commuting.

BY 2020, THE UNIVERSITY WILL STUDY THE EFFECTIVENESS OF PROVIDING A HIGH-OCCUPANCY VEHICLE PARKING INCENTIVE PROGRAM THAT PROVIDES PREFERENTIAL PARKING TREATMENT FOR AUTOMOBILES CARRYING TWO OR MORE PERSONS.

UCF will increase shuttle use by:

- Increasing the tracking ability to determine high demand times and routes for better load management and scheduling
- Installing global positioning system (GPS) capability on the shuttles for better time management and to decrease rider anxiety regarding time management
- Increasing awareness of availability, routes, and schedules of the shuttles to students, as well as to faculty and staff who rarely utilize this resource

UCF will work with the shuttle operator to purchase more fuel-efficient vehicles, alternative fuel options, shorten idling times, and install portable cooling options when a shuttle is idle. UCF also encourages commuters to use the buses and carpool/vanpool programs hosted by the Central Florida Regional Transportation Authority.

University Fleet—The university seeks out alternative fuel, flex fuel, or hybrid fueled vehicles when replacing or adding to its fleet. The university also hosts the Space Coast Clean Cities Coalition, which promotes alternative fueled vehicles—it's only one of seven universities to participate in this Department of Energy program.

According to a federal mandate requiring that new university vehicles are compatible with E85, the university is discouraged from purchasing hybrid vehicles that may be more cost effective or fuel efficient, since they use regular gasoline instead of E85—a challenge, as the closest E85 fueling station to UCF is at least 40 minutes away. The university will work to install an E85 gas pump on campus and advocate for the ability to purchase the most efficient vehicles given the needs of the purchaser. In addition, the university is interested in advancing alternative fuel vehicles such as hybrids, electric, solar, hydrogen, and other biomass vehicles to decrease its carbon footprint.

UCF WILL SEEK OUT ALTERNATIVE FUEL, FLEX FUEL, OR HYBRID FUELED VEHICLES WHEN REPLACING OR ADDING TO ITS FLEET.

Already, several of UCF's departments are testing solar electric golf carts and vehicles. For example, the Sustainability and Energy Management department purchased a Zenn plug-in vehicle and retrofitted it to run on solar power alone using three solar panels on top of the roof for zero emissions. The department purchased a Toyota Prius and converted it to a plug-in hybrid vehicle.

Distributed Learning—Providing distributed learning will greatly reduce emissions from transportation and lessen pressures for parking, as fewer will commute to campus. Web courses have become very popular at UCF and are expected to be a primary source for growth, as student enrollment in at least one fully online course more than doubled between 2003 and 2008; the proportion of students in Web-based learning grew from 13 to 23 percent during that same period, and student production for fully online courses increased about 30 percent from 2008 to 2009.¹⁰ In addition, faculty and students have used Web technologies to conduct advisory and/or group meetings online. The university forecasts that, by 2014, given growth rates, as much as 20 percent of credit hour production will be fully online, with an additional 20 percent of credits delivered with some technology component that allows for reduced seat time and needs.

Reduce, Re-use, and Recycling

UCF ASPIRES TO HAVE A 75 PERCENT RECYCLING RATE BY 2020.

UCF is investigating new facility options that will allow it to sort, recycle, and compost most of its solid waste before sending the remainder to the landfills—resulting in an ability to sort and process waste on campus with minimal amounts transported to local landfills.

Recycling—UCF is firmly committed to its recycling program at all levels, from senior executives to students. UCF understands the positive impact to the environment through recycling, but also believes it is the right thing to do. UCF has seen steady progress since it started recycling in 2005 and recycled five percent of its waste to estimate that, in 2009, it recycled 30 percent of its waste. The main drivers of that success have been an unwavering commitment by staff, student involvement, availability of recycling containers placed throughout campus, and a change in mindset from considering it “a waste stream to a recycling stream.” The university’s goal is to reach a 75 percent rate by 2020.

UCF has several recycling initiatives to generate awareness and participation on campus:

- In 2009-2010, freshman residents in UCF’s Brevard Residence Hall are piloting a “Green House,” where recycling bins will be ample and the importance of recycling will be communicated and tracked.
- Since 2007, UCF has participated in Recyclemania, an inter-collegiate competition for college and university recycling programs. In January 2009, UCF placed 159th out of 204 schools in its recycling rate and 21st out of 151 schools for its waste minimization efforts.
- Since 2007, UCF has held game day recycling drives for the duration of the football season. For each home game, recycling receptacles are placed throughout campus for students, alumni, and revelers to deposit bottles and cans; student and staff volunteers work alongside the university’s vendors throughout the day to collect and sort the recyclable materials. During the 2008 football season, more than 39,000 pounds were recycled, about 60 percent more than in the previous year.

- In 2007, Housekeeping and Recycling Services initiated the Student Move Out Recycling Project, distributing containers that collected unwanted material students often dispose of when moving. More than 9,000 pounds of clothing, bedding, appliances, and electronics have been donated thus far to a local community center to help local families in need.

Reuse—UCF re-circulates surplus furniture between departments, selling on consignment what remains after two weeks. There are several benefits to the university:

- Eliminates need for storage or maintenance of surplus items, saving UCF about \$50,000 per year
- Provides extra revenue from the resale
- Enables re-use of these items by others in the global marketplace

Reduction—UCF is dedicated to moderating its consumption of natural resources such as forest products and food, as well as reducing the use of harmful chemicals. UCF supports certification programs that ensure products meet a set of standards that go beyond compliance to national environmental laws and further protect the environment. For example, UCF:

- Purchased approximately 7,000 ENERGY STAR products, which bolstered the demand for energy efficient products in the marketplace by approximately \$7.3 million
- Cleaned with Green Seal certified cleaning products, which contain no volatile organic compounds (VOC) and improve air quality
- Dined without trays in two dining halls, which minimized water and waste
- Procured environmentally preferred forestry products, such as paper and furniture—more than 80 percent of the forestry products purchased met the criteria for environmentally preferable such as paper made with recycled content and/or certified by the Forest Stewardship Council
- Offered some Fair Trade certified coffee for purchase

THE COLLEGE OF BUSINESS ADMINISTRATION HAS ENCOURAGED ITS FACULTY AND STAFF TO REDUCE THEIR PAPER CONSUMPTION.

THE COLLEGE’S FACULTY HAVE PLACED THEIR EXAMS ONLINE AND ITS ADVISING OFFICE DOES ON-SCREEN GRADUATION AUDITS.

IN THE 2008-2009 ACADEMIC YEAR, MORE THAN 130,000 EXAMS WERE TAKEN ONLINE, WHICH SAVED APPROXIMATELY 2,700 REAMS OF PAPER AND IMPROVED STUDENT SECURITY SINCE NO SHREDDING OF DOCUMENTS WAS NEEDED.

¹⁰ “UCF FTE Enrollment Plan 2009-2019 through 2020-2021” University Analysis and Planning Support, University of Central Florida, July 31, 2009.

Hazardous Waste—UCF's Environmental Health & Safety has a waste minimization program in place designed to reduce, reuse, and recycle the hazardous materials used on campus such as batteries, fuels, devices containing mercury, biohazardous wastes, radioactive waste, and other laboratory wastes. The program includes a Web site where departments may list their unused chemicals for interested parties within the university to utilize, a mercury device exchange program, and procedures that encourage purchasing the least toxic and smallest quantities possible.

UCF SEEKS TO IRRIGATE 95 PERCENT OF ITS CAMPUS WITH STORMWATER AND RECLAIMED WATER BY 2012.

Grounds and Land Management

UCF manages around 800 acres of natural upland and wetland habitats on campus. More than 35 federal- and state-listed species have been recorded within these natural lands. UCF manages its grounds and lands through sustainable methods, using all applicable best management practices, including restoration of the natural areas, prescribed fires, invasive species management, listed species management, and stormwater management. The university will continue its efforts through a Master Landscape plan, which will include xeriscaping and planting Florida-friendly plants on campus, using greater amounts of reclaimed water for irrigation, collecting rainwater, removing invasive species, and following integrated pest management (IPM) approaches.

Carbon Mitigation

Along with ACUPCC, UCF believes its primary commitment is to reduce its energy and natural resource use as much as possible before pursuing carbon offsets. In accordance with UCF's entrepreneurial and experiential culture, the university will first pursue greater energy conservation and energy efficiencies on campus. Then, UCF will explore switching to cleaner fuels and adding to its renewable energy mix. Once the university has reduced its emissions as much as possible, it will then explore carbon mitigation and offsets, including using its large natural areas to explore biological offsets, investing in renewable energy credits, and helping others in the community gain energy efficiencies.

UCF WILL ENDEAVOR TO REDUCE ITS CO₂ BY:

- **17 PERCENT** below 2005 levels by 2020
- **42 PERCENT** below 2005 levels by 2030
- **BEING CLIMATE NEUTRAL** by 2050



ABOVE: UCF removed trays from its cafeteria-style dining facilities after research found that trayless dining decreases food waste by 25 to 30 percent. Trayless dining also saves water and energy.



Enterprising students designed and built a system that converts used vegetable oil into biodiesel fuel—for just 80 cents a gallon. UCF uses biodiesel to fuel some fleet campus vehicles.

Education *and* Community Outreach

UCF students are concerned about the environment, specifically global climate change, and passionate about creating a just and sustainable future. UCF has approached education about the environment and sustainability by creating the Unifying Theme, with a student chosen tagline of “Our Planet, Our Education, Our Future.” The program is in its third year and is already producing excellent results.

Goals

Higher education plays a unique and pivotal function in shaping students to understand their role in creating a healthy, just, and sustainable society. It prepares professionals who in turn develop, lead, manage, teach, and influence various sectors and institutions in the global community. UCF plans to teach students to understand their economic, social, and environmental impacts on the community, empowering them to reduce their negative impacts and to create solutions to local, national, and global needs. This will be accomplished through interdisciplinary study of the complex issues involved in establishing a sustainable future and practical application of that knowledge to address societal needs.

STUDENTS WILL UNDERSTAND THEIR IMPACT, BE EMPOWERED TO REDUCE THE NEGATIVE IMPACTS, AND SEIZE OPPORTUNITIES TO CREATE POSITIVE SOLUTIONS THROUGH INTERDISCIPLINARY STUDY AND PRACTICAL APPLICATIONS OF KNOWLEDGE.

UCF encouraged students, faculty members, businesses and other universities to adopt a green culture during Sustainability Week—which included a Campus and Community Sustainability Conference and a Green Fair.



Curriculum

Course Development Resources

UCF’s administration has been a strong champion of the Unifying Theme. It has provided resources and has incentivized the incorporation of sustainability concepts and community engagement into the curriculum using methods such as:

- A twice-a-year conference held by UCF’s Faculty Center for Teaching and Learning, where faculty receive compensation for participation in gaining instruction and assistance on incorporating core concepts such as sustainability, globalization, and experiential learning into their existing or new courses
- A three-day “Course Innovation Workshops” event will focus on sustainability during the spring of 2010, where participants will complete a learning module on sustainability, implement it during the semester, collect assessments, and share their results
- Service learning (SL) additions to course curriculum, where students apply theories or skills being taught in class to address real-world problems—there are now 119 approved SL courses at UCF, 52 of which were offered in 2008 with more than 360 class sections taught¹¹

UCF AND JUNIOR ACHIEVEMENT

UCF is one of the largest service learning partnerships in the nation.

In 2008, through this partnership, UCF students contributed:

- 36,500 Volunteer Hours
- Raised \$106,000 for Schools
- Taught 2,674 Classes
- Reached 50,600 K-8 students
- From 110 Central Florida schools
- For an Economic Impact of \$621,000

“I went into my first Junior Achievement class with the goal to change the lives of the students, but from the moment I stepped into the classroom full of smiling, awestruck faces, I realized that not only did I have a chance to impact their lives, but that they would also change my own life. Junior Achievement has opened my eyes to diversity and increased my self-confidence.”

—STEPHANIE RASH

¹¹ “Annual Data Report for Service Learning for 2008-2009” compiled by the Office of Experiential Learning, University of Central Florida.

- Contributions from students in SL courses of 15 hours of service to one of UCF's community partners. The student benefits from an enriched learning experience and enhances his or her employability with professional development. In addition, the community benefits from additional resources that help sustain its economic, environmental, and/or social well-being. More than 100 faculty members taught classes with service learning components, with the majority in the Colleges of Education, Business Administration, Health and Public Affairs, and Arts and Humanities
- Peer to peer mentoring from a sustainability faculty fellow who has demonstrated the ability to incorporate sustainability into his or her curriculum, and is dedicated and available during the school year to mentor faculty to do the same.
- Book clubs, teaching circles, and faculty showcases to share teaching practices

Sustainability-Related and Sustainability-Focused Courses

Interdisciplinarity is key to the success of sustainability efforts, as knowledge integration is essential. Students in sustainability-focused classes—such as Energy and Society, Economics and the Environment, Global Environmental Politics, Systems Sustainability, and Urban Environmental Policy—are exposed to these multi-stakeholder concerns.

According to the 2009 STARS report, UCF calculated that at least 5,120 credit hours of sustainability-related courses were produced while 97 sustainability-focused courses were available. In addition, out of the more than 1 million credit hours taken by students, approximately 68,850 credit hours were sustainability related or focused.¹² UCF will continue to work on developing curriculum and integrating core concepts of sustainability into classes to improve the understanding, awareness, and job skill of every UCF student. UCF has already begun to offer a new interdisciplinary Energy and Sustainability minor to undergraduates focused on sustainable energy generation, conservation, management, and utilization. In addition, UCF plans to:

- Create combined bachelor's and master's programs in Energy Systems Engineering, enhanced with internships
- Create combined bachelor's and master's programs in Conservation Biology
- Create an academic research center that takes advantage of UCF's strengths in green and clean technologies
- Build online modules about sustainability concepts for inclusion into course material

These offerings will augment existing programs such as Conservation Biology, Environmental Engineering, Environmental Politics and Water Resources Engineering.

NEW AND UPCOMING COURSES

Energy and Sustainability minor

Combined bachelor's and master's program on Energy Systems Engineering with internships

Combined bachelor's and master's program on Conservation Biology

Online modules on sustainability topics

SUSTAINABILITY IN THE CLASSROOM

Environmentalism and Island Nations: St. Kitts/Nevis

An interdisciplinary course, where students studied the impact of culture, economic development, environment, politics, and public health on island nations. The class included a two-week trip to St. Kitts & Nevis for hands-on experiences such as a tour of a geothermal facility, ecotourism activities, sea turtle monitoring, and serving at a health clinic.

Environmental Politics

A course that explored the nature of classical and new models of citizenship. Students worked with environmental organizations to comprehend to whom and to what were they responsible. From 2003 to 2008, students completed more than 8,000 hours of environmental service.

Honors English Composition

A course that researched and analyzed the rhetorical principles used to compose arguments and present ideas. Class has analyzed diverse perspectives and arguments on climate change, global citizenship, and landscape and identity.

Professional Science Master's Program in Energy Systems Engineering

This is a new one-of-a-kind program under development with multi-disciplinary curricular content and summer-long industrial internships. The graduates will have in-depth knowledge of energy systems with a holistic outlook of its implications on society.

Experiential Learning—UCF plans to enhance every student's academic program with experiential learning, whether that comes in the form of cooperative education (co-op), internships, or service learning. In 2008, 21,000 students were engaged in experiential learning, including approximately 2,800 in co-ops, 7,780 in internships, and 10,400 in service learning.¹³ Due to the results of a survey of graduating seniors where 80 percent of them had participated in an experiential learning experience during their time at UCF, the Dean of Undergraduate Studies and other faculty and staff leads are working with academic departments that currently do not offer experiential learning to increase that participation to 100 percent by 2014.

In addition, starting in the fall of 2009, students can take a one-credit community engagement course with 20 hours of service to a university partner to partake in or amplify their experiential learning.

BY 2014, 100 PERCENT OF GRADUATING SENIORS WILL HAVE ENGAGED IN AT LEAST 15 HOURS OF APPLIED LEARNING IN AN EXPERIENTIAL LEARNING COURSE DURING THEIR ACADEMIC PROGRAM THAT CONTRIBUTES TO THE COMMUNITY.

¹² Courses which include sustainability principles as a course component or module are considered sustainability-related while courses which examine a topic using sustainability as a lens is classified as sustainability-focused.

¹³ "Annual Data Report for Service Learning, Co-ops, and Internships for 2008-2009" compiled by the Office of Experiential Learning, University of Central Florida.



With hundreds of species of animal and plant life, the 82-acre Arboretum stands as a long-standing symbol of UCF's dedication to educating students and the community about nature, while protecting our environment.

Workshops, Symposiums, and Other Educational Activities—

UCF will continue to invite speakers to engage in seminars, summits, or conferences hosted by different schools and entities on campus. For example, in 2009, a program series of the Global Perspectives office was the environment, energy, and its implications for national and global security issues. Thus far, speakers have included leaders from the Environmental Protection Agency and a Time magazine designated “Hero of the Planet.”

As an extension of their experiential learning experience, some students exhibit their assignments in campus showcases or symposiums. For example, in April 2009, the first university Senior Design Symposium on renewable and sustainable energy in America was held at UCF. Due to the success of this symposium, UCF is investigating the optimization and expansion of this format.

UCF’s Arboretum, which consists of more than 82 acres of natural lands and three miles of hiking trails, also provides an opportunity to learn about Central Florida’s ecological qualities. In February of 2009, a half-acre organic community garden was opened adjacent to the Arboretum for the public to plant vegetables, fruits, and herbs. Within the first six months, the garden was visited by more than 200 people who volunteered 1,500 hours. All in all, in 2008, the Arboretum gave 20 educational tours, engaging more than 320 people.

Student Outreach—The university has a “one-stop shop” Web site for those interested in learning more about UCF’s efforts in creating a sustainable campus, its academic discourse on sustainability, and its cutting-edge research. The address of the Web site is www.sustainable.ucf.edu. The site has links to other UCF Web sites for those interested in specific topics such as links to the Unifying Theme, the Faculty Center, and the Arboretum. In addition, students can network with like-minded students and stay up-to-date about upcoming sustainability events through outlets such as Sustainable UCF on Facebook and Twitter.

Student Groups—UCF has more than 400 registered student organizations, several of which are related to sustainability. UCF’s peer-to-peer sustainability education groups include:

- Environmental Coalition
- Climate Connections
- Engineers without Borders
- Eco-advocates
- I.D.E.A.S
- Raccoons
- Habitat for Humanity’s green team
- Student Sustainability Alliance
- Volunteer UCF

The Environmental Coalition is an umbrella organization that brings together representatives from all other groups and conducts two town hall meetings each year to listen and address students’ concerns about sustainability issues. Since the town hall meetings are held at the beginning of each semester, it can influence the objectives and work plan for the coalition for that semester.

ENGINEERS WITHOUT BORDERS

The Engineers Without Borders chapter at UCF is partnering with the Health Education Relief Organization to determine the most cost-effective and technically feasible way of providing water, in both quality and quantity, to Mare Brignol in the southeast of Haiti.

The team will address the challenge of acquiring potable water through the collection and purification of rainwater.

Project manager James Crawford said, “We can directly help people in Haiti and affect their lives. This also gives us an opportunity to work in a real-life situation. We have a problem, we have to fix it, and we have to learn how to fundraise, research, and network with other people— it’s a lot more than engineering.”

Volunteer UCF is dedicated to promoting community service and education on various environmental and social issues in partnership with 200 community agencies and organizes outreach efforts such as Knights Give Back, Knight-Thon, and Alternative Spring Break. According to the 2009 STARS report, Volunteer UCF planned 94 community service opportunities, with more than 4,000 students attending. UCF estimates that students volunteered a total of 338,000 hours in 2008. The organization will assist the students enrolled in the fall of 2009 one-credit community engagement course to find the appropriate community agency with matching interests and needs.

SENIOR DESIGN SYMPOSIUM

The first university Senior Design Symposium on renewable and sustainable energy in America was held at UCF in 2009.

Undergraduate seniors in engineering and computer science participated in year-long design projects that involved renewable and sustainable energy.

Twenty-one senior design projects showcased included a power management system for a local county, alternative fuel vehicles, a mechanism for capturing ocean wave energy, and wind turbines improvements.

Housing and Residence Life—UCF's Housing and Residential Life currently houses 5,800 students on campus, 70 percent to 80 percent of which are freshmen. Housing and Residence Life has been successful in connecting new students to UCF's campus community. UCF observed that first-year students who lived on campus have a 9.9 percent higher rate of retention for their second year at UCF than those who do not.¹⁴ Therefore, to leverage that success, the university will focus on raising awareness of sustainability issues and encouraging positive change with students in the residential life program.

UCF will also pilot the "Green House" program with the 100 Brevard hall residents and will be replicated if found to be successful. Freshman residents will be exposed to continual conservation messaging, have more recycling receptacles, and be informed about their energy consumption and savings each month.

Finally, since 2007, UCF holds a month-long student competition in the residence halls to encourage energy conservation that has saved the university \$57,000 in energy costs. UCF plans to increase the frequency of its residence hall competitions from once- to twice-a-year to encourage energy conservation year-round. Additionally, the university will explore other programs and incentives to engage the students in continuous energy conservation.

UCF aims to develop confident, prepared citizens who present a well-reasoned voice in the global community. Students benefit from UCF's strengths in entrepreneurship, innovative and impactful research, experiential learning, results-oriented mindset, and partnership aptitude. Through their experiences at UCF, students will understand their impact in society and seize opportunities to create solutions to the world's needs.

In 2009, about 6,000 UCF students reduced energy consumption by 13 percent, enough to power 180 homes for a month (or to pay \$27,000 in energy bills).



¹⁴ Office of Institutional Research, University of Central Florida.

Research

UCF's Office of Research & Commercialization (ORC) fosters the creation of intellectual capital that can solve today's pressing problems, improve the quality of life, and provide an engine for economic growth. The ORC assists UCF faculty and researchers in securing funding for their research, in technology transfer, and for commercialization of the research. A searchable database of funded projects can be found at argis.research.ucf.edu.

As an example of UCF's success, the University Patent Scorecard ranked UCF's strength in patents at number eight out of 122 universities in 2008 and in 2009; \$121.7 million came from federal, state, and industry partners¹⁵—it is estimated that for each dollar of research funding revenue received at UCF, approximately two dollars in total economic output in the region is created.¹⁶

UCF has developed an “entrepreneurship ecosystem” that includes working with entrepreneurs to license UCF's intellectual property, coaching and mentoring entrepreneurs at a venture lab to transform their ideas into business plans, and cultivating an incubation program where start-up companies are nurtured. With the support of UCF's services, Orlando was named in August 2009 as one of the “10 Best Cities to Start a Business” by *Entrepreneur Magazine*.

Goals—UCF academic units and centers will contribute their strengths in basic and applied research to help UCF and its partners on their paths to long-term climate neutrality. Such academic units include:

- Advanced Materials Processing and Analysis Center (AMPAC)
- Center for Advanced Transportation Systems Simulation (CATSS)
- Center for Advanced Turbines and Energy Research (CATER)
- CREOL, the College of Optics and Photonics
- Florida Solar Energy Center (FSEC)
- NanoScience Technology Center
- Stormwater Management Academy
- College of Sciences
- College of Engineering and Computer Science

While the university's major initiatives towards climate neutrality will be supported by current and future research at these academic units and centers, the most relevant research for the goals and targets highlighted in this climate action plan pertain to building efficiency, renewable energy sources, transportation, and natural resource management. To that end, UCF will create an academic research center that will aim to harness the synergies across these departments and prepare well-qualified professionals to meet the demands of the green, clean technology industry.

Also, because UCF's population is now larger than some counties in Florida, the campus can serve as a living laboratory where research concepts are applied or showcased in pursuit of climate neutrality—it has the scale, scope, and resources available, and has the drive to be climate neutral.

UCF RESEARCHERS CAN HELP THE CAMPUS AND THE GLOBAL COMMUNITY ADVANCE TOWARDS CLIMATE NEUTRALITY IN AREAS SUCH AS BUILDING EFFICIENCY, RENEWABLE ENERGY SOURCES, TRANSPORTATION, AND NATURAL RESOURCE MANAGEMENT.

UCF BUSINESS INCUBATION PROGRAM

This program was created in 1999 to provide early-stage companies with tools, training, and infrastructure to create financially stable, high-growth enterprises. Since then, it has created **900 jobs**, received more than **\$170 million** in investment funding, and generated **\$200 million** in business. Seventy percent of the clients are from outside the university.

Florida Solar Energy Center (FSEC)

FSEC is one of the primary resources for sustainability research at UCF. The center focuses on solar photovoltaic, solar thermal, building efficiency, hydrogen, and alternative fueled vehicles. As its title indicates, FSEC has significant expertise in solar energy. A study by FSEC found that, while the desert southwest has the largest solar resource in the continental United States, Florida is not far behind with 85 percent of the maximum solar resource.¹⁷

One area of research expansion could be to experiment on campus with design approaches that could lead to marketable zero energy commercial buildings, which would be aligned with the U.S. Department of Energy's goal of having Net-Zero Energy Commercial Buildings by 2025.¹⁸

¹⁵ University of Central Florida, UCF Research & Commercialization, Fiscal 2009 Annual Report.

¹⁶ Real Estate Research Consultants, Inc. “Economic Impact of Funding for Research and Development at the University of Central Florida,” April 6, 2009.

¹⁷ Lombardi, Matthew, Parker, Danny, Vieira, Robin, Fairey, Philip, “Geographic Variation in Potential of Rooftop Residential Photovoltaic Electric Power Production in the United States,” Proceedings of ACEEE 2004 Summer Study on Energy Efficiency in Buildings, American Council for an Energy Efficient Economy, Washington, DC, August 2004.

¹⁸ A net-zero energy building is a building with greatly reduced needs for energy through efficiency gains, 60% to 70% less than conventional practice, with the balance of energy needs supplied by renewable technologies.

FSEC AT-A-GLANCE

- Created in **1975** to research, develop, and test renewable energy technologies
- In 2009, garnered more than **\$11.5 million** in research awards
- Has more than **40 patents** licensed to industry
- Total funding awards since 1975 exceeds **\$140 million**

Dr. M.J. Soileau, the vice president of research and commercialization, explained: “What makes FSEC unique is its holistic approach to energy efficiency. FSEC conducts research, holds field tests, develops standards, educates the public, and contributes to public policy.”

Center for Advanced Transportation Systems Simulation (CATSS)

The center’s purpose is to apply computer simulation, driving simulators, virtual reality, wireless communication, and other advanced technologies to enhance the planning, design, operation, management and safety of transportation systems. Research has found that CO₂ emissions could be reduced by up to 20 percent through congestion mitigation, traffic flow smoothing (where “stop and go” is reduced) and speed management techniques.¹⁹

Since transportation contributes up to 30 percent of UCF’s estimated GHG emissions, the expertise at CATSS could help UCF better manage its transportation system, traffic flow, and multi-modal transportation options.

Stormwater Management Academy

The Stormwater Management Academy at UCF aims to protect and enhance valuable surface and groundwater supplies by providing educational materials and research to advance the understanding and practice of stormwater management and to influence policy and procedures.

Stormwater is a concern because of the volume and timing of water during precipitation, as well as the pollutants the water amasses in areas such as:

- Roads
- Lawns
- Roofs
- Agricultural lands

The U.S. Environmental Protection Agency declared the pollution associated with stormwater runoff as the nation’s leading cause of non-point source pollution. Proper stormwater management can reduce the risk and impact of flooding, improve water quality in groundwater, and deliver additional water resources to the water supply.

Research & UCF Sustainability Targets

UCF’s research is sizeable and varied in scope; this report highlights only a handful of its current and/or proposed research that may directly or eventually contribute to UCF’s ability to reach some of its stated goals in its journey to climate neutrality.

Construction and Operation of Buildings—Goals related to building efficiency include:

- New buildings will be LEED Silver or higher certified
- Major existing educational buildings will be LEED EBOM certified by 2045
- Energy consumption will decrease 30 percent below 2005 levels by 2013

To support those goals, UCF is either currently or plans to:

- Propose ventilation strategies to reduce energy consumption, but maintain occupant comfort
- Study lighting controls and day-lighting strategies to reduce energy consumption and examine its effect on productivity
- Develop off-peak conditioning strategies to reduce peak demand
- Create new materials with better energy savings characteristics, including thermal management materials/devices, power converters, and lighting
- Verify the efficacy of LEED-certified construction

A wind turbine maximizer designed by UCF students in the College of Engineering & Computer Science won first place at the 2009 Future Energy Challenge in Australia. The design outperformed maximizers from five other universities in this global competition. The team is now working to enhance the design and make it commercially viable.

¹⁹ Barth, Matthew, Boriboonsomsin, Kanok, “Real World CO₂ Impacts of Traffic Congestion” Transportation Research Record: Journal of the Transportation Research Board, Issue 2058, 2008, pp. 163-171.

The **Gossamer Wind** ceiling fan, patented by Danny Parker at FSEC, consumes **half the energy** and is saving **\$20 million a year** in energy costs. More than a million have been sold nationally and are available at The Home Depot.

Renewable energy production: UCF's goal is to produce at least 15 percent of its electricity consumption from renewable energy sources by 2020. The following research will assist with that goal:

- Examine strategies to minimize installation costs of large-scale, campuswide solar energy use
- Develop new, low-cost, flexible inorganic/organic photovoltaic solar cell materials and devices that more efficiently absorb and convert sunlight.
- Assess various materials to determine solar energy storage capacity for energy utilization during periods of lower or no generation.
- Demonstrate smart-grid inverters for wider photovoltaic technology utilization.
- Build a low-cost, commercially viable, wind turbine maximizer that controls output power despite varying wind speeds
- Design a municipal solid waste landfill bioreactor that produces energy and poses minimal risk to humans and the environment

Transportation—UCF will encourage multi-modal transportation so that, by 2020, up to 40 percent of those who commute to campus will use an environmentally preferred method of transportation. Knowledge gained to support this goal will be from the following current or future research plans:

- Conduct an origin and destination study of enrolled students to determine commuting and traffic flow
- Study cooling system strategies for the university's shuttles to decrease idling
- Measure and verify the university shuttles' peak riding times and routes for better load management
- Analyze the power load demand and supply for solar-powered electric plug-in vehicle charging stations
- Investigate different biological matter for alternative fuel in vehicles and its costs
- Determine the feasibility of a solar-powered monorail or light rail

Natural Resources Management—UCF will work to sustainably manage the campus lands and waters, and will explore and develop best management practices within the wildland-urban interface. To that end, the university plans to:

- Examine the carbon sequestration and storage capability of native Florida vegetation and natural communities
- Evaluate and improve water quality in natural and man-made systems
- Measure the effects of high wind conditions on the design and establishment of green roofs
- Perform virtual reality simulations of forest fires to demonstrate implications and outcomes of public policy decisions
- Forecast and model wind, wave, and storm surge effects of hurricanes on Florida cities to provide more accurate emergency advisories

The research outlined here represent only a portion of the university's research plans. UCF will continue to bring its well-honed ability to work with and to build upon the creative efforts of individuals, communities, businesses, organizations, and governmental agencies, creating pragmatic solutions to the complex global climate challenge.

The **Bold and Gold™** pollution control media was patented by the Stormwater Management Academy. This material is placed in stormwater filtration systems, beneath pervious pavements, or under irrigation fields to **remove nitrogen and phosphates** from the waste stream and filter additional particulate materials. In addition to **improving water quality**, the material is made from **recycled tires**, which increases the market for that product.



UCF's Zenn car runs on solar power alone. No fuel. No emissions. No need to plug it in.

Financing *and* Tracking

UCF made an early commitment to sustainability long before the term became a buzzword. UCF has been a strong supporter of local economic development and community engagement. For example, in 2007 alone, UCF:

- Invested approximately \$3.25 million and \$3 million in volunteer hours to nonprofits related to community and neighborhood development
- Provided more than \$1 million to UCF's colleges based on faculty participation in Service Learning
- Provided \$5 million in support for local economic development²⁰

After UCF's initial GHG emissions inventory, UCF established an in-house commissioning team geared to run similar to an in-house energy service company, which:

- Was granted \$1 million in seed money
- Prioritizes projects based upon payback periods of five years or less and lifecycle analysis
- Re-invests all saved funds from building upgrades for future projects

Currently, the university is experimenting with a performance contract model for all non-educational buildings, where an initial interest-free loan is given to auxiliary entities such as parking, residence halls, or athletics for operational upgrades and repaid by the energy savings—this plan requires no initial investment or up-front funds. Additionally, the university is:

- Exploring purchase power agreements for its renewable energy production needs, which allows for the electricity producer to assume the risks and responsibilities of operating and maintaining the facility, maintain energy prices at a fixed price for a set amount of time and requires no upfront costs
- Pursuing greater on-campus energy conservation and energy efficiencies with UCF-affiliated partners
- Exploring a switch to cleaner fuels and adding to its renewable energy mix
- Exploring carbon mitigation and offsets, after it applies the previous strategies, which may include the exploration of community partnerships to reduce energy consumption within the Orlando area, biological carbon offsets, and investment in off-site renewable energy production

If the university considers investing in renewable energy credits (RECs) strictly for its electricity usage, it would need approximately \$288,000. This calculation was estimated using the university's 2008 consumption of 144,000 MWh at the current market price for RECs of \$2/MWh. The university will explore various funding mechanisms, including flat and variable student and staff green fees, as well as fees for per-square-footage use.

The university finances non-building operations oriented projects, such as educational and marketing efforts, through traditional mechanisms, including capital project requests, department budgets, student fees, donor gifts and external grants as available.

How Will UCF Track Its Progress?

UCF is committed to adhering to the standards expressed by the ACUPCC, which requires:

1. Measuring its GHG emissions regularly, an activity the university has conducted annually since 2006—metrics such as total campus energy consumption, total carbon emissions, energy per-square-foot of conditioned space, and fuel used were collected

As UCF's sustainability efforts continue to expand and more data is available; it will revise its GHG emissions to incorporate information from indirect sources and other UCF-affiliated entities. Additionally, the university compiles the results of the previous year's re-commissioned projects.

2. Developing an institutional action plan with interim milestones to achieve climate neutrality that integrates sustainability into university operations, educational experiences, and research

This climate action report is the product of that stakeholder engagement process. However, the university acknowledges the uncertainty of future stakeholder circumstances and behaviors—the strategies and targets outlined in this plan are best estimates of what may be feasible in the future. The plans and strategies to achieve climate neutrality in this report will be continually reviewed and updated to reflect new and emerging markets, technologies, regulations, and opportunities.

3. Creating an institutional structure to guide the development and implementation of this plan—the university has assembled a strategic team of senior executives from operations, academics, and research, which will guide the development and implementation of the plan

Since on-campus grassroots, peer-to-peer engagement has been an effective model, several alliances were formed to engage, inform, and coordinate the efforts of students, faculty and operational staff. These groups meet at various intervals from weekly to quarterly to coordinate and communicate sustainability initiatives.

4. Establishing mechanisms for tracking progress. As the goals are outlined in this report, each entity is responsible for meeting those goals—some of the goals have clear change agents

For example, the university's recycling goals would be advanced and monitored by the housekeeping and recycling department. Goals that do not have a clear change agent responsible will need to be determined by the appropriate party for monitoring progress and overseeing periodic updates—this will be coordinated by the department of Sustainability and Energy Management.

5. Initiating tangible actions to reduce GHG emissions while the comprehensive plan is being developed

The university has already initiated four of the tangible outcomes recommended, including adhering to the LEED Silver standard for new construction, adopting a policy requiring ENERGY STAR certified products where available, encouraging the use of public transportation at the institution, and participation in waste minimization programs.

²⁰ Coalition of Urban Serving Universities Survey, University of Central Florida, 2007.



Appendix A: Acknowledgements and Special Thanks

Thank you to all of the following for their commitment, hard work, and contributions to UCF's sustainability efforts on campus and to this report.

Ms. Barbara Abney
Ms. Jennifer Albert
Dr. Sandra Archer
Dr. Kathleen Bell
Ms. Alaina Bernard-Kitchings
Dr. Melody Bowdon
Dr. Penelope Canan
Ms. Renea Carver
Dr. Tom Cavanagh
Dr. Manoj Chopra
Mr. Keith Coelho
Dr. Tace Crouse
Mr. Jim Cummings
Mr. James Davis
Dr. Sheri Dressler
Mr. David Frosch
Ms. Michelle Fuentes
Dr. Michael Hampton
Mr. Mike Hardin
Vice Admiral Al Harms (Ret.)
Ms. Christi Hartzler
Mr. Terry Helms
Dr. Charles Ross Hinkle
Ms. Lynell Hodge
Ms. Peggy Howse
Mr. Dustin Jackson
Dr. Peter Jacques
Mr. Shane Juntunen
Dr. Jay Kapat
Ms. Lee Kernek
Ms. Lisa Kiperstock
Ms. Margaret Lo
Mr. Eric Main
Dr. Kevin Meehan
Mr. Jimmy Moore
Dr. Alison Morrison-Shetlar
Dr. Nabil Nassif
Mr. Thuan Nguyen
Mr. David Norvell
Mr. Jeff Novak
Dr. Martin Quigley
Dr. Essam Radwan
Mr. Bob Reedy
Dr. Deborah Reinhart
Mr. Bob Rich
Ms. Tina Richards
Mr. Eugene Roberts
Mr. Curt Sawyer
Dr. Rick Schell
Dr. Winston Schoenfeld
Dr. John Shen
Mr. Joe Simon
Mr. Krishna Singh
Ms. Dorothy Straight
Mr. Erik Stuart
Ms. Jennifer Taylor
Mr. Rob Vieira
Ms. Montel Watson
Mr. Brian Wormwood
Dr. William Young
Ms. Amy Zeh
Dr. Lei Zhai



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ORLANDO, FLORIDA

UCF is the university that seeks opportunities, creates opportunities, and brings them to fruition. The university's culture of opportunity is driven by the diverse people it attracts and serves, its Orlando environment, its history of entrepreneurship, and its youth, relevance, and energy.

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