

2010-11



The University of North Carolina at Chapel Hill

Climate Action Plan Update



Summary

In 2007, the University of North Carolina at Chapel Hill committed to achieving climate neutrality by mid-century, reducing its greenhouse gas emissions to zero through renewable energy, alternative transportation, and efficiency programs. In 2009, faculty, staff, and students laid out a plan for achieving that goal. Now, in the fifth year of its commitment, we look back to see how those plans have taken shape.

Emissions Steady

Greenhouse Gas emissions remained level in 2010, changing by a fraction of a percent compared to the previous year. This stability places the University ahead of schedule on its goal of climate neutrality, and maintains emissions near 2004 levels.

Despite the relatively static emissions, major improvements to campus efficiency and monitoring occurred behind the scenes in 2010. It marked the first year that the Cogeneration

Facility and Manning Steam Plant reported the physical metering of carbon dioxide emissions from the smoke stacks. Previous inventories estimated these emissions based on calculations incorporating fuel mass and combustion efficiency.

Back on campus, the University won a national award from the Environmental Protection Agency for reducing energy usage in Morrison Residence Hall by thirty-six percent. Far from an outlier, the work in Morrison was part of a much larger campus program to implement low-cost energy saving measures that have that have achieved avoided costs of over \$6.6M.”

Climate Action

These improvements were the result of extensive planning and a high-level commitment by the University to eliminate its carbon footprint. In fact, every single one of the fifteen greenhouse gas mitigation projects identified in the 2009 Climate Action Plan have seen progress over the last two years.

For energy supply, the University

performed test burns of biomass in its coal boilers, planned and built a landfill gas methane capture and destruction system, and improved the efficiency of its chillers.

Energy managers supplemented their award winning energy saving program with behavioral initiatives that educated and motivated building occupants to save energy and water.

Transportation managers applied novel technologies to solve the problems commuters face in reaching campus every day. They also adopted alternative fuels to offset vehicle emissions.

Campus staff researched and piloted projects to eliminate wasted energy in idle computers, wasted paper from commercial mail, and wasted organic material in dining hall food scraps.

Together, the University has shown its bias for action, and for carrying its careful plans to fruition. Far from resting on its heels, this year of stable emissions simply marks the next jumping off point as faculty, students, and staff reach toward the goal of climate neutrality.

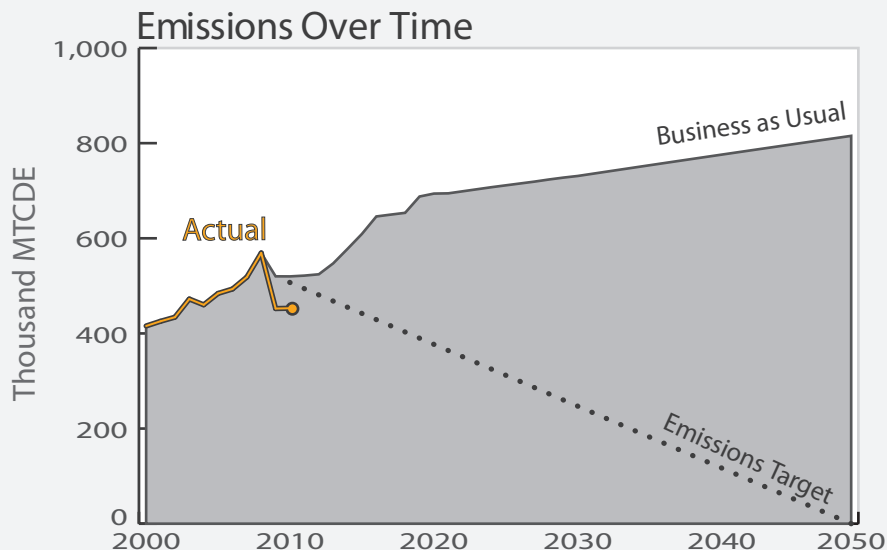
Near-Term Climate Action Projects

Project	Description	Status
Landfill Gas	Capture and combust landfill methane from Orange County Landfill	Under Construction
20% Coal Substitute	Replace 20% of coal with torrefied wood in cogeneration boilers	Pilot Project
Heat Recovery Chillers	Capture and utilize heat from chiller condensing unit	Under Construction
Chiller Efficiency	Three projects to replace or upgrade chillers to more efficient models	Under Construction
Low-Cost ECMs	Improve building energy efficiency using low-cost Energy Conservation Measures	Ongoing
Behavioral Initiatives	Outreach and training to encourage occupants in energy savings	Multiple Projects
Green Building	Adhere to NC Senate Bill 668 energy efficiency requirements	Ongoing
Commuter Travel	Avoided parking construction and increased public transportation	Multiple Projects
Vehicle Fleet	Increase fuel efficiency of campus fleet based on CAFÉ standards	Ongoing
Business Travel	Improve teleconferencing facilities to decrease air travel	Research
Thin Clients	Utilize low-energy web-based computers for libraries and other applications	Pilot Project
Duplex Printing	Make double-sided printing the default for campus printers	Research
Computer Standby	Manage computer sleep and standby modes for campus computers	Research
Commercial Mail	Reduce the amount of junk mail or undeliverable mail sent to campus	Pilot Project
Composting	Extend composting to additional campus dining facilities	Ongoing

Emissions: Past, Present, and Future

Emissions Over Time

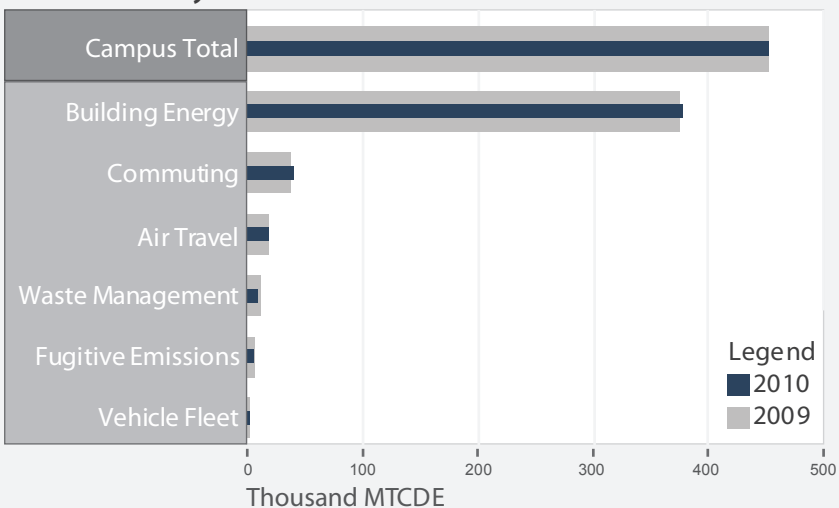
In 2010, total greenhouse gas emissions on campus held steady at 2009 levels. Overall emissions remain below the target levels outlined in the University's Climate Action Plan.



Emissions by Demand

While emissions remained level across the board compared with 2009, building energy usage remained the primary source of greenhouse gas emissions in 2010. Slight increases in commute distance and campus population were balanced by a decrease in methane emissions due to landfilled waste.

Emissions by Demand



By the Numbers

While campus population and building square footage grew moderately in 2010, emissions intensity measured per full-time-equivalent (FTE) student and per thousand square feet of building space decreased.

Key Figures	2009	2010	Change
Greenhouse Gas Emissions (MTCDE)	452,272	452,566	0.1%
Full-Time Equivalent (FTE) Students	26,707	27,006	1.1%
Emissions per FTE	16.9	16.8	-1.0%
Campus Population	41,120	41,442	0.8%
Emissions per Capita	11.0	10.9	-0.7%
Gross Square Footage (Million Sq.Ft.)	18.6	18.9	1.6%
Total Emissions/1,000 Sq.Ft.	24.3	23.9	-1.5%
Building Energy Emissions/1,000 Sq.Ft.	20.2	19.9	-1.1%

Emissions by Source

All values in metric tons of carbon dioxide equivalent (MTCDE)

Source	CO ₂	CH ₄	N ₂ O	HFCs/ CFCs*	SF ₆	Subtotal
Scope 1	275,441	20	1,399	4,358	1,138	282,356
Stationary Combustion						
Blackstart Generators	484	-	1			485
Individual Building Boilers	6,164	2	46			6,212
Cameron Cogeneration Plant	258,510	14	1,285			259,809
Emergency Generators	160	-	-			160
Manning Steam Plant	7,838	3	7			7,848
Fugitive Emissions						
Air Conditioning [†]				2,280		2,280
Laboratory Gases	308		46	80		434
Water Chillers				1,998		1,998
Electrical Switchgear					1,138	1,138
Mobile Combustion						
Vehicle Fleet	1,977	1	14			1,992
Scope 2	180,529	118	1,143			181,790
Purchased Electricity						
Duke Energy	180,220	118	1,142			181,480
Progress Energy	309	-	1			310
Scope 3	(20,656)	9,292	(312)	96		(11,580)
Commuting						
Mass Transit	6,461	-	6	96		6,563
Employee Commute	21,259	19	57			21,335
Student Commute	12,023	11	32			12,066
Energy Sales						
Hospital Chilled Water	(371)	-	(2)			(373)
Hospital Electricity	(40,841)	(20)	(244)			(41,105)
Hospital Steam	(37,138)	(3)	(178)			(37,319)
Solid Waste						
Compost		(348)				(348)
Landfill		16,684				16,684
Recycling		(7,051)				(7,051)
Other						
Air Travel	17,949					17,949
Grand Totals	435,314	9,430	2,230	4,454	1,138	452,566
Biogenic Emissions [‡]	440					440

[†] Data unavailable from some facilities for 2010. Estimated from previous years.

[‡] Biogenic emissions sources include bioethanol, biodiesel, and wood pellets.

* Hydrofluorocarbons and Chlorofluorocarbons

Climate Action Projects

Energy Supply and Generation

Coal-free by 2020

“Universities must lead the transition away from fossil fuels to clean energy.” With this statement, UNC Chancellor Holden Thorp committed the University to being coal-free by 2020.

In 2010, Chancellor Thorp appointed an Energy Task Force to assess opportunities for the University to transition from coal to renewable energy sources. They worked with University staff, local leaders, students, and national advocacy groups to identify UNC’s opportunities to transition its existing coal boilers, which have another 20-30 years of useful life, to alternative fuels such as natural gas or biomass.

The Chancellor accepted the Energy Task Force’s full list of recommendations:

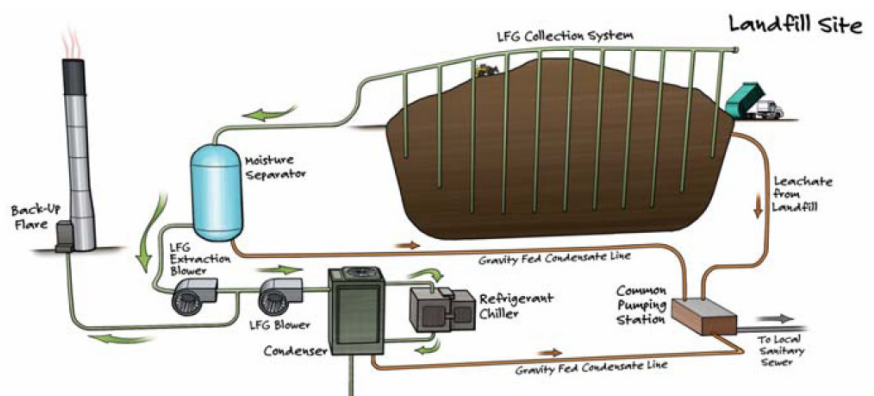
1. End all use of coal on campus by May 1, 2020;
2. Accelerate conversion from coal to a cleaner fuel or fuel mix;
3. Source biomass, if used, from certified “sustainably managed” forests, as determined by third-party verification;
4. Make best efforts to identify and secure coal that is certified by a third party and sourced from deep mines only;
5. Optimize use of natural gas as supplies and costs warrant; and
6. Undertake periodic reviews of the potential for solar thermal and solar photovoltaic system installations.

Landfill Methane Capture and Destruction

The University is nearing completion of its landfill methane capture and destruction system located at the Orange County Landfill on Eubanks Road. Begun in November of 2010, the first phase of the project is scheduled to complete in November 2011.

Landfill Gas Phase 1

After drilling holes into the landfill, perforated pipes will capture and carry methane through a series of processing steps before flaring. In Phase 2, the methane will be used to power a 1,000 kW electrical generator.



Methane, a greenhouse gas over twenty times more potent than carbon dioxide, is released when organic waste decays deep inside the landfill. Traditionally, it has been allowed to escape to the atmosphere, but concerns over environmental impact led University officials and county representatives to seek a solution.

The Energy Services Department organized a team to design and build a methane collection and flaring system, expected to offset over 620,000 metric tons of greenhouse gases.

Initially, that methane will be burned in a flare, but in the next phase of the project, gas will be used to provide heat and electricity for buildings at the Carolina North Campus.

Biomass Co-firing

Constructed in the 1990's, the two Circulating Fluidized Bed (CFB) Boilers at the Cameron Cogeneration Facility have many more years of useful service remaining. These boilers were designed to burn peppercorn-sized coal fragments in a way that dramatically reduces sulfur oxide (SO_x) and nitrogen oxide (NO_x) emissions - components of acid rain.

Because these boilers will continue to serve the University for years, engineers at the plant searched for alternative fuels that could be co-fired with coal to offset the campus carbon footprint. In the 2009 Climate Action Plan, they identified torrefied wood, a charcoal like substance, and woody biomass as possible alternatives.

Cogeneration staff completed a series of test-burns in 2010 and 2011, mixing wood pellets with coal in the CFB boilers. Initial tests focused on fuel handling and processing, followed by a large scale test burned 390 tons of wood pellets. Full results of the study will be published in late 2011, but while it appears that co-firing is technologically viable, fuel availability and sourcing remain topics of concern.

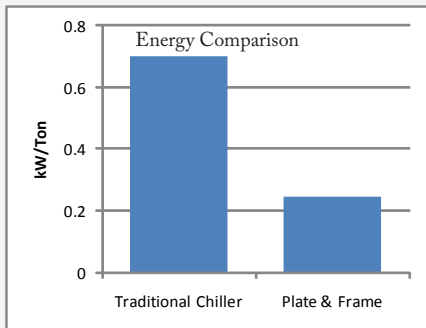


Wood Pellets

By mixing wood pellets with coal in the existing boilers, UNC can offset a portion of its carbon footprint while utilizing existing infrastructure.

Plate and Frame

Relying on cooler outdoor temperatures allows Plate and Frame heat exchangers to use a fraction of the energy of a traditional chiller.



Chiller Improvements

The 2009 Climate Action Plan identified a series of efficiency improvements available for the campus's chilled water infrastructure. Notably, a heat-recovery chiller, which captures the "waste heat" from the condensing unit, is currently under construction in the Imaging Research Building on the medical campus. It performs double duty, providing both hot and chilled water for building HVAC usage.

Another significant addition is a Plate and Frame heat exchanger at the Tomkins Plant. This heat exchanger will allow the plant to drastically reduce its electricity needs, shutting down chillers when outdoor air temperatures fall below 45° and relying on the heat exchanger to produce chilled water at a higher efficiency.

Initial engineering estimates show a projected savings of approximately 2,000,000 kWh of electricity per year. That amounts to an avoided cost of over \$100,000 and 800 metric tons of greenhouse gases!

Conservation



Biggest Loser

Winner of the US EPA's inaugural Biggest Loser energy efficiency competition, Morrison Hall shed 35% of its energy usage in one year.

Learn more online
Save-Energy.unc.edu
[EPA Biggest Loser Competition](#)
[Carolina Green Program](#)

Energy Conservation Measures

Energy conservation at UNC continues to gain momentum with a national award this year from the EPA for energy conservation exceeding 35% at Morrison Residence hall. The in-house HVAC tuning program, which was the basis for the efforts at Morrison, reduced costs across campus by over \$6.6M. Further the accumulated avoided energy costs rose to \$63.9M since FY2002-03 while the accumulated avoided water costs rose to \$7.5M. As expected, greenhouse gas emissions per 1000 square feet dropped from 30.4 Metric Tons of Carbon Dioxide Equivalent (MTCDE) in 1998 to just under 20 in 2010.

Over the past eight years, efficiency efforts included: lighting upgrades, retro-commissioning, implementation of temperature control standards, and airflow reduction in buildings.

Tracking and measurement also improved recently when student interns were hired to enter 193 campus buildings into the Energy Star Portfolio Manager. All of the laboratory buildings were also entered into the Labs21 database. Both tools allow benchmarking and comparison of performance to other institutions from around the country.

Behavioral Initiatives

The Conserving Carolina Energy Recognition Program, led by Energy Management staff, recognizes students, faculty and staff for their energy conservation efforts on campus. The program begins by training facilities services employees and campus building managers on energy and water conservation best practices. The recognition program rewards measurable energy savings efforts for individuals or teams with money, vacation and an engraved brick installed on campus.

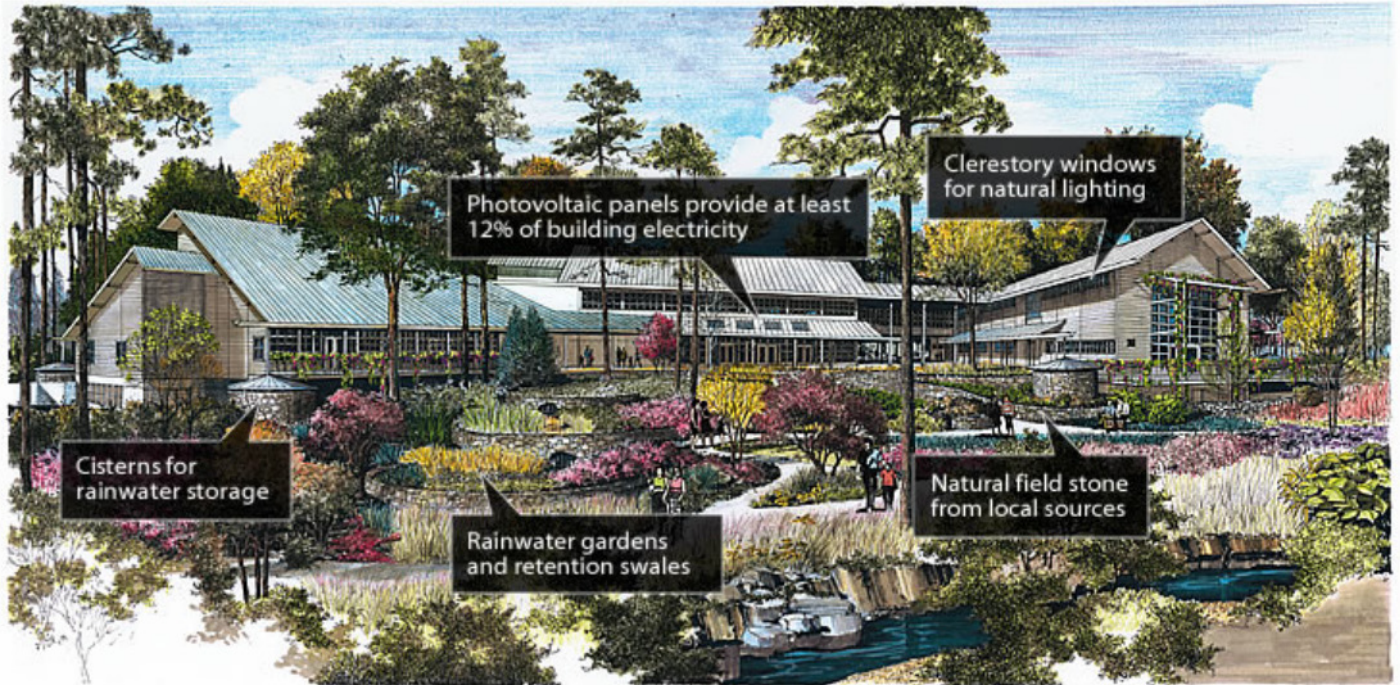
To further educate building managers and occupants, student interns created a packet of energy conservation information called the X-treme Energy Team Packet. In addition to energy saving tips for computers, lighting, and laboratories, the packets also contain "Turn Off the Lights" stickers and contact information for Energy Management Staff.

Student leaders, dubbed "EcoReps," are being trained on energy and water conservation, recycling efforts, and sustainability initiatives at the University. EcoReps provide training and campus tours for their peers, and act as liaisons between campus staff and students.

Green Building

As the University's built environment expands to serve a growing community and cutting edge programs, its carbon footprint and energy intensity must diminish. That's why all new buildings entering design since 2008 will achieve a minimum Leadership in Energy and Environmental Design (LEED) Silver performance standard. They will also use at least thirty percent less energy than allowed by N.C. Building Code standard ASHRAE 90.1 2004. Indoor water use will be at least 30 percent less than the 2006 N.C. Plumbing Code allows and outdoor water use will be at least 50 percent less.

Notably, the Education Center at the North Carolina Botanical Garden became the first state-owned building to be certified to the LEED Platinum level. Incorporating a wide variety of green building techniques including geothermal heating, solar photovoltaic panels, rainwater cisterns, day lighting, local and sus-



LEED Platinum

The Education Center at the NC Botanical Garden boasts a variety of green building features.

Transportation

tainably sourced materials, and a construction waste recycling rate of over 75%, the Education Center embodies the Botanical Garden's mission of conservation and the beauty of the natural world.

ZipCar

Sometimes, faculty, staff, and students bring a car to campus rather than taking the free bus system because they have an appointment or need a car for a few hours a month. Rather than drive every day, they can now utilize the car sharing service Zipcar whenever they need a ride.

The UNC campus has eight Zipcars available for online reservation, including four hybrid vehicles. The program currently boasts over 840 individual members and thirty-four departmental memberships with each car driving an average of 14,500 miles per month.

ZimRide

Another innovative and tech-driven approach to transportation is Zimride, an online community devoted to carpooling and ride-sharing. Participants can either search for rides departing from their community, or offer their own ride to fellow employees and students.

Current offers originate from as far away as Greensboro or as near by as Carboro, and the website allows users to name the price they're willing to pay or accept to make the drive. The UNC Zimride program has over 1,100 participants and 17,250 rides, for a potential carbon savings of 323 lbs of CO₂ per user.

Commuter Alternatives

The Town of Chapel Hill's lease for the 512-space NC 54 park-and-ride lot, near the Friday Center, expired and UNC converted it to a Commuter Alternatives

Learn more online

<http://zipcar.com/unc>

<http://ZimRide.unc.edu>

[Commuter Alternatives Program](#)

Program lot, easing demand for the popular nearby Friday Center 900-space park-and-ride location. Chapel Hill Transit was awarded a Job Access Reverse Commute grant to partially fund bus service to Pittsboro, and secured 150 spaces for park-and-ride in the Lowe's Home Improvement parking lot.

In addition to more spaces around the area, the CAP Merchants Program has expanded and improved as well. Over forty merchants currently participate with coupons, discounts and other incentives when smart travellers show their membership cards.

Vehicle Fleet

UNC's goal to reduce vehicle petroleum use is not just a sustainability project, it's the law. As part of the State Petroleum Displacement Plan, the University was required to decrease fossil fuel use in the vehicle fleet by 20%, or over 55,000 gallons per year by 2010.

University staff met the challenge through a combination of efficiency measures and alternative fuels like ethanol.

The newest addition to the program was a 1,000 gallon B20 tank (20% biodiesel) that was installed and became operational in December 2010. At the time of this writing, there are sixteen vehicles using biodiesel, including the University's own campus-to-downtown student shuttle buses. The tank has dispensed nearly 3,000 gallons since its installation.

Because biodiesel is produced from waste cooking oils or fats, every gallon of B20 used in place of standard diesel shaves about four and a half pounds of carbon dioxide emissions from the campus carbon footprint.



Biodiesel

The addition of a biodiesel tank on campus allows shuttle buses to operate with a lower carbon footprint.

Operations

Business Travel

The Climate Action Plan recommended utilizing teleconferencing facilities and technologies to reduce the need for faculty and staff air travel. A preliminary study, sponsored by the Carolina Counts Program, will look at the existing teleconferencing infrastructure across campus and provide recommendations for future improvements.

Thin Clients

One way to save power in computing is to slim down the machine. Thin clients are bare-bones computer systems with just a keyboard, monitor, and the minimal hardware necessary to connect to the web. All of their computing power resides on a central server, so power consumption at the terminal is very low.



Campus Services IT reviewed its existing thin client deployments in places like the Cogeneration Facility to determine whether cloud-based computing could be expanded to other locations. Based on favorable responses, they will deploy roughly one hundred additional thin clients to Facilities Services employees by the end of 2011. Further expansion on campus will rely on the results of this pilot project.

Thin Clients

By moving processing power to the cloud, each individual computer terminal is more efficient and longer lasting.

Duplex Printing

Printing on one side of a sheet of paper leaves half of the resource wasted! For this reason, Campus Services IT staff is doing a pilot project to make duplex printing the default. First steps include an inventory of all printing assets to make sure they're capable of double-sided printing. After that, all connected computers can be setup to print on both sides of the page as a default, reducing paper consumption by almost half.

Computer Standby

Leaving computers on 24 hours a day consumes a lot of energy. By enabling automated power saving features like standby or hibernate, the EPA estimates that the University could save over \$40 in electricity costs and over 600 lbs of carbon emissions every year for a desktop PC. With tens of thousands of computers on campus, the cost and carbon savings really add up.

A cross-functional team representing Campus Services and the IT department explored the current status of computer energy usage on campus, as well as interviewing vendors of energy saving software. They concluded that the opportunity for computer standby savings were actually much lower than initially imagined.

All computers purchased through the Carolina Computing Initiative (CCI) which includes all student laptops, come pre-equipped with sleep or standby settings. An assessment of departmental computer use revealed that many computers already implement standby settings, or must be exempt due to usage patterns, such as those in the district energy plants.

Still, staff performed a pilot launch of commercial standby management software on 150 computers, and results of the study can be used to inform a campus-wide program.

Commercial Mail

Tons of undeliverable commercial mail arrive on campus every week, only to be recycled by mail services staff, or delivered and disposed of by an end user. Much of this mail has missing information, incorrect address, or is meant for faculty, staff, and students who have left the University.

Mail Center staff have partnered with Intra-Mail Networks to pilot a reduction program that filters out this unwanted mail before it's sent. In the most recent year, 37% of the mail handled by IMN required address correction, and another 38% was addressed to people no longer associated with the University. This pilot program prevented the delivery and waste of over 5,800 lbs of paper.



Composting

Alpine Bagel collects organic waste in used pickle buckets for composting, keeping this organic material out of the landfill and reducing methane emissions from campus waste.

Composting

A comprehensive waste audit revealed that about 64% of the garbage hauled away from Alpine Bagel in the Student Union was composed of organic material.

In a landfill, organics such as food scraps, coffee grounds, and napkins, are broken down by bacteria that produce methane gas, a contributor to global warming. Composting supports a different type of bacteria that don't produce methane, providing an opportunity to decrease the University's greenhouse gas emissions.

The UNC Student Government's Environmental Affairs Committee recently teamed with the Office of Waste Reduction and Recycling and Alpine Bagel staff to begin collecting and composting food scraps and organic waste in the Student Union. Empty pickle buckets collect the scrap behind the counter, and full containers are picked up at the loading dock by compost facility operators.

A future waste audit will reveal just how well the program is working, but for now, staff and patrons can enjoy their meals knowing their morning bagel and cup of coffee caused fewer trips to the landfill and produced rich compost for the garden.

Teaching

UNC's first task in meeting its climate change teaching, research, and outreach goals is to understand the current offerings. To that end, a series of upper-level capstone courses in the Institute for the Environment assessed the University's progress.

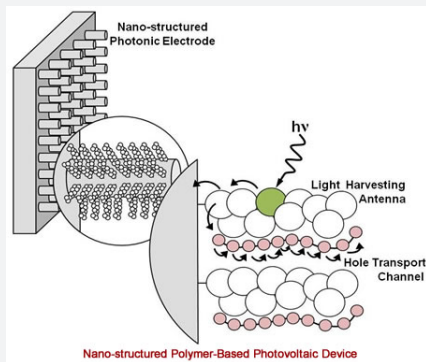
An inventory of sustainability-related courses at UNC identified more than 150 undergraduate and graduate offerings. Classes are primarily in the College of Arts and Sciences, but several graduate and professional schools, including Business, Journalism and Mass Communication, Law, Public Health, and Social Work have also introduced sustainability into their curricula.

A new sustainability minor, introduced in 2008, offers courses in environmental science, business, public policy, and planning. Other departments with multiple sustainability options include anthropology, communications, geography, geology, and philosophy.

Research

An inventory of sustainability-related research at UNC identified more than 10% of UNC's research faculty engaged in sustainability related research and over 40% of departments did some sort of Sustainability-related research.

In 2009, UNC was the proud recipient of a Department of Energy (DOE) Energy Frontiers Grant. Totalling over \$17.5 million, the five-year grant supports a research center focused on developing next-generation photovoltaics, solar fuels, and spectroscopy. Though headquartered at UNC, the center fosters collaboration among researchers at Duke University, North Carolina Central University, North Carolina State University, the University of Florida, and Research Triangle Institute.



Next-Gen Solar

Researchers at UNC's Solar Energy Research Center investigate the properties of nanoscale materials that may become tomorrow's solar collectors.

Learn more online

[Carolina Computing Initiative](#)
[Intra-Mail Network](#)
[Sustainable Teaching Inventory](#)
[Sustainable Research Inventory](#)
[Solar Energy Research Center](#)

Outreach

Beyond implementing new practices and technologies on campus, UNC is providing local and state leaders with the tools to address climate change. At the request of the North Carolina General Assembly, UNC's Institute for the Environment coordinated and provided an extensive Climate Change Committee Report in spring 2009. This report tapped the expertise of more than 40 University faculty and staff to provide policymakers with explanations, predictions, and recommendations specifically related to climate change in North Carolina.

In 2009, UNC also conducted a study of the feasibility of locating wind turbines in the Pamlico and Albemarle sounds and in ocean waters off the North Carolina coast. This study included an analysis of the spatial distributions of available wind power, ecological risks and synergies, use conflicts affecting site selection, foundation systems and their compatibility with sound and ocean bottom geology and associated geologic dynamics, electric transmission infrastructure, utility statutory and regulatory barriers, the legal context, carbon reduction potential, and economics. UNC faculty and students conducted much of the research, with specialty assistance from East Carolina, North Carolina State, and Duke Universities. The study confirmed that large areas offshore are well-suited for wind energy development.

Subsequently, in 2010, UNC faculty, funded by Duke Energy Carolinas, conducted additional wind research and gathered extensive data on the presence of birds, fish, and marine mammals in the areas well-suited for wind development during all seasons of the year.

Contributors

Inventory

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On the Web

Climate Action Program

<http://www.climate.unc.edu>

UNC Energy Policy

http://www.unc.edu/campus/policies/Energy_Use_Policy.pdf

Commuter Alternatives Program

<http://www.dps.unc.edu/Transit/gettingtowork/gettingtowork.cfm>

Energy Management

<http://www.save-energy.unc.edu>

Energy Services

<http://www.energy.unc.edu>

Office of Waste Reduction and Recycling

<http://www.fac.unc.edu/WasteReduction/>