UNC Power Plant Expansion Statement
Chapel Hill Town Council
November 9, 2005
Joyce Brown

ATTACHMENT 3

Twenty years ago some power plant neighbors responded to UNC's plans for a huge new coal fired plant with an alternative proposal. We asked that UNC upgrade the then existing fairly small power plant and use natural gas to fuel the upgraded plant and then have each new building on campus have its own heating and cooling system and incorporate renewable energy technologies and the strictest energy efficiencies to lessen the overall operating cost of each building. We were told that use of natural gas was not possible and I can't remember any response to the renewable energy and energy efficiency suggestions. So I was glad when I heard that UNC planned to use the much cleaner burning natural gas to fuel the present proposed plant expansion. I wanted to say something positive about that. But then I was told by a power plant official that natural gas would not be the main fuel for the expansion. So that let that out

Then I read in the materials provided for tonight that "We are proposing no changes to the Cogen facility that increase the coal burning capacity of the plant." I thought that I could say something positive about that. Then I was told that coal would continue to be the main fuel for the expansion. And how can you have an expansion without an increase in the amount of coal used? So that raised many more questions about the power plant expansion and real concerns about the public and especially the Council being provided ample and accurate information about this expansion so that the Council can make a fully informed decision. Because of the time constraints on speakers, I have listed some of my questions separately for you. I hope that the Council will ask that these questions be addressed and any others raised tonight and brought back for public discussion before any decision is made.

I was looking forward to the response to the request that a stipulation be included in the SUP modification to require that UNC publish annually the Emissions Inventory from the plant in all local newspapers While the Inventory was included and an agreement to provide this to the Council annually, there was no mention of the request that this be published in the local papers. This was extremely disappointing. I was also looking forward to the discussion about the greenhouse gas emissions in response to the request made on September 19. Though the amount of coal burned in some years was listed, there was no mention at all of greenhouse gases or amounts. In light of numerous articles published, especially recently, to have this issue ignored was surprising as well as disappointing.

Of equal disappointment was the fact that the request that the Cameron Avenue power plant not be allowed future expansions. At least a mention of this would have been appreciated.

When this was before the Council in September, unlike the implication in some articles, I did not oppose this present expansion, but did request stipulations for the Council to include in the permit. I did request that there be no future expansions after this one. Since learning more details about the expansion and having questions raised about some of the information in the Council's information packet, I now request that the Council not vote on this proposed SUP modification tonight, to ask that you and the public be more fully informed, that you address the questions that have been raised tonight and on the list provided you and continue this public discussion until every possible question has been raised and you are fully prepared to make a much more informed decision.

WESTSIDE NEIGHBORHOOD ASSOCIATION

407 Ransom Street
Chapel Hill, NC 27516

TO: The Mayor and Town Council Members
FROM: Baird S. Grimson, President
DATE: November 9, 2005
RE: UNC Cogeneration Facility SUP Application

The UNC Cogeneration Facility currently operates under a Special Use Permit. One of the stipulations of the Special Use Permit, adopted May 15, 2000, governs noise. It states: "Noise Control: That the development comply with the Town Control Noise Ordinance as now constituted in Sec 11-37 et. seq. of the code of ordinances and as amended in the future."

Anna A. Wu, Director of Facilities Planning at UNC, wrote in her October 21, 2005 letter to JB Culpepper, Town Planning Director, "Any non-compliant noises are the result of the provision of government services necessary to maintain the public infrastructure, as allowed in the current Noise Code." As a member of the committee formed to evaluate changes in the previous Chapel Hill Noise Ordinance, I can state that this section of the ordinance governing exemptions was discussed extensively and evaluated carefully by Milton Heath of the UNC School of Government (also a member of the committee). Mr. Heath also spoke on this issue to the Chapel Hill Town Council and stated that exemption should not apply to the routine running of a government service facility.

We are told that the Cogeneration Plant is a state of the art facility. As such it should be able to comply with the current Noise Ordinance during its normal everyday operations. Exemptions to the noise ordinance should only include such items as the repair of the infrastructure, the release of steam, the start up of a boiler or other unusual events. We are asking the Town Council to include such a stipulation in the new Special Use Permit.

Chapel Hill Town Council Meeting
UNC Power Plant
November 9, 2005
Joyce Brown

On Thursday I noticed a surveyor's flag on the McCauley Street side of my property. By good luck the surveyor was still working, and I asked him what and why he was surveying and why there was a flag on my property. He explained that he was a subcontractor surveying for the University and that his job was to survey McCauley Street, plus twenty feet from the back of the curb on the southern side of the street. The survey was to be the length of McCauley Street from the power plant to the chillers on campus. The twenty feet from the back of the curb on the southern side puts the survey well into my property as well as all of the property owners on the southern side of McCauley Street. That twenty feet includes not only the Town's gravel walk, but privacy hedges, charming rock walls, handsome old trees, sidewalks leading to homes, lovely landscaping, etc. He said that his responsibility was only for what was on the ground, but that another survey would be then done of the underground utilities in that area.

I asked several of my neighbors if they knew this was happening and none did.

Could the Council please find out if it is legal for even as powerful an entity as a State University to come onto private property and survey without that property owner's consent, or even knowledge.

Even if it is legal, it isn't very good neighborly.

And more importantly, why is the University surveying the length of McCauley Street and a considerable amount of private property from the power plant to the chillers?

None of the possibilities that I have considered are very pleasant, but whatever the University is considering for McCauley Street, or any other neighborhood street or area, or already has planned, the Town and its citizens need to know.

Power Plant Questions for November 9, 2005
Joyce Brown

- Has UNC installed the most advanced scrubbers available to reduce as much as possible the air pollutant point source emissions? (This is not a question about what is required by federal or state laws, and it is apart from the fluidized bed combustion system.)
- If not, why not?
- How is the Emissions Inventory determined? (i.e., a measuring device on stacks, computer modeling based on amount and kind of coal, changing methodology, etc.?)
- A comparison with the 1999 Emissions Inventory shows some pollutant emissions about the same, some reduced and some increased. How do you account for the changes or lack of changes?
- Specifically, the 1999 Emissions Inventory showed 1.2 tons of actual emissions of PM-2-5 and 2004 showed 4.4 tons of actual emissions of PM-2-5 – small particulate matter. How do you account for such significant differences when the Carbon Monoxide for the two years was about the same (1,010 tons/Year for 1999 and 1,040.8 Tons/Year for 2004)?
- A study published in The Journal of the American Medical Association pointed to the threat of small particulate matter. There have been other studies indicating these dangers and the fact that "there appears to be no level below which effects disappear." Has UNC made any assessment of how far small particulate matter from the plant could travel, depending, of course, on the weather circumstances?
- Has UNC calculated how far any of the pollutants travel, both those that would be heavier, such as mercury, and the lighter gases?
- UNC has won some sustainability awards for its work. But as far as energy efficiency, what hard data does UNC have about either before or after installing energy efficiency measures in older buildings or comparison between newer and upgraded older buildings of comparable sizes?
- What monitoring methods are there in each building to insure that all windows and doors are closed and as air tight as possible when being heated and cooled?
- Are the buildings that have window air conditioning units on campus being cooled by the power plant as well?
- It is my understanding that there are currently no technologies that can remove greenhouse gases from such facilities as this one. Though UNC has given the amount of coal burned in certain years, what are the greenhouse gases emitted and how much of each?
- Could this coal burning facility be converted to the use of #2 low-sulfur fuel oil that I understand is used elsewhere on the campus?
- Could this coal burning facility be converted to the use of bio diesel fuel when this or other such alternative fuels become more plentiful?
- UNC officials have said many times that the Main Campus is almost built out. Given that, why is UNC asking for such a large power plant expansion now?
- Does Carolina North figure into this expansion proposal in any way?
- How is UNC proposing to heat, cool and provide electricity to Carolina North?

Soot Particles Strongly Tied To Lung Cancer, Study Finds

By ANDREW C. REVKIN

Prolonged exposure to air tainted with tiny particles of soot significantly raises the risk of dying of lung cancer or other lung and heart diseases, according to a new study of 500,000 people in 116 American cities.

In fact, the authors say, many city residents face a long-term risk of fatal lung cancer similar to that of someone living with a smoker.

Because lung cancer is so rare among nonsmokers, that translates into just two additional lung cancer fatalities per 100,000 people, said a leader of the research project, Dr. George D. Thurston, associate professor of environmental medicine at the New York University School of Medicine. But, Dr. Thurston added, the finding helps suggest a cause for many otherwise unexplained lung cancer deaths and adds urgency to efforts to reduce fine-particle pollution, which comes from power plants and motor vehicles.

Earlier studies had hinted at a link between fine soot particles and lung cancer. But this one, whose results appear today in The Journal of the American Medical Association, was the first with sufficient breadth (involving the 500,000 subjects) and duration (16 years) to show a strong relationship.

The Environmental Protection Agency has written rules to crack down on soot pollution, but they have been held up by lawsuits brought by the power industry and by vehicle manufacturers and operators. Now, in the aftermath of a Supreme Court ruling favorable to the agency, the regulations could take effect late next year, and a senior E.P.A. official said yesterday that the new study suggested that "we're on the right track" in pressing for them.

Microscopic soot particles, far smaller than those that collect on urban windowpanes, have increasingly been identified as a leading pollution threat. The average level of them in American cities has declined by more than 30 percent since 1980, a result of existing broader regulations that do not make a target of these fine particles specifically. But a growing body of studies pointing to their threat prompted the environmental agency in 1997 to issue the restrictions subsequently delayed in court.

The average urban level of these particles in 1980 was 21 micrograms per cubic meter of air. In 2000, it was 14 micrograms. The E.P.A. standard would set an average annual limit of 15 micrograms for cities, but even so, experts expect many metropolitan areas to fail to meet the target.

The 500,000 adults on whom the new study focused were recruited in 1982 by the American Cancer Society for a lifelong project tracking their lifestyles, diets, work conditions and, ultimately, causes of death.

More evidence than ever of a particular airborne threat.

Experts who have spent years analyzing theorized links between pollution and illness generally gave the study high marks.

"One study alone doesn't answer these questions, but it opens the door wider on the issue of lung cancer and pollution," said Daniel S. Greenbaum, president of the Health Effects Institute, a pollution research group in Boston that is financed equally by the E.P.A. and manufacturing industries.

Dr. Thurston, co-author of the new study, said it carried both good news and bad.

"The bad news is that fine-particle air pollution is even more toxic than we thought before," he said. "The good news is we are addressing this problem and there are ways we can further reduce this risk, by moving forward with the Clean Air Act and cleaning up these power plants that are a major source."

NYTimes
3-6-02

RACHEL'S HAZARDOUS WASTE NEWS #373

Providing news and resources for environmental justice -- January 20, 1994

INVISIBLE KILLERS: FINE PARTICLES

Eight studies of air pollution in U.S. cities have now shown that fine particles (the invisible soot emitted by incinerators, automobiles, power plants and heating units) are presently killing about 60,000 Americans each year.[1] More than a dozen studies have, in one way or another, confirmed this relationship. Furthermore, there appears to be no threshold, no level below which effects disappear. This means that people are being killed by air pollution levels well within existing federal standards.

To summarize bluntly, any increase in fine particles in the atmosphere kills someone. The victims remain nameless, but they have been deprived of life all the same. Mere compliance with federal standards does not protect the public. Any increase in the number of small particles in the air elevates the death rate. This has obvious implications for certain technologies: incinerators and fossil-fuel-powered machines (automobiles and trucks, power plants and heating units). To protect public health, these technologies must be avoided, or fitted with expensive control equipment, or replaced by cleaner alternatives.

People have known for a long time that particles in the air can kill. In 1952, a dense smog killed 4000 people during one week in London, and since then no one has doubted the cause-and-effect relationship. The question, therefore, isn't whether airborne particles can harm humans, but rather, how much pollution causes how much damage, and, secondly, is there a threshold, an amount below which no effects are seen?

Throughout the '50s and '60s, complacent authorities assumed there was a threshold -- some amount that was safe. However, after 1975, a revolution took place in scientific understanding of fine particles and health. In 1979, the National Research Council of the National Academy of Sciences,[2] and the United Nations,[3] both published book-length studies of the dangers of small particles to humans. Here is the current view: humans evolved in an environment where dust was made up of large particles. Humans therefore evolved means for protecting themselves against large particles. Large particles are filtered our by hairs inside the nose, mucous membranes in the throat and airways, and other mechanisms. However, modern combustion machines produce small particles which pass right by these natural protections and then enter the deep lung. In the deep lung, air comes into contact with a person's blood stream; this is where oxygen passes into the body and carbon dioxide passes out with each breath we take. Putting tiny particles of pollution directly in contact with the surface of the deep lung is a recipe for trouble. Because of their origin in combustion processes, most fine particles are coated with toxic materials -- metals like lead and mercury, or toxic organics like polycyclic aromatic hydrocarbons (PAHs). So fine particles provide a uniquely efficient carrier, giving dangerous toxins direct entry into the blood stream.

Armed with new knowledge, in 1987, U.S. Environmental Protection Agency (EPA) established new, stricter standards for particles in the air. The 1987 standard, which governs today, is expressed in terms of small particles (also called particulate matter) that measure 10 micrometers or less in diameter. (A meter is 39 inches and a micrometer is a millionth of a meter.) These are called respirable or inhalable particles because, as we saw above, they are small enough to get into the deep lung where they cause various kinds of damage. The shorthand way to refer to these pollutants is PM_{10} (meaning Particulate Matter 10 micrometers or less in diameter). Current U.S. standards say that the ambient air (the general air we all breathe) may contain no more than 50 micrograms (μg) of PM_{10} particles per cubic meter (m^3) of air as an annual average, and the one-day average should exceed 150 micrograms per cubic meter ($\mu g/m^3$) only one day each year. (A gram is 1/28th of an ounce and a microgram is a millionth of a gram.)

Since 1987, evidence has been accumulating, showing that the 1987 standards do not protect human health. The question about the existence of a PM_{10} threshold was addressed first by Joel Schwartz of U.S. Environmental Protection Agency (EPA). Schwartz reviewed data on air pollution and deaths from London, 1958-1972, and showed there was no threshold down to the lowest observed levels of air pollution.[4] A study published last month in the *New England Journal of Medicine*, of six U.S. cities, including several that are not heavily polluted, such as Portage, Wisconsin and Topeka, Kansas, shows death rates increasing with just 15 $\mu g/m^3$ of PM_{10} pollutants.[5] In all, at least 8 studies have now shown that PM_{10} at any level kills people. It seems clear there is no threshold.

A study of people in Steubenville, Ohio, showed that each increase of 100 $\mu g/m^3$ of total suspended particles (of which PM_{10} represents about half) is associated with a 4% increase in the death rate, with no threshold.[6] Interestingly, the Steubenville study showed that the death rate changes as fine particle levels change, but not as sulphur dioxide levels change.

In Philadelphia, a close relationship between PM_{10} pollutants and the death rate was observed.[7] Once again sulfur dioxide levels did not correlate with the death rate, but particle concentrations did. Here each increase of 100 $\mu g/m^3$ of total suspended particles (of which PM_{10} makes up half) was associated with a 7% increase in the death rate. There was no threshold.

A study of people in Detroit showed that a 6% increase in the death rate was associated with each increase of 100 $\mu g/m^3$ of total suspended particles (of which PM_{10} makes up half).[8] There was no evidence of a threshold. Sulfur dioxide levels were not signifi-

cantly associated with increases in the death rate.

Studies[9] of St. Louis, Missouri and Kingston, Tennessee, showed that the death rate increased 16% (St. Louis) and 17% (Kingston) with each addition of 100 $\mu g/m^3$ of PM_{10} pollutants to the air. Associations with gaseous pollutants -- sulfur dioxide, nitrogen oxides and ozone -- did not come close to achieving statistical significance.

In the Utah Valley, a study of the population of Provo revealed that the daily death rate was closely associated with levels of PM_{10} pollution.[10] The Utah Valley is unique because PM_{10} is the only pollution present there in significant quantities (contributed chiefly by a steel mill). For every increase of 100 $\mu g/m^3$ of PM_{10} pollutants, there was a 16% increase in the death rate, and no threshold was observed.

In all cities, the increase in deaths was most notable among people older than 65 and in people with chronic obstructive pulmonary disease (COPD) or cardiovascular disease.

There is a remarkable consistency apparent in all these studies: a 100 $\mu g/m^3$ increase in PM_{10} is always accompanied by an 8% to 17% increase in the death rate. Joel Schwartz, the only EPA employee ever given a "genius award" by the MacArthur Foundation, re-analyzed data from London's 1952 killer smog and showed that the death rate increased 6.4% for each increase of 100 $\mu g/m^3$ total suspended particles, or about 13% for each 100 $\mu g/m^3$ increase in PM_{10} pollutants--again, remarkably consistent with the other studies.

No epidemiological study can prove a cause and effect relationship because it is always possible that some key factor was not considered. Until last month, skeptics could say smoking might explain why death rates increase as PM_{10} concentrations increase. But the study published last month in the *New England Journal of Medicine* looked at 8111 adults in six American cities and showed that smoking did not explain the increased death rate observable when PM_{10} concentrations rise.[5] Smoking has now been ruled out.

Joel Schwartz recently quoted the British researcher, Bradford Hill, saying, "All scientific work is incomplete... All scientific work is liable to be upset or modified by advancing knowledge. That does not confer upon us a freedom to ignore the knowledge we already have, or to postpone the action that it appears to demand at a given time." Then Schwartz added: "At this given time, the knowledge we already have seems to demand a reduction in population exposure to airborne particles."[1]

==========

[1] Seven studies are reviewed by Joel Schwartz, "Particulate Air Pollution and Daily Mortality: A Synthesis," *Public Health Reviews 1991/1992* Vol. 19 (1992), pgs. 39-60. For the 8th, see footnote 5. The 60,000 figure is taken from "Air Pollution in Typical U.S. Cities Increases Death Risk," press release dated May 13, 1991, from the Harvard School of Public Health, Boston, Mass. describing findings later reported in Joel Schwartz and Douglas W. Dockery, "Increased Mortality in Philadelphia Associated With Daily Air Pollution Concentrations," *American Review of Respiratory Disease* Vol. 145 (1992), pgs. 600-604. Two million deaths occur in the U.S. each year; according to Schwartz and Dockery, fine particles account for 3%. See also, Michael Weisskopf, "Particles in the Air Help Kill 60,000 a Year, Study Says," *Washington Post* May 13, 1991, pg. A13.

[2] National Research Council, *Airborne Particles* (Baltimore: University Park Press, 1979).

[3] United Nations, *Fine Particulate Pollution* (NY: Pergamon Press, 1979).

[4] Joel Schwartz and Allan Marcus, "Mortality and Air Pollution in London: A Time series Analysis," *American Journal of Epidemiology* Vol. 131 (1990), pgs. 185-194.

[5] Douglas Dockery and others, "An Association Between Air Pollution and Mortality in Six U.S. Cities," *New England Journal of Medicine* Vol. 329 (1993), pgs. 1753-1759; see also pgs. 1807-1808.

[6] Joel Schwartz and Douglas Dockery, "Particulate Air Pollution and Daily Mortality in Steubenville, Ohio," *American Journal of Epidemiology* Vol. 135 (1992), pgs. 12-19; see also pgs. 20 and 23 for discussion of the Steubenville study.

[7] Philadelphia study cited in note 1, above.

[8] Joel Schwartz, "Particulate Pollution and Daily Mortality in Detroit," *Environmental Research* Vol. 56 (1991), pgs. 204-213.

[9] Douglas W. Dockery and others, "Air Pollution and Daily Mortality: Associations with Particulates and Acid Aerosols," *Environmental Research* Vol. 59 (1992), pgs. 362-373.

[10] C. Arden Pope III and others, "Daily Mortality and PM_{10} Pollution in Utah Valley," *Archives of Environmental Health* Vol. 47 (1992), pgs. 211-217.

Rachel's Hazardous Waste News (ISSN 1065-4623) is published weekly by
Environmental Research Foundation (ERF)
Telephone (410) 263-1584; fax: (410) 263-8944
Econet: erf Internet: erf@igc.apc.org
Editor: Peter Montague, Ph.D.
Associate editor: Maria B. Pellerano
Staff scientist: Mary O'Brien
Research assistant: Andrea K. Fearneyhough
Subscription rates: $25 per year for individuals and citizen groups; $80 for professionals and government agencies; $15 for students and seniors with ID; $400 for businesses; in Canada and Mexico, add $6.00; in all other countries, add 11.00. All payments in U.S. funds drawn on U.S. banks. Visa & Mastercard accepted. *Rachel's Hazardous Waste News* is not copyrighted; we encourage reprinting so long as you send us a copy. Printed on 100% recycled paper.

Environmental Research Foundation
P.O. Box 5036
Annapolis, MD 21403-7036

ADDRESS CORRECTION REQUESTED

Contiguous Property Tax Values--Cogeneration Facility

PIN:	2005	2004	2000	% Change (04-05)	% Change (00-05)
9788140889	$309,541.00	$249,771.00	$200,379.00	23.93%	54.48%
9788140894	$195,338.00	$144,683.00	$114,996.00	35.01%	69.87%
9788141426	$1,106,181.00	$651,400.00	$721,168.00	69.82%	53.39%
9788141527	$189,298.00	$102,904.00	$71,179.00	83.96%	165.95%
9788141639	$122,368.00	$86,479.00	$69,181.00	41.50%	76.88%
9788141738	$191,925.00	$147,687.00	$117,927.00	29.95%	62.75%
9788142601	$102,494.00	$62,241.00	$47,776.00	64.67%	114.53%
9788142703	$99,233.00	$58,470.00	$45,110.00	69.72%	119.98%
9788149649	$209,417.00	$126,483.00	$93,412.00	65.57%	124.19%
9788149792	$227,895.00	$156,901.00	$122,183.00	45.25%	86.52%
9788158267	$287,923.00	$241,529.00	$141,924.00	19.21%	102.87%
9788159118	$212,752.00	$165,152.00	$80,051.00	28.82%	165.77%
9788240786	$390,397.00	$312,340.00	$214,274.00	24.99%	82.20%
9788241850	$305,932.00	$229,730.00	$166,400.00	33.17%	83.85%
9788242813	$220,193.00	$164,351.00	$114,636.00	33.98%	92.08%
9788242991	$264,228.00	$202,728.00	$135,214.00	30.34%	95.41%
9788243819	$265,819.00	$189,309.00	$126,440.00	40.42%	110.23%
9788243827	$267,400.00	$190,449.00	$127,234.00	40.41%	110.16%
9788243835	$264,347.00	$191,597.00	$126,440.00	37.97%	109.07%
9788243853	$268,992.00	$191,597.00	$128,031.00	40.39%	110.10%
9788250129	$368,249.00	$268,559.00	$208,774.00	37.12%	76.39%
9788251191	$299,909.00	$134,864.00	$82,305.00	122.38%	264.39%
Average Increase:				**46.30%**	**105.96%**

Prepared by UNC Chapel Hill Property Office for
Town Council Meeting November 9, 2005

An Environmental View of the UNC Co-Gen Facility

Doug Crawford-Brown
Director, Carolina Environmental Program
UNC-Chapel Hill

1

What drives energy policy?

- ***Pollutant releases***
- Price of energy
- Availability of technology
- Security of resources
- Social acceptability/concern

2

Two Main Issues

- Global issue- Carbon dioxide emissions

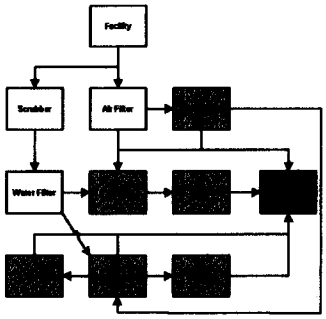
- Local issue- Emissions of toxics, with mercury as the "driver"

3

A local issue: mercury, co-gen and the City of Salzburg

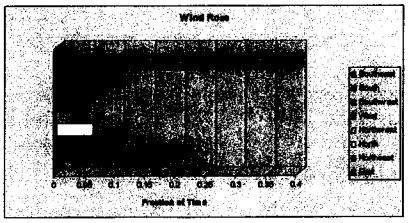
4

The model



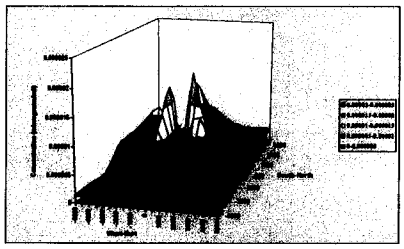
5

The wind in Chapel Hill



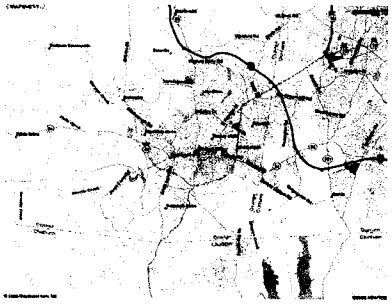
6

An example air dispersion result



7

The geographic area



8

Exposure pathways

- Inhalation of air
- Ingestion of vegetables from a back-yard garden
- Ingestion of soil from vegetables
- Ingestion of fish from University Lake
- Ingestion of water from University Lake

9

Precautionary assumptions used

- People spend all of their time in Chapel Hill
- People ingest all vegetables from the back-yard garden
- Water is untreated before consumption
- People eat all fish from University Lake
- Highest bioaccumulation factor for fish
- Assumes mercury is a carcinogen

10

All parameter values taken from:

- EPA's Mercury Report to Congress
- EPA's Integrated Risk Information System (IRIS)
- EPA's Exposure Factors Handbook

11

So the steps...

- Estimate mercury emission rate
- Calculate concentrations in air, water, soil, vegetables and fish
- Calculate rate at which people inhale or ingest mercury from these
- Add them all up
- Multiply by the cancer slope factor (to get the probability of cancer)
- Divide by the Reference Dose (to get the hazard quotient for non-cancer effects)

12

What do I compare these against?

- A probability of cancer of 1E-4 (one chance in ten thousand)
- A hazard quotient of 1 (protection against the effect with an "ample margin of safety")

13

So, where does the co-gen facility stand (for current daily operations)?

- The maximum lifetime probability of cancer from the mercury is 3E-6 (three chances in a million), or a factor of 33 below 1E-4
- The maximum hazard quotient is 0.015, or a factor of 67 below a value of 1.0

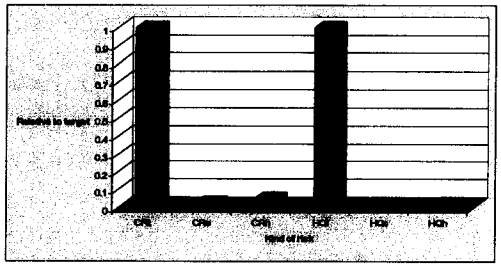
14

So, where does the co-gen facility stand (for maximum operations)?

- The maximum lifetime probability of cancer from the mercury is 5.6E-6 (5.6 chances in a million), or a factor of 18 below 1E-4
- The maximum hazard quotient is 0.028, or a factor of 36 below a value of 1.0

15

So, where does the co-gen facility stand?



16

A global issue: carbon dioxide emissions

Or???

Duke Power.

17

Back to Cambridge for the methods

18

What is compared against what?

- The total carbon dioxide emissions from electricity and steam generation from the co-gen facility

against

- The total carbon dioxide emissions from having Duke Power supply this same energy as electricity, with some converted back to heat for the buildings

19

The relevant numbers:

- Co-gen released **345,335** tons of carbon dioxide last year (if we assume ALL carbon is converted).
- Co-gen has 81% efficiency
- Overall Duke Power efficiency is 33%
- So, Duke Power would have produced **847,640** tons of carbon dioxide to provide the same energy if they used coal

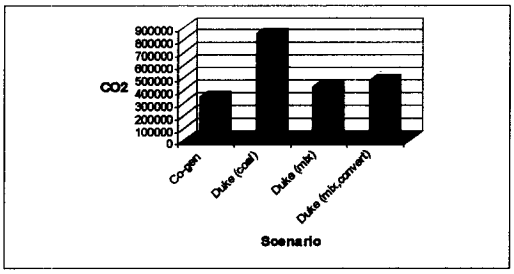
20

The relevant numbers:

- So, Duke Power would have produced **423,820** tons of carbon dioxide to provide the same energy if they used their mix of 50% nuclear
- Or Duke Power would have produced **472,989** tons of carbon dioxide given current efficiencies of converting electricity to heat on campus

21

Or to make it more visual:

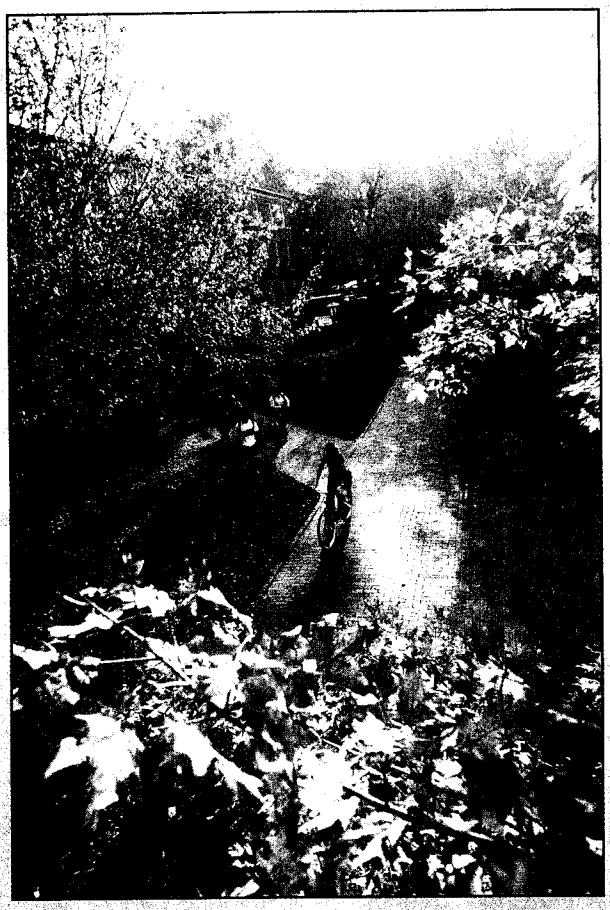


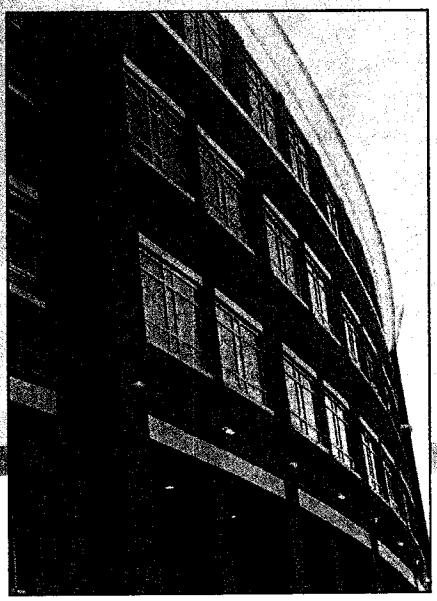
22

My conclusions from an environmental perspective:

- The co-gen facility does not produce local health risks from mercury that approach regulatory limits.
- Generating energy from the current co-gen facility to supply the campus produces a lower global risk from carbon dioxide emissions than does purchasing the equivalent energy from Duke Power.

23





UNC CHAPEL HILL CAMPUS SUSTAINABILITY REPORT 2005

Contact Us

UNC Sustainability Officer:
Carolyn Elfland
Associate Vice Chancellor
Campus Services

Director, Sustainability Office:
Cynthia Pollock Shea

UNC Sustainability Office
Facilities Services
103 Airport Drive
UNC Chapel Hill
Chapel Hill, NC 27599-1800

919-843-7284
sustainability@unc.edu
http://sustainability.unc.edu

Institutionalizing Sustainability at the University of North Carolina at Chapel Hill

2005 Campus Sustainability Report

Table of Contents — Page

LETTER FROM THE CHANCELLOR

We express our values in what we build. Buildings that will stand the test of time, and grounds that welcome and shade us, are part of the Carolina tradition.

Carolina is in the midst of perhaps the most intense period of development the campus has ever seen. When the current building program is completed about 2008, we will have built more than fifty percent of the building space provided for in the 2001 Campus Master Plan.

As this process has occurred, the guiding principles of the Campus Master Plan have helped continue to remind us of the need to protect the natural resources that support us. Stormwater management, tree and site protection, and transportation policies that favor alternatives to the single occupant vehicle have become standard practice. Efficient use of energy, water, and materials, reduced life-cycle costs, and a comfortable and healthy environment, are goals of every project. In the process of creating five million new square feet of buildings, we are also adding ten acres of green space.

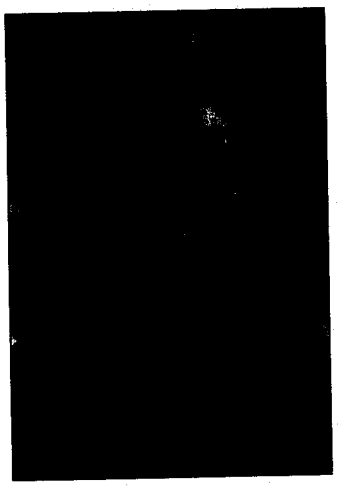
We are proud to be a leader in sustainability. Our teaching and research mission has long been coupled with public service. Now, at a time of unprecedented growth, we have the opportunity – and obligation – to introduce innovative, best practices in our buildings and on our grounds. The vegetated roofs at Rams Head and on the addition to Carrington Nursing School are but two examples of creative new approaches to addressing environmental challenges.

In 2005, the State recognized our efforts by awarding the University the State Government Sustainability Award. This honor recognized our "green" building strategies that guide construction planning; stormwater management strategies; and the interdisciplinary Carolina Environmental Program, offering bachelor's degrees in environmental studies and environmental sciences. In addition, Carolina is among the first universities nationwide to offer a joint master's degree in planning and public health, through the College of Arts and Sciences and the School of Public Health.

Carolina is recognized as a national leader in sustainability and we are committed to imparting this stewardship ethic to those on our campus and beyond. Our efforts are not for ourselves alone, but for the community and the region; and for future generations. It is our gift back to the people who built this campus – the citizens of North Carolina.

James Moeser

LETTER FROM THE DIRECTOR, SUSTAINABILITY OFFICE



Simultaneously fostering environmental quality, economic vitality, and social justice requires the intellect, creativity, and good will of many. At UNC Chapel Hill, students, staff, faculty, and administrators share ideas about how to remove obstacles and create incentives for achieving sustainability. While clearly a process of continuous improvement, the progress to date is impressive.

New policies, practices, and curricula reflect this increasing institutionalization of sustainability. Transportation policies focus on transit and other commuter alternatives. Construction projects are adopting "green" building practices. Course work is more global and interdisciplinary. Sustainability considerations increasingly influence campus decision making, spending, and hiring. The most recent addition is a commissioning coordinator to ensure that our buildings function as designed.

Students are actively engaged in this effort. Students have twice voted to invest a portion of their fees in renewable energy infrastructure and will fund $1.1 million worth of projects over a six year period. During the '04-'05 academic year, student government requested the introduction of a sustainability minor. Now under development, the minor will include courses in environmental science, policy, business, and planning. MBA students who obtain the popular Sustainable Enterprise Concentration view social and environmental impact management as a key strategy for innovation and competitive corporate advantage.

Carolina already reaps financial benefits from more sustainable practices. Improved recycling programs divert 41% of our discards from the landfill, avoiding $210,000 in landfill tipping fees and waste hauling costs each year. Lighting upgrades, begun in 2001, avoid $125,000 in annual electricity costs, for a 21% return on investment. The 3,500 members of the Commuter Alternatives Program have freed up over 700 on-campus parking spaces. Members will keep $300,000 in their collective pockets each year, while reducing the need for additional parking infrastructure.

The University's sustainability intelligence is expanding in many directions. Courses, internships, and events are readily available. Professional training for staff is increasingly targeted to areas in need of improvement. A new and robust sustainability website, introduced in 2004, receives thousands of hits monthly. And hundreds participate in the campus listserv.

Nancy Suttenfield

While many issues, such as climate change, public health, environmental protection, and economic development are global, progress requires local action. The recently formed Vice Chancellors Sustainability Advisory Committee is charged with developing new strategies for the University and reports to Nancy Suttenfield, the Vice Chancellor for Finance and Administration. Composed of representatives from the academic and operations sides of campus, the group will foster connections and help leverage new ideas.

Ultimately, the effort to advance sustainability at UNC requires the participation of the entire campus community. Addressing economic, environmental, and social challenges simultaneously is a task larger than any one group. We welcome and encourage your involvement.

Cynthia P Shea

Cynthia Pollock Shea
Director, Sustainability Office

ACKNOWLEDGEMENTS

Many members of the UNC community contribute daily to the effort to institutionalize sustainability in campus policies, practices, and curricula. The following individuals have supported the effort significantly over the past two years. Thank you!

Carole Acquesta
Steve Allred
Jim Alty
Charlie Anderson
Pete Andrews

Craig Baker
Barbara Beechwood
Angkana Bode
Bill Burston
Garland Burton

Tom Bythell
Jill Coleman
Steve Copeland
Toby Considine
Linda Convissor

Paul Cox
Doug Crawford-Brown
Paula Gee Davis
Ray Doyle
Ray DuBose

Kim Eheman
Carolyn Elfland
Jay Evans
Chip Fehr
Mary Jane Felgenhauer

Tyler Felgenhauer
Debbie Freed
Greg Gangi
Diane Gillis
David Godschalk

Jerry Guerrier
Stuart Hart
John Heuer
Larry Hicks
Luke Hoff

Maura Hogan
Meg Holton
Ron Howell
Jonathan Howes
Bob Humphreys

Jim Johnson
Paul Kapp
Peter Krawchyk
Katie Kross
Susannah Lach

Vincent Lagace
Cheryl Leguillow
Steve Lofgren
Emil Malizia
Dennis Markatos

Bob Marriott
Chris Martin
Jennifer Maxwell
Mike McFarland
Bill McCraw

Jim Mergner
Midge Metheny
Mark Milstein
James Moeser
Cameron Morgan

Sarah Myers
Sharon Myers
John Oberlin
Katherine O'Brien
Chris Payne

Sara Peach
Kirk Pelland
Martha Pendergrass
Ed Phillips
Susan Phillips

Nathan Poslusny
Jessica Potter
Mary Beth Powell
Amy Preble
Kevin Quinlan

Scott Ragland
Johnny Randall
Tony Reevy
Peter Reinhardt
Udo Reisinger

Jacki Resnick
Bill Roach
Alaina Rogers
Bruce Runberg
Al Segars

Gary Shaver
Elizabeth Shay
Cindy Shea
Robert Shelton
Eddie Short

Ira Simon
Robin Sinhababu
Jeannie Smith
Keith Snead
Jennifer Stallings

Dan Stern
Nancy Suttenfield
Ralph Taylor
Matt Tepper
Autumn Thoyre

Julie Thurston
BJ Tipton
Ruth Tolman
Monica Touesnard
Ginger Travis

Carol Tresolini
Liz Veazey
Jim Ward
Steven Waters
Dan Waxman

Chris Wedding
Rick Welborn
Peter White
Ruth Williams
Brad Wood

Anna Wu
Logan Yonavjak
Rex Zachary

TEACHING

Carolina Environmental Program (CEP)

At the request of the Student Government Environmental Affairs Committee, the Carolina Environmental Program will soon launch both an honors program and a minor in sustainability. The courses offered will draw on Carolina's expertise in business, environmental science, public policy, and planning. Students in the multidisciplinary course of study will integrate the principles of environmental quality, social justice, and economic vitality and develop an appreciation of the tradeoffs and synergies required to achieve more sustainable communities and economies.

Students can currently choose from among eight environmentally oriented bachelor's degrees in the College of Arts and Sciences and the School of Public Health. At the graduate level, nine departmental degrees are offered in addition to the two profiled below. For students wanting to conduct interdisciplinary graduate work, five academic clusters are available in: ecology, conservation, and biodiversity; environmental arts and humanities; environmental behavior and decision making; environmental change and human biology; and quantitative study of the earth environment.

UNC has more than 125 Environmental Faculty in 22 different departments spread among seven schools. The university is known for its outstanding programs in water and air quality, environmental modeling and engineering, and environmental policy and management. Through a unique partnership with the U.S. Environmental Protection Agency, the effect of inhaled pollutants on human respiratory health is studied in smog chambers located on the UNC campus.

First offered in 2003, the "Sustainable UNC" course drew on Carolina staff for an exploration of sustainable practices and initiatives on campus. Topics covered included historic preservation and master planning, energy management, landscaping and tree protection, water quality and storm-water management, waste management, construction practices, transportation, and purchasing. "Sustainable Communities" in spring 2004 brought in practitioners from local government, non-profits, and small businesses to discuss practices and trends in urban design, small business management, architecture and construction, green banking and investment, water and wastewater, transportation, affordable housing, land conservation, waste management, agriculture and dairy, and local and renewable energy.

In Spring 2005, the "Sustainability Primer" combined both campus and community initiatives. At least one course on "sustainability at UNC" has been offered each academic year since 2000-'01.

Students pursuing an undergraduate degree in Environmental Science or Environmental Studies complement their academic course work with a semester at a field site in Highlands, Manteo, or Morehead City, North Carolina, or abroad in Cambridge (U.K.) or Thailand. A new field site option at the 400-acre Pickard's Mountain Eco-Institute, just eight miles west of campus, focuses on renewable energy, sustainable agriculture, natural building, and biodiesel production. Students who study in the mountains and on the Albermarle Sound conduct internships with environmental entities in the area. Results of the students' research are presented to the local community. In Morehead City, students work with UNC's Institute of Marine Sciences faculty.

Kenan-Flagler Business School

The Sustainable Enterprise concentration at UNC's Kenan-Flagler Business School takes a holistic approach to sustainability, incorporating all aspects of the "triple bottom line" (economic, environmental and social impacts). Course work focuses on the competitive advantages that accrue to businesses and nonprofits with a sustainable strategy. During the program, students choose from over a dozen Sustainable Enterprise electives and numerous practicum opportunities. During '04-'05, the core Sustainable Enterprise course was extended to the weekend and evening MBA students for the first time and filled 65 seats.

The UNC Sustainable Enterprise MBA program is ranked among the six best in the world by the World Resources Institute and the Aspen Institute in their Beyond Grey Pinstripes report (2003). One of the largest and most active chapters of the Net Impact Club, a global organization of emerging business leaders committed to creating a better world, is at Kenan-Flagler.

Department of City and Regional Planning (DCRP)

Five general areas of study are available to planning students: community development, economic development, environmental planning, land use planning, and transportation planning. Within each of these areas, students select specialty concentrations.

With populations growing, environmental and health concerns increasing, and laws becoming more complex, the DCRP has teamed with other departments to create dual-degree programs. Students seeking a Masters in Regional Planning can now add a year to their studies and obtain masters degrees in Business, Civil Engineering, Landscape Architecture, Law, Public Administration, or Public Health. The opportunity also exists to receive a certificate in Geographic Information Sciences. Undergraduates can minor in Urban Studies and Planning.

The new dual degree programs with the Department of Health Behavior and Health Education and the Department of Health Policy and Administration are among the first of their kind in the country. They reflect an emerging emphasis on the impacts of the built environment on public health and safety. The multi-million dollar, national Active Living by Design program in the School of Public Health was created to establish and evaluate approaches to increasing physical activity through community design and transportation.

Carolina Entrepreneurial Initiative

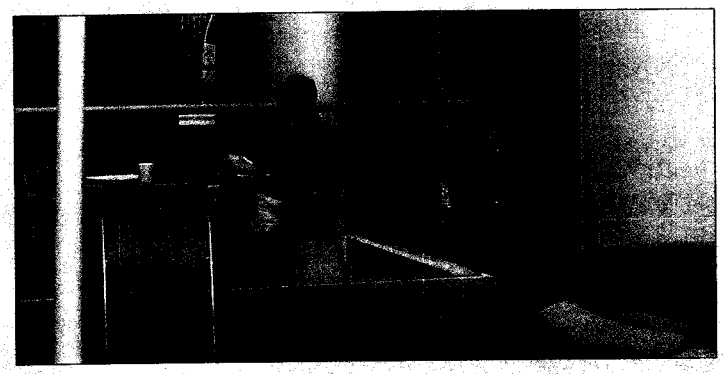
The Carolina Entrepreneurial Initiative seeks to inspire, teach and connect students, faculty, and alumni in ways that enable them to transform their ideas into enterprises that create value – commercial, societal, artistic, and educational – and are sustainable. The $11 million program is funded in part by the Ewing Marion Kauffman Foundation, managed by the Frank Hawkins Kenan Institute of Private Enterprise, and led by faculty and staff across the university from an array of disciplines. Successful entrepreneurs, many of them Carolina alumni, serve as advisors, lending their real-world expertise.

Any faculty, staff, or student with an interest in launching a business or social venture can apply for the two semester program. During the first semester, selected applicants take a course, either alone or as a member of a team. The teams with the best and most mature ideas proceed to the second semester. There, a series of workshops and activities, and working with mentors, provides the knowledge, skills, and connections to succeed.

The Campus Y, the student center for social justice, service activism, and philanthropy at UNC, will initiate a Social Justice Entrepreneurs Incubator Program, complete with small grants. A concentration in entrepreneurship is available to undergraduate students seeking a business degree, and a minor in entrepreneurship has been created for students in the College of Arts and Sciences. Already America's most entrepreneurial campus according to ***Forbes*** magazine, UNC is taking entrepreneurship outside the business school and bringing it to the masses.

The Study Abroad Office

For the second consecutive year, UNC had a higher rate of students going abroad than any other public research university nationwide. More than one-third of Carolina students now study abroad before they graduate and participation is growing 10% annually. The Study Abroad Office is one of the largest and most innovative of its kind in the nation, with 276 programs in 68 countries.



RESEARCH

Center for Sustainable Enterprise (CSE)

Housed in the Kenan Institute of Private Enterprise, and affiliated with the Kenan-Flagler Business School, the CSE was founded in 2001 to advance sustainable business practices. Sustainable businesses measure success using the triple bottom lines of financial profitability, ecological integrity, and social equity.

In 2004, distinguished Professor Dr. Al Segars, a leader in innovation and technology management, was appointed director of the CSE. (Drs. Stuart Hart and Jim Johnson were founding directors of the Center.) Economic development, financial and operational metrics of sustainability, innovation strategy, and corporate governance form the core of the CSE's research agenda.

Under the leadership of Dr. Segars and executive director Katie Kross, the CSE launched a sustainability consulting program staffed by graduate students and a quarterly newsletter, "Innovations in Sustainable Enterprise". The Center also facilitates curriculum development, speakers, conferences, and career-related activities and networking for sustainable enterprise MBA students.

Center for Environmental Modeling for Policy Development

The CEP Center for Environmental Modeling for Policy Development, formerly at MCNC in Research Triangle Park, consists of scientists, mathematicians and engineers expanding the frontiers of environmental computing. Advanced scientific modeling is linked with environmental policy analysis to better inform decision makers. Clients include the U.S. Environmental Protection Agency, the U.S. Department of Energy, the National Science Foundation, and the N.C. Department of Environment and Natural Resources.

The multi-year Air Quality Modeling Project studies how weather and emissions from vehicles, power plants and other sources interact to affect air quality in the state. Three regions of the state along the I-85 corridor – the Triangle, Triad, and Charlotte region – are designated non-attainment areas under EPA's 8-hour ozone standard. Once key sources contributing to air pollution are identified, strategies can be developed to improve the health of North Carolinians.

Center for Urban and Regional Studies (CURS)

Faculty and graduate student researchers at CURS focus on transportation, growth management, and equity issues. One recent product is a Smart Growth Report Card for the region. Despite a relatively strong economy and well-educated residents, the area received only average grades for traffic, sprawl, and air quality. Daily vehicle miles traveled per capita are growing, and the time it takes to drive to work is increasing even faster.

Center for Community Capitalism

Policy expert Dr. Michael Stegman thinks having a chance to own a home, build assets, and pass those assets on to your children is the way to build a better life. Yet about one-third of U.S. families maintain no savings and no financial assets. As the director of the Center for Community Capitalism in the Kenan Institute, Stegman manages $10 million in funded projects that focus on the intersection of community development and private enterprise.

Center on Poverty, Work & Opportunity

Created in 2005 and housed in the UNC Law School, the Center on Poverty, Work & Opportunity is directed by former vice-presidential candidate John Edwards. The center will analyze and seek to provide solutions to the many health, education, housing, and income-generating challenges that affect low-income Americans.

55

INTERDISCIPLINARY RESEARCH

At Carolina, one of our greatest strengths is our ability to bring different fields of knowledge to bear on complex problems in science and policy. When the National Institutes of Health awarded 21 "Roadmap for Medical Research" planning grants in fall 2004, Carolina received three, the largest number awarded to any single university in the country. New interdisciplinary research centers will form to study obesity, inflammation, and genetic analysis.

Inter-Disciplinary Obesity Center – (IDOC)

More than $5 million will be allocated over the next three years to plan and establish the IDOC. Researchers engaged in the effort will come from nutrition, epidemiology, health behavior, urban planning, health economics, physiology, psychology, genetics and clinical medicine. With 59% of the U.S. and North Carolina populations overweight or obese, health care costs to treat diabetes and cardiovascular disease are climbing rapidly, while worker productivity is falling.

Active Living by Design

The focus of Active Living by Design is to examine how people and communities encourage physical activity as part of daily routines. A $17 million project funded by the Robert Wood Johnson Foundation and housed in the UNC School of Public Health, this Chapel Hill-based effort will examine 25 communities across the country. Researchers and planners are exploring the link between community design, active lifestyles, and health.

Chapel Hill is one of the study communities. The town is home to a walkable central business district and two new urbanist neighborhoods designed to encourage physical activity (Meadowmont and Southern Village). While common prior to World War II, this kind of mixed-use, walkable neighborhood now represents only about 1% of real estate development in the United States. As a result, 70% of Americans do not achieve the U.S. Surgeon General's recommendation of 30 minutes of accumulated daily activity.

Institute for Advanced Materials, Nanoscience and Technology

Chemist Joe DeSimone and his team are revolutionizing a range of industries. More than 100 U.S. patents have stemmed from discovering ways to use carbon dioxide in place of conventional organic solvents for environmentally responsible manufacturing, cleaning and processing. The approach resulted in the development of a new kind of Teflon and a form of dry cleaning that produces no hazardous byproducts. DuPont built a $40 million plant in Fayetteville, NC, to produce the new Teflon, which has applications in data communications, semiconductors, automotive parts and other industrial markets. Fuels cells and advanced drug delivery methods that target specific organs are under development.

Sustainable Energy, Environment, and Economic Development for North Carolina (SEEED4NC)

In May 2005, an interdisciplinary research group was created at UNC to study North Carolina's economic development opportunities in a period of global climate change and increasing energy costs. The research group is a collaboration among the Carolina Center for Competitive Economies (C3E) in the business school, the Carolina Environmental Program, and the Department of Public Policy.

STUDENT-LED RESEARCH

Carbon Reduction

The Carolina Environmental Program (CEP) has made the reduction of carbon dioxide emissions a core aspect of its education, research, and outreach activities. CEP is the first U.S. partner in the Community Carbon Reduction (CRed) program begun at the University of East Anglia in England. CRed was inspired by the U.K. Government's energy policy, which set a goal to reduce carbon dioxide emissions 60% by 2050. If adopted by all developed countries, this reduction would lead to what scientists on the Intergovernmental Panel on Climate Change recommend as the upper limit of carbon dioxide in the atmosphere, or no more than twice pre-industrial CO_2 levels.

Environmental majors at UNC could, and still can, participate in a CRed-related senior capstone course in either Chapel Hill or Cambridge, England, during the '04-'05, '05-'06, and '06-'07 academic years. At the International Environmental Assessment and Energy Policy field site in the historic city of Cambridge, students assist both the town and the university to develop a carbon reduction plan. Other campuses and communities throughout the U.S. are invited to become CRed partners. The CRed at UNC web site addresses the mixture of policy options, community design, and personal action needed to reduce carbon dioxide emissions.

In fall 2004, two students in a CEP service learning course started work on a UNC Greenhouse Gas Emissions Inventory. The effort was continued by a graduate student in summer 2005. A parallel effort will soon be undertaken by Orange County and the towns of Chapel Hill and Carrboro.

Microbial Disease in Watersheds

In fall 2003, the CEP was awarded a $1.6 million Ecology of Infectious Disease grant to study the impacts of environmental change on human health in the Neuse River Basin. Funded by the National Science Foundation and the National Institutes of Health, students in three year's worth of senior capstone courses will analyze the interaction of nutrients and microbes in the Neuse River watershed.

In spring 2005, the class investigated the risk of illness from microbial pathogens that result from septic tank failure in underserved, minority neighborhoods in Mebane, NC. The socio-economic factors involved with septic system failure and remediation were analyzed along with the environmental pathways through which citizens are exposed to microbes.

Greening UNC

In fall 2003, CEP capstone students focused on UNC design and construction guidelines. They compared university guidelines to the LEED (Leadership in Energy and Environmental Design) guidelines developed by the U.S. Green Building Council. Students found that to achieve a LEED silver performance rating would require the implementation of daylighting analyses, energy modeling, and fundamental building commissioning. Findings and recommendations were presented to university architects and engineers and contributed to the university's commitment to strive for a LEED silver performance level on all new building projects.

During 2004, a team of graduate students in the Life Cycle Management class at the business school researched building commissioning at the encouragement of the Sustainability Office. Case studies demonstrated the reduced life cycle costs associated with verifying that building systems operate as designed. The students presented their findings to UNC management and staff, confirming that UNC would benefit by adopting commissioning standards for new and existing buildings. Another team of MBA students conducted a practicum on ***Making the Business Case for Green Building at UNC***. This research showed that the benefits associated with reduced energy, water, and materials costs, lower maintenance expenses, and improved occupant comfort and productivity more than offset any incremental design and construction costs.

PUBLIC SERVICE

Carolina Center for Public Service (CPS)

Students interested in public service now have one-stop shopping available at the Carolina Center for Public Service, which offers classes, internships, travel opportunities, and grants. Participation is strong, growing, and now officially recognized on student transcripts through the new Public Service Scholars Program. More than 450 students, representing three-fourths of the majors across campus, logged 42,000 hours of service last year. The Carolina Center for Public Service Database contains information about some 800 service projects across the state. Community members, students, employees, and alumni can find out how the university serves communities across the state and how individuals interested in participating can get involved.

In May 2005, the first class of Public Service Scholars graduated. These fifteen students compiled a minimum of 300 hours of service, completed at least two service-learning courses, and attended skills-training workshops. As a group, they logged 6,079 hours of service since 2003, an average of 405 hours per graduate.

Carolina Environmental Program (CEP)

In rapidly growing North Carolina, many of the state's forests, farm fields, and wetlands are being converted to roads, houses, and shopping centers. In order to maintain functional ecosystems, biological diversity, and working landscapes, the CEP is assisting the NC Department of Environment and Natural Resources to map the state's open space and prioritize land acquisition and protection strategies. A web-based GIS data repository and decision support system is now available. Continually updated data from local and regional open space planning efforts are incorporated into the online map. Selected geospatial layers reveal critical features such as habitats, water bodies, and infrastructure. Future versions will include statewide greenway and trail data as well as canoe trails and boat access points. The importance of this effort was recognized with an Office of the Provost Public Service Award.

The CEP's public service and outreach arm, the Environmental Resource Program, provides technical assistance to community groups, offers K-12 teacher professional development, conducts policy research for non-profits and government agencies, and sponsors undergraduate environmental internships. It also disseminates research findings from the Center for Environmental Health and Susceptibility and the Superfund Basic Research Program in terms that can be understood by the general public.

In spring 2003, the CEP initiated a series of Environmental Policy Papers, which are distributed to some 2,000 key decision makers in the state, including the General Assembly. The papers issued to date address "***The Need for a Statewide Plan of Land and Water Conservation", "A Sustainable Future for North Carolina", "The Changing Face of Water",*** and ***"The Carbon Reduction Project".***

Council on a Sustainable Community

Locally, many university staff and administrators work closely with the Chapel Hill-Carrboro Chamber of Commerce. As the largest employer and landowner in town, and the drawing card for 26,000 students, UNC is inextricably linked to the health of the local economy. When the Chamber formed the Council on a Sustainable Community, high-level university representatives – administrators, faculty, and a member of the Board of Trustees – actively participated.

The resulting Vision of a Sustainable Community includes eight mutually supportive components:

1. Compact urban form with increased density and mixed use that fosters walkability, reduced dependence on fossil fuels, accommodates future growth, and provides affordable housing.
2. Local businesses voluntarily adopt sustainable business practices and strive for a "triple bottom line" of environmental, social, and economic outcomes.
3. A sufficient supply of meaningful jobs so that local residents can work close to where they live, thereby maintaining the social diversity necessary for a strong and vibrant community.
4. Multiple forms of transportation to increase connectivity and reduce the impacts on air quality, watersheds and public health that result from dependence on the automobile.

5. A diverse entrepreneurial structure that supports local firms and facilitates them working together to fulfill economic needs.
6. Life-long learning opportunities for everyone.
7. A Growth Boundary that conserves farmland, protects water supplies, open space and wildlife habitat, and prevents sprawl.
8. Thriving downtowns that are centers of commerce, and mixed-use neighborhood centers with goods and services in walking distance of most residences.

To enable members of the Chapel Hill, Carrboro, and Orange County communities to better understand and participate in university activities, a new Community Website was launched in spring 2005.

TRANSPORTATION

Under the long-term Master Plan, approved in spring 2001, some 20 acres of surface parking will be removed from campus. Ten acres will be replaced by new buildings, including parking decks. Another ten acres will become new green space.

Primarily to accommodate visitors and hospital patients, a net gain of 1,550 new parking spaces will be added to campus by 2010. Parking decks, to accommodate new and replacement spaces, will account for 5,100 of the total new spaces. Slightly over 100 net additional parking spaces will be included for a growing population of students and employees.

Neither first year students, nor students living within two miles of campus, are eligible to purchase on-campus parking permits in the annual lottery. Employees pay from $365-$1037 per year depending on location and salary grade. Parking fees rise annually, with the highest paid employees paying the steepest increases.

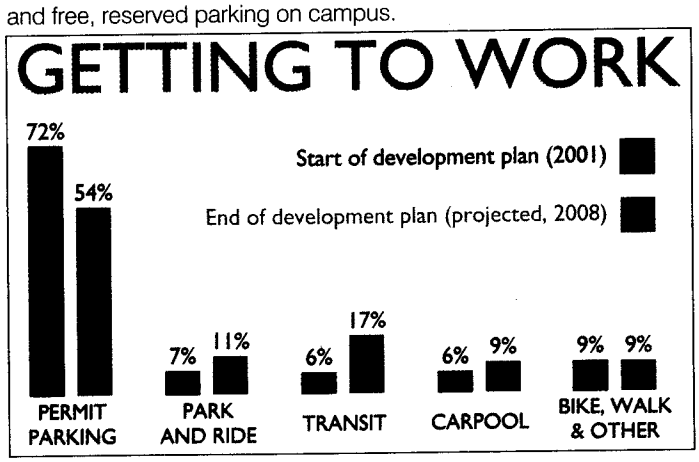
Transportation Demand Management

UNC was the first employer in the region to hire a Transportation Demand Management Coordinator in fall 2001 to further develop alternatives to the single occupant vehicle. UNC has been designated a Best Workplace for Commuters by the U.S. Environmental Protection Agency since 2003. This designation is given to workplaces where at least 14% of employees arrive by a means other than a single occupant vehicle.

Chapel Hill and Carrboro have among the highest per capita bus ridership in the country. Community wide fare-free transit, introduced in January 2002, has increased ridership over 60%. Double-digit growth continues each year, with more than 5 million rides provided annually. The percentage of students who reported using the bus to get to campus increased from 28% in 2001 to 42% in 2004. UNC remains the largest funder of Chapel Hill Transit, contributing $4.7 million to the system's budget in 2004. Each student pays $47.50 per year toward the service as part of their fees. Departments pay an annual 0.104% on all salary sources.

All Chapel Hill Transit busses are equipped with bicycle racks, making it easier for commuters to mix their transportation modes during the day. New, weather-protected route maps and schedule displays inform passengers waiting at the bus stop where each bus is going and when to expect it.

Launched in August 2002, the Commuter Alternatives Program (CAP) has registered over 3,500 members to date. The free program is available to participants who walk, bike, take public transit, carpool, or vanpool to campus. Almost 700 enrollees voluntarily gave up their campus parking permits to register in the program. Members receive emergency rideback service anywhere in Chapel Hill and Carrboro, including park and ride lots. They also receive free campus parking one day per month and 10-15% discounts from many local merchants. Starting in fall 2004, transit passes on Triangle Transit Authority buses were offered to the university community at an 80% discount. An on-line trip planning service provides consolidated schedules from all regional transit providers. Employees riding in TTA vanpools receive a $10 per month subsidy and free, reserved parking on campus.



Since 2001, UNC and the towns of Chapel Hill and Carrboro have added over 1,300 park-and-ride spaces, bringing the total available to 3,400. A 2004 commuting survey for the Department of Public Safety shows that 17% of employees used park-and-ride lots to get to work in 2004, compared to 8% in 2001. During the '05-'06 academic year a new park and ride lot opened in Chatham County. This 550-space lot is the first to cross a county line. Now there are at least two park and ride lots available on the eastern, northern, western, and southern approaches to campus. Additional capacity is still sought on the northeast approach from Durham.

Because a growing number of the UNC community is not bringing cars to campus, a fleet of four "zipcars" were introduced in January 2004. These Volkswagen Beetles are available on demand for a fee of just $5 per hour. Departments, individual employees, and students who are 21 and over can join the program for a $20 fee, creditable toward four hours of driving during the first month of membership. An electronic reservation system and swipe cards programmed to unlock the vehicle at the time of your appointment make the system easy to use. Demand is slowly growing with an average

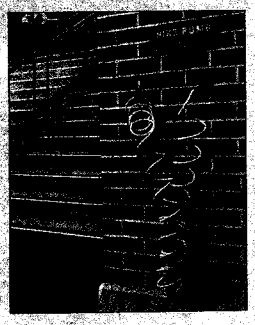
of ten new members signing up each month. 58

In addition, the university has long maintained a small fleet of rental vehicles in the Carolina Motor Pool. These vehicles are for the use of departments that do not need a permanently assigned vehicle or that need to occasionally supplement their fleet. The 28-vehicle fleet consists of various size sedans, including a hybrid, and passenger vans. During '04-'05, more than 1,800 reservations were made, ranging in length from a single day to several weeks. Occasional rentals are less expensive than the minimum $3,655 annual lease and parking fee for a permantly assigned vehicle.

Walking and Biking

For those walking across campus, brick walkways and wide sidewalks provide a safe and pleasurable walking experience along gently sloped paths. These paths were cut over many years by the feet of pedestrians on the shortest route from here to there. They were then accepted as official paths and eventually paved with brick. Improvements to the extent and density of this network are integral to implementation of the Master Plan, especially in the districts below South Road. The application of universal access principles, to accommodate those with mobility challenges, is resulting in gentler slopes, fewer steps, and ramps where required.

Better integrating south campus residence halls into the intellectual vitality, social vibrancy, and natural beauty of the university is a primary goal of the campus Master Plan. The Rams Head Center is a linchpin project. Rams Head was the first surface parking lot identified by planners as a low-value use of scarce land. Now, instead of navigating steep hills, walkers, bikers, and the wheelchair bound traverse a landscaped plaza constructed on top of a three-level parking deck that has doubled the site's parking capacity.



To assist bike commuters, a bicycle pump was installed on the front of the Student Union in June 2004. Bicycle racks are positioned close to building entrances, and beneath overhangs where the option exists. New buildings are increasingly adding showers to better accommodate bike commuters. Voters in both the towns of Chapel Hill and Carrboro have approved bonds to invest in bike and pedestrian infrastructure and greenways. And developments on the outskirts of campus are starting to put in bike paths at the request of the town.

BUILDINGS

New construction and renovation projects dominate the Carolina skyline. At the peak of UNC's $1.5 billion capital improvement program, more than 150 individual projects are currently in design or under construction. To reduce the environmental impact associated with this construction boom, aspects of the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) guidelines are applied to every project on campus. LEED is a voluntary, consensus-based national standard for developing high-performance, sustainable buildings.

New Design and Construction Guidelines clarify university expectations for everything from loading docks to fume hoods to stormwater management. A customized LEED checklist, included in the guidelines, is requested from designers at each phase of project submittals. The goal is to achieve a LEED Silver performance level on all projects.

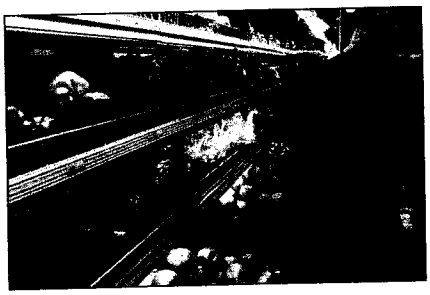
Three engineers, hired to conduct and coordinate in-house design reviews, provide consistency and incorporate lessons learned on prior projects. A new, online system for collecting design review comments from multiple campus departments was launched in spring 2005. The software tracks comments and responses from initial programming through final construction documents.

Commissioning, the process of ensuring that a building performs as designed and in a manner that satisfies the owner's needs, is a new quality control measure at UNC. The new Hooker Research Center at the School of Public Health is the first building on the UNC campus to benefit from verification of system functions. A full time commissioning coordinator, who will track new capital projects, and manage retro-commissioning efforts in existing buildings, was hired in July 2005.

Rams Head

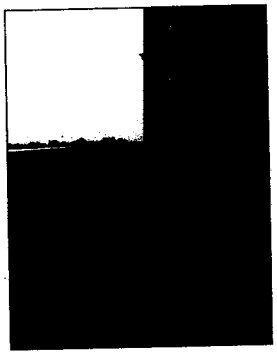
Located within a short walk of 8,000 residential students and most campus classrooms, Rams Head Plaza is part of the new connective tissue forming on campus. This 700-space parking garage is inconspicuous because of its roof, which consists of a grassy plaza with wide, bricked walkways. The green or vegetated roof on top of the parking deck is designed to absorb and reuse rainwater rather than allowing it to immediately run off into the drainage system. On one side of the plaza is a two-story brick structure that houses a dining hall, a sports café, and a game room. On another side of the plaza, bordering the football stadium, is a two-story recreation center.

At Rams Head, the first mixed-use project on campus, students heading back from class can stop for a workout, enjoy a meal, view a large-screen sporting event, or play a video game. They can also shop for competitively-priced groceries at the second largest campus market in the country, including lots of fresh produce, bakery, coffee, and deli selections. Because many students do not have cars, and the closest off-campus grocery store is three miles



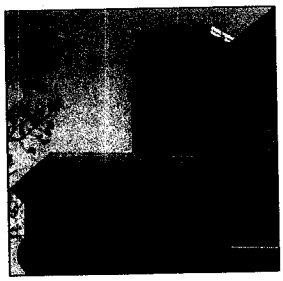
away, the market helps students eat healthier food, for less money, without driving or taking the bus. The variety of fresh food offerings is also a signature feature of the dining hall, where chefs prepare the food in full view of the patrons at each station. Offerings include the Carolina Diner; Barraca's Pizza, Pasta, and Deli; Lean & Green; the Chop House; and the Rolling Pin.

Carrington Nursing School Addition



The 69,000 square foot addition to the nursing school, completed in April 2005, is the first building in the 16-campus UNC system with a pending Leadership in Energy and Environmental Design (LEED) certification from the U.S. Green Building Council. Certification is voluntary and based on design and construction practices that promote environmentally responsible buildings that are healthy places to work.

Built on former surface parking, the project paid $350,000 into a central campus parking fund to eliminate 23 spaces. Trees on the west side of the building were protected by putting logging mats and mulch under the construction staging and traffic area. The thin building profile brings daylight into most of the interior spaces. Efficient plumbing fixtures use 41% less water than allowed by the building code and 56% of the construction and demolition waste was diverted from area landfills. Materials selected for use in the building do not contaminate indoor air, were obtained from local sources, and kept dry during construction. The "cool roof" with a reflective surface reduces the urban heat island effect. A glycol loop recovers the energy used to heat and cool the building and reduces the need to condition outside air. Carbon dioxide monitoring brings additional fresh air into the auditorium only when the space is occupied by a large number of people.



The former dean, who wanted to create a place of peaceful respite for nursing students, provided the funding for an extensive, or thin, "green" roof on the fourth floor. The sedum, blueberries, and purple coneflower surround a small patio while capturing 70% of the stormwater that falls on the building. Crepe myrtle trees planted in brick wells will eventually shade the patio.

Environment Health and Safety

Scheduled for completion in early 2006, the new Environment Health and Safety (EHS) building will be the first on campus to incorporate controlled daylighting. Rooftop "monitors" will harvest daylight while excluding glare and unwanted heat gain. Photo sensors will ensure that electric lights only turn on when required, thus reducing electricity bills and the need for cooling. Because the EHS building and a new facility for the in-house, small project construction staff are joining existing physical plant and warehouse space, a district cooling system is being installed to serve the entire complex. This cooled water loop will improve efficiencies and result in less noise than stand-alone compressors.

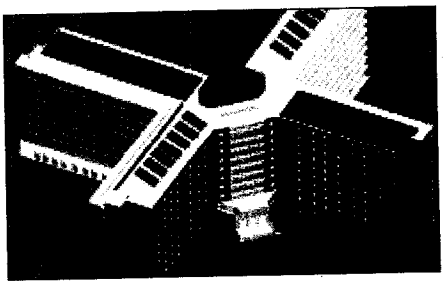
Global Education Center

The Global Education Center is one of 16 North Carolina buildings designed using the state's High Performance Building Guidelines. This project focused on water conservation and low-impact site development. The building was designed to protect an existing grove of post oak trees and uses the slope of the land to conceal a parking deck beneath. Rainwater will be collected and used on site for irrigation. Part of the roof will be vegetated to provide a walkout garden and to manage stormwater.

Formerly a 140-space surface parking lot, the site will be transformed into a global meeting place, flooded with natural light. Visiting international scholars and a large percentage of UNC students will see this building and be drawn to its programs. More than one-third of Carolina students study abroad before they graduate, a higher rate than at any other public research university nationwide.

Morrison Residence Hall

The Morrison Residence Hall renovation is another High Performance Building project. Long a favorite of students, despite its age and lack of air conditioning, Morrison will finally be connected to the centralized chilled water system. A new heating system and energy-efficient windows will also be installed. The current suites will be transformed into apartment style rooms and more, better lit common areas will be added. Total occupancy will decline to 800 students, down from 1,000 in the 1960s era 10-story structure.

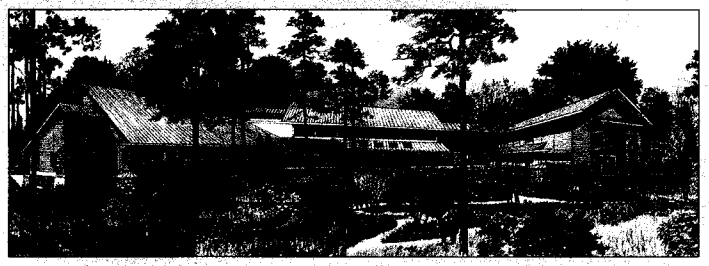


Morrison will be the first building on campus to incorporate renewable energy technology. Solar panels to provide domestic hot water will be mounted on the roof of all four wings of the building. The plumbing system will draw first on solar-heated water from the storage tank and then add steam-heated water when supplementing is required. Submetering of the building's electricity, water, heating and cooling loads will provide real-time, web-based feedback to the students. With plans to turn at least part of the residence hall into sustainability themed housing, it is hoped that students living in Morrison will take an active interest in monitoring, reducing, and learning about their resource consumption.

NC Botanical Garden Visitor Education Center

The North Carolina Botanical Garden's Visitor Education Center has been designed as a LEED Platinum building—the highest designation of the LEED (Leadership in Energy and Environmental Design) Green Building Rating System. A capital campaign to fund

construction is underway. Frank Harmon of Raleigh is the principal architect, whose work has been guided by the vision of many Garden staff.



The green building will express a sense of place and celebrate relationships between humans and nature through the integration of indoor and outdoor spaces. "The entire project will be an educational exhibit," declares Dr. Peter White, Garden director.

The building employs a geothermal-supported energy system, photovoltaics to generate electricity, day-lighting, and many other "green" features. Cisterns will collect roof water that will be used to grow a diverse and colorful botanical garden relying only on water that falls directly on the site. The Garden has pledged that construction materials will come from within a 500-mile radius—to reduce the generation of carbon dioxide through transportation and to support local economies—and will use only wood from certified sustainable sources. The plan includes recycling programs for construction waste and supports pedestrian, bike, and public transportation access to the new Center.

The project fits seamlessly with the Garden's mission "to inspire understanding and appreciation of plants, gardens, and natural areas, and to advance the conservation of biological diversity and a sustainable relationship between people and nature." The new Center represents great potential for demonstrating sustainability since gardening activities are the number one leisure time activity for Americans, and the gardening industry, including nursery businesses, is one of the largest employers in North Carolina.

ENERGY

The huge amount of building construction at UNC is placing increased demands on the campus electricity, steam, and chilled water networks. An eight – year utility master plan guides efforts to accommodate that growth and expand the energy infrastructure.

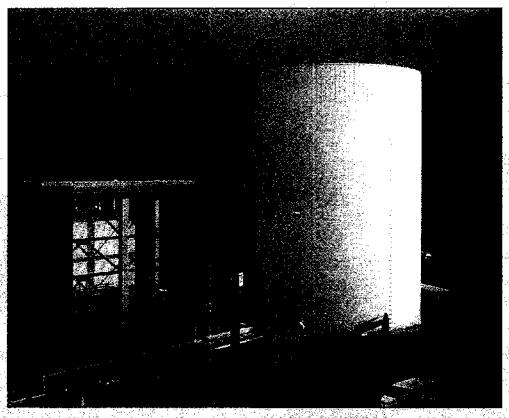
At present, one-quarter of the electricity and all of the steam used at UNC is generated on campus at the combined heat and power plant on Cameron Avenue. Using three boilers and a 28-megawatt generator, this cogeneration facility produces twice as much energy from a pound of coal as a traditional coal-fired generating plant that does not capture the steam. Each year, approximately $50 million is spent to heat, cool, and power the campus.

Chilled water at UNC is produced in both steam absorption and electric chillers. These systems chill water to 42 degrees Fahrenheit. The water is then distributed through underground pipes to more than 100 campus buildings, at a temperature of up to 45 degrees. There it is used by the air conditioning equipment to cool the space. When the water has warmed by a minimum of 14 degrees, it is returned to the chiller plant and cooled again.

To accomodate campus growth, the capacity of the chilled water system will be expanded 45% by the end of the decade. A new chiller plant and five miles of chilled-water pipe will be added to the 14 miles of pipe that already weave through campus. Five miles of steam lines will be added to the 40 miles of steam and condensate pipe now installed, as well as a new steam plant. An 11 foot by 11 foot walkable utility tunnel, the first on campus, is under construction between the new steam plant on Manning Drive and the Science Complex on South Road.

Thermal Storage

A 5 million gallon thermal energy storage system completed in summer 2005 will help to reduce campus energy costs. Cooling water at night, or "off peak", transfers the time when energy is needed. Electricity and chilled water rates at UNC reflect this "time dependent value" of energy. A kilowatt-hour of electricity used on a summer afternoon is billed at up to 10 to 20 times a kilowatt-hour used on a summer night. "Shifting load" to less expensive periods evens out demand and reduces university costs.



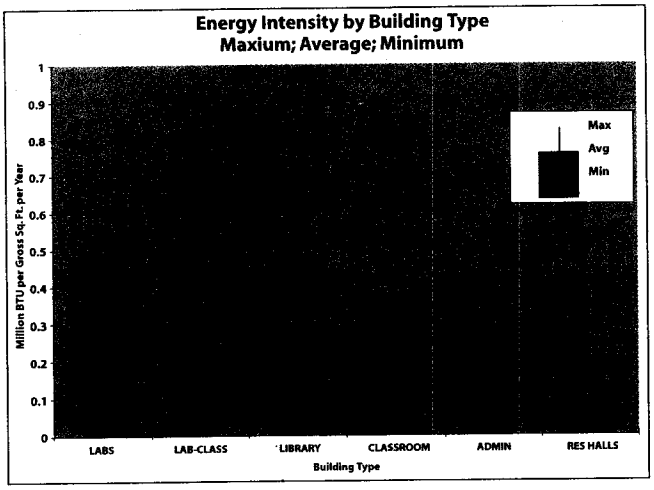
Storing chilled water at night to cool buildings during the heat of the day also reduces the size and cost of the cooling equipment that would otherwise be required. In addition, "shaving" the amount of steam and electricity needed during peak periods reduces air emissions during hot summer afternoons when the Triangle suffers from high ozone levels. The electric generating plants used to meet peak summer demand are typically among the oldest and least efficient plants in an electric utility's inventory.

Campus Energy Consumption

To better understand when and how much electricity, steam, and chilled water are used, Energy Services accelerated the installation of meters across campus. Electricity had already been metered in virtually every one of the 200 buildings on campus. By summer

2005, 114 buildings had chilled water meters and 120 buildings had steam or steam condensate meters. Revenue supported functions, such as housing and dining services, were the first to be metered. Research laboratories, with their resource-intensive fume hoods, were second.

Previously, the best knowledge available on campus energy consumption came from prior billing records. By combining total steam, electricity, and chilled water use into British Thermal Units (BTUs), energy-intensity comparisons could be made among building types. The Sustainability Office discovered that the average lab building uses more than four times as much energy per square foot as the average classroom, administrative, or residential building.



Energy consumption can also vary by as much as a factor of four from one building to another within the same type of building. Delving deeper into this data will enable us to identify buildings that should be the highest priorities for energy upgrades. There may also be design approaches, technologies, and operational practices that we should replicate because they save energy.

Attracting interest in energy consumption issues from the campus community is an ongoing challenge. Customers who charge for their services, like housing and dining, are among the few that see and pay their energy bills directly. Most other campus buildings are charged via one central account. So building occupants do not know how much energy they use, nor do they have any direct incentive to reduce consumption. Means of providing real time consumption information in a relevant and user friendly format are currently under investigation.

Energy Conserving Measures

Many energy conserving practices are already standard. Variable air volume systems, for example, draw in only as much unconditioned outside air as necessary to heat, cool, and ventilate indoor spaces. Variable speed motors enable equipment to ratchet up or down depending on current requirements. In some buildings, such as the Carrington and Public Health additions and the Stone Center, the energy value in heated and cooled air is recovered prior to exhausting the air outdoors.

With more than 14 million gross square feet of space, and rising energy costs, improving the operational performance of existing buildings is a growing priority. New software that tracks the functioning of building systems, and troubleshoots performance issues, was installed first at the McColl Building in the business school in 2005. The first full scale retro-commissioning of an existing building was launched at Bioinformatics, a building completed in 2002. The initial study identified some $200,000 worth of improvements needed to bring the system up to its specified design

WATER

To stretch potable water supplies in our growing community, the university and the Orange Water and Sewer Authority (OWASA) are partnering to build a water reclamation and reuse system. The water from OWASA's Mason Farm Wastewater Treatment Plant will be purified to use in the university's chiller plants. Scheduled to be in place by 2007, this system will initially decrease the university's potable water demand by an average of 515,000 gallons a day. That is equivalent to expanding OWASA's water supply and treatment capacity by nearly 7%. Greater savings will be achieved as more facilities are connected to the system.

This approach will enable OWASA to forego making major capital improvements to pump and treat water from Jordan Lake, at a considerable savings to the community. OWASA has received a $1.87 million N.C. Clean Water Management Trust Fund grant and a $645,000 federal grant for the project. The university will provide the remaining funding required.

UNC has installed approximately 180 waterfree urinals in a range of building types across campus. Experience to date indicates that buildings with predictable occupancy patterns are the best candidates. If there are large swings in occupancy, it is important to ensure that housekeeping staff is on duty when crowds are expected. Ultra low-flow urinals that use 0.5 gallons per flush have also been specified in some new buildings.

In new science labs, heat producing equipment, such as lasers and x-rays, will be cooled with closed-loop cooling systems driven by the chilled water supply in the building. Water savings in one laser lab can amount to 1.5 million gallons annually compared to a "once-through" cooling system.

Solvent-free vacuum pumps, instead of water aspirators, represent another large water saving opportunity in labs. Water aspirators require 3 gallons of water per minute to generate a vacuum. Calculations performed by a member of the chemistry faculty indicate that switching out just 40 pumps would save more than 8 million gallons of water each year. In the undergraduate chemistry labs, one experiment formerly conducted early in the semester was replaced entirely after an examination of water usage in the building revealed that consumption tripled in the month the experiment was conducted.

capabilities. At the recently renovated Undergraduate Library, an energy audit identified systems and equipment that require repair or replacement in order to reduce energy consumption. The return on investment is projected to range from 50-100% depending on the strategy adopted.

In 2001, UNC Chapel Hill began a program to install more energy efficient lighting in campus buildings. A dozen energy conservation lighting projects have been conducted over the past four years. Some $600,000 has been invested, resulting in over $125,000 of avoided electricity costs per year.

Many campus buildings have also been renovated to varying degrees over this time period, often incorporating energy efficient lighting. To assess the current lighting standard and the opportunity for additional savings, the Sustainability Office conducted a survey of 13 campus buildings in spring 2005. Savings that would result from replacing the remaining T-12 magnetic ballasts with T-8 electronic ballasts and lamps, and installing occupancy sensors, were calculated. Based on simple payback, the return on investment associated with these 13 buildings ranges from 21% to 125%. If all $237,000 of work were completed, the projected return is 32% annually. To verify the accuracy of these savings estimates, data loggers that track lighting usage and occupancy will be installed in representative spaces both before and after the lighting upgrades.

Operational and staffing changes have also resulted in energy savings. To recover hot steam condensate and prevent steam leaks, for example, a plumber now works full time on steam trap maintenance. At the new Science Complex, an HVAC technician was hired early in the multiyear construction project to troubleshoot system installation and learn how to operate the sophisticated air handling equipment prior to occupancy.

As buildings become more complex, and automation systems incorporate control technologies from multiple vendors, staff are challenged to keep up and energy performance can suffer. Consistent standards and improved system integration are goals of the $3.5 million Energy Management Control System upgrade now underway. Standards-based systems that feed information to the web will enable improved analysis and the development of new energy saving strategies. Improved employee training, and better operations and maintenance protocols, are also expected to result in significant energy savings.

Renewable Energy

Students interested in climate change and renewable energy have twice voted to fund investment in renewable energy infrastructure on campus. The $4 per semester fee was first approved for two years in 2003. In 2005, 85% of voting students reauthorized the fee, at the same rate, for an additional four years. First collected in fall 2004, the fee generates some $193,000 annually.

Student members of the Renewable Energy Special Projects Committee allocate the revenue with input from campus administrators. The first project to receive funding is a solar hot water heating system on the renovated Morrison Residence Hall. When Morrison reopens in 2007, its 800 residents will shower in water heated by the sun. Impressed by the students' commitment to the effort, the State Energy Policy Council approved a $137,000 Clean Technology Demonstration Grant for the project.

STORMWATER

The Environmental Master Plan adopted as part of the Campus Master Plan in 2001 established the following goals:

- **Balance growth with preservation of the natural drainage system.**
- **Manage storm water as an opportunity not a problem.**
- **Recognize that UNC is part of the Cape Fear Watershed.**
- **Reinforce the university's position as a role model.**

A stormwater management plan completed in 2004 will guide the implementation of these goals.

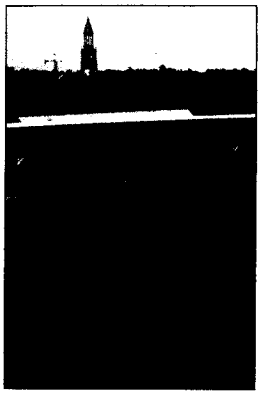
As part of new zoning for main campus, UNC committed not to increase the volume, rate, or pollutant load of stormwater leaving campus following a two-year storm. Thus every project that increases impervious surface is required to develop a stormwater mitigation strategy. Erosion and flooding at many existing sites will also be addressed.

Because much of the construction during the 8-year Development Plan occurs in previously developed areas, total impervious surface on campus will increase by only 6.5 acres. And because relatively clean roof areas will replace parking lots, a net decrease is expected in the amount of pollutants in the stormwater runoff. Non-structural approaches to stormwater management focus on land cover plantings, management practices, and education and outreach programs.

To support this fundamental change in thinking and practice, UNC commissioned an infrastructure study to map all the major pipes (over 12 inches in diameter) throughout the entire 740 acre campus. Stormwater quality and quantity impacts were analyzed for each of the five campus watersheds. Two guiding principles resulted: 1. It is best to manage stormwater where the problem is generated. 2. Many smaller solutions distributed throughout a drainage area are inherently better than a single large solution whose failure would have larger consequences.

Proposed best management practices include both operational and structural changes. UNC is actively implementing both.

Green Roofs

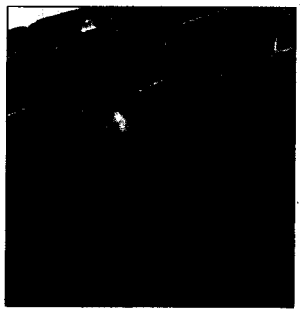


In spring 2005, the first two "green" or vegetated roofs on campus were completed. At the Carrington Nursing School addition, an extensive, or thin, green roof was planted on the fourth floor. The roof mitigates 70% of the stormwater runoff from the 69,000 square foot addition while providing an attractive amenity for building occupants.

The intensive, or deep, roof at Rams Head Plaza sits atop a three-level parking structure. With 30 inches of planting media, this new campus green space is planted with trees that will grow up to 60 feet tall. Rain water that falls on the dining hall and recreation center on the plaza runs into underground cisterns along two sides of the roof garden. A central water storage area underlies the walkways. The stored water will irrigate the planted surface and evapotranspirate back into the atmosphere. Water quality inlet filters are intended to trap sediment and debris before it enters and clogs the system.

At the Global Education Center, currently under construction, both an intensive and extensive green roof have been incorporated into the project. A cistern will store water to irrigate the landscape. At the first two Science Complex buildings, storage and infiltration beds will reduce peak water flow from the entire upstream drainage area by half.

Storage and Infiltration



An overflow drainage outlet at Rams Head empties onto a vegetated swale that slopes down to Ehringhaus Field. Used as a temporary parking and staging area during the construction of Rams Head, this field is being returned to recreational use. The stormwater storage and infiltration bed that has already been installed will be covered with topsoil and pervious artificial turf. A surface stream will run along the perimeter of the field to slow stormwater runoff from the seeps of the forested hillside.

At Carmichael Field, a recreational sports field, a 70,000 gallon underground cistern and a 500,000 gallon infiltration bed were installed in 2002. A gravel infiltration bed also lies under

the parking lot of the new Administrative Office Building on Airport Drive.

Large stone planters, able to accommodate trees, were installed on the brick plaza in front of the Union and the Lenoir Dining Hall.

Porous Pavement

Porous pavement parking lots are another structural approach to stormwater management that has been employed extensively at Carolina. Gravel beds under the porous surface store rainwater until it slowly infiltrates into our clay soils. The soil then filters out pollutants conveyed from the parking lot. At the Friday Center park and ride lot and the student remote lot on Estes Extension, both porous asphalt and pervious concrete were installed so their performance could be monitored over time. Additional porous asphalt lots have been installed at the Facilities Complex, on Cameron Avenue across from the cogeneration plant, in front of the EPA building on campus, and at the Hedrick lot. The new park and ride lot in Chatham County is a porous lot designed to infiltrate into a sandy soil layer. Porous lots with detention beds are also planned behind the Steele and Caldwell buildings on Cameron Avenue as part of a pipe replacement project.

Grounds

Because lawns contribute nitrogen and phosphorous to surface water bodies, and Jordan Lake is already eutrophic, or overloaded with nutrients, Grounds Services is assessing opportunities to convert lawns into more stormwater retentive landscapes with lower maintenance costs. Steeply sloped and shaded areas were the first candidates for conversion. Areas with mulch are being looked at to see if low shrubs or groundcovers can be added to improve the quality and reduce the quantity of stormwater runoff. Recent project areas include the hillside in front of Wilson and Coker Hall, the slope on the east side of Columbia Street at Neurosciences, a mulched area south of the Law School, and a grass knoll along the south side of the entrance to the Bell Tower Parking Lot.

Converting managed woodland back into layered forest is a way to restore natural hydrologic patterns. Some 17 acres of campus, found at the edges of developed areas, may be suited for forest restoration. A list of proposed native plant communities recommended for stormwater management in various campus locations was developed by Andropogon Associates and now guides the planting done by Grounds Services.

Stormwater Quality

A soil erosion and sediment control plan is incorporated into all construction. The logging mats used to protect tree roots provide the added benefit of keeping soil in place. To reduce the runoff of sediment and pollutants from streets and parking lots and to keep porous parking lots from clogging, UNC uses a regenerative vacuum sweeper truck. A portable storm water drain vacuum enables the Grounds Department to keep vaults, cisterns, and other stormwater infrastructure flowing smoothly.

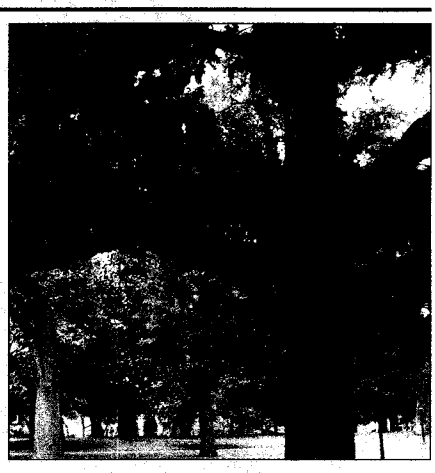
To detect and eliminate illicit discharges to stormwater, mapping of the stormwater piping system is underway. Drains and sanitary sewer lines found emptying into the stormwater system are rerouted. Hundreds of drain markers on campus, many affixed by students, alert passersby that anything entering the grate flows into a stream. A public "hotline" is available to report odors and unusual colors in campus streams. The results from continuous and quarterly stream sampling programs are available by contacting UNC's Department of Environment, Health and Safety. Student groups regularly sponsor creek clean ups to remove trash from creek beds. And a new stormwater website is under development by Environment, Health and Safety.

GROUNDS

The beauty of Carolina's historic landscape strikes visitors from the moment they set foot on campus. Mature individual trees in a park-like setting have defined Carolina for over 200 years. Trees reduce the perceived scale of campus buildings. They unite buildings of diverse architectural styles into a unified whole. Trees help to create an atmosphere of permanence, calm, closeness to nature, and separation from the frenzied outside world. And trees have enormous practical value – they provide shaded outdoor rooms, they cool buildings, and they evapotranspirate stormwater.

At the time of this writing, Carolina is in the midst of the most significant building and renovation period in its history. Efforts to maintain our desirable sense of place have included hiring a landscape architect, a historic preservation manager, a university arborist, a campus stormwater manager, a horticulturist, and a landscape supervisor. Each of these professionals strives to maintain and enhance the physical integrity of the campus.

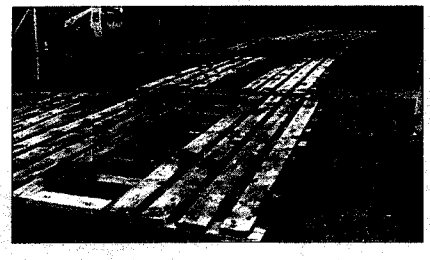
Tree & Landscape Protection



Concern for the survival and well-being of our cherished trees and landscapes during this period of unprecedented growth led to the formation of a chancellor-appointed Task Force on Landscape Heritage and Plant Diversity. The report produced by the task force identifies, promotes awareness, and provides guidelines for both the protection and enhancement of the grounds at UNC. A comprehensive inventory of heritage trees and landmark spaces, and a map of their locations, was prepared for the report and will be maintained by Grounds Services.

One of the task force recommendations is that any trees lost should be replaced – inch for inch – by the planting of new trees somewhere else on campus. Thus if a 20-inch tree is removed, it may be replaced by ten 2-inch trees of a species to be determined by the university arborist. After good experience with a part-time tree warden during a one-year pilot project, UNC will continue to contract with a tree-warden on an as-needed basis.

The campus tree protection policy, which preceded the task force, has been further strengthened. Although few building sites remain on campus, building orientation decisions are now based partly on the existing tree cover. Construction drawings must show which trees to protect and which to cut and delineate the limits of excavation. Chain link fences are placed around the dripline of trees to protect the roots. When space does not permit fencing, logging mats are laid to distribute the weight of construction vehicles and staging areas. These mats have successfully prevented soil compaction and root damage on over a dozen campus projects.



Now that each landscape district on campus has been thoroughly studied — and all trees included in a geographic information system (GIS) inventory — it is easier to provide guidance regarding future development. The Landscape Heritage and Plant Diversity task force report includes recommendations and guidelines for landscape designers working in each of the three main campus districts. Desirable and undesirable features of each area and preferred planting types, as well as a list of plants to avoid, are noted. Direction is also given for stone walls, brick walkways, bicycle racks, benches, and way-finding signs.

Grounds Services practices and promotes sound stewardship. While individual construction projects design and fund new

plantings, it is Grounds Services personnel who prepare the planting beds, and plant the landscapes, for the new and renovated buildings. Contractors install drip irrigation systems per Grounds Services' specifications. Survival rates are high because staff in each campus zone takes pride in their respective areas and knows which sections require extra care in getting established.

A long-standing Integrated Pest Management program, which relies on scouting for pests and minimizing pesticide applications, is complemented by a concerted effort to plant a wide variety of plants, including natives and low-maintenance plants. Designers are encouraged to use their imaginations and avoid over-reliance on the 40 to 50 plants currently in vogue. They are also instructed to seek appropriate ways to maximize infiltration of stormwater into soil and to augment existing wildlife corridors throughout campus. Native hollies, red cedars, dogwoods, and persimmons, for example, are important fall and winter food sources for birds.

Sometimes trees decline even with tender loving care. Many of the cherry trees presented by the class of 1929, that lined the east and west walkways of McCorkle Place, have died. Some new cherry trees were planted in the 1960s, but the allee was no longer complete. Thanks to the first donor gift made for maintaining the university's grounds, new cherry trees to complete the path were planted in spring 2005.

Another allee planted in spring 2005 takes many of us back to our childhoods. In towns across the United States, verdant archways reminiscent of Gothic cathedrals became vacant streets when invasive beetles spread the deadly Dutch elm disease. Tom Campanella, an assistant professor in city and regional planning, is so enamored of the elm tree and its fountain spray-shape that he wrote a book, ***Republic of Shade: New England and the American Elm.*** Campus arborist Tom Bythell tended the ubiquitous elm trees at Princeton University before he left them for the southern oaks at UNC. In spring 2005, the two Tom's collaborated to obtain and plant 10 newly cultivated, disease-resistant elm saplings. Six will form an allee, with trees planted on both sides of the path, outside the New East building that houses the planning department. Now only 20 feet high and five inches around at their base, the trees will one day form an archway to shade our grandchildren.

The North Carolina Botanical Garden

The North Carolina Botanical Garden maintains and protects nearly 600 acres of land adjacent to main campus, as well as seven nature preserves across the state. It holds 23 conservation easements and was the first garden in the U.S. to establish an exotic plant pest policy. A founding member of the Center for Plant Conservation, the Garden is one of 28 in the country to hold the National Collection of Endangered Species for storage of germplasm diversity. Locally, Garden staff rescue endangered plants, propagate them in captivity, and re-introduce them into the wild. Protecting, studying, and raising awareness of native plants takes many forms. Fifteen collections and display gardens are complemented with research and teaching sites and the 660,000-specimen herbarium.

Located south of campus off the 15-501 bypass, the Garden's home can also be reached via a primitive walking trail along Meeting of the Waters Creek through the Coker Pinetum.

The Garden has recently advised and donated plants to various health affairs groups on campus that are establishing medicinal plant gardens. The largest garden consists of five plots at the newly renovated Health Sciences Library. Several other gardens have bloomed under the nurturing care of volunteers and staff in front of the Clinical Cancer Center, between the Neurosciences and Women's Hospitals, and near the employee entrance to Memorial Hospital. The gardens represent a shift toward integrated health care, an effort to create healing spaces both indoors and out.

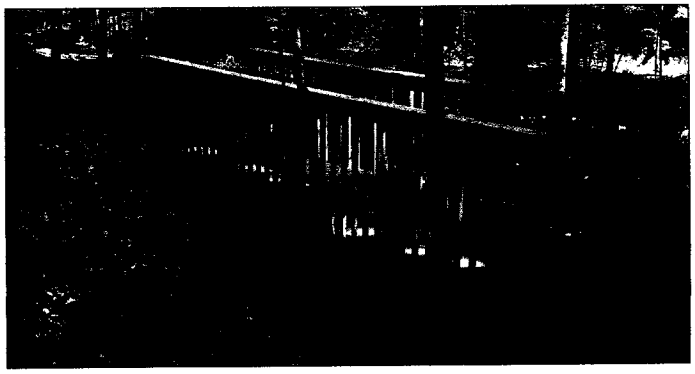
The Wildflower of the Year program run by the Garden has distributed seed packets to local gardeners for 20 years. In 2005, the revised and improved 2nd Edition of ***Wild Flowers of North Carolina,*** written by the founding director of the Garden and his wife, was published by UNC Press. Future botany books are likely to contain the artwork of the Garden's first class of students to graduate with Certificates in Botanical Illustration.

Coker Arboretum

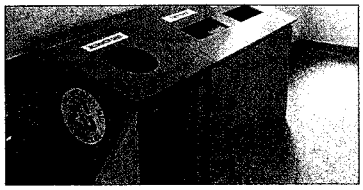
On main campus, the Garden manages the Coker Arboretum, where members of the university community go to unwind and appreciate the rich collection of plants established in 1903. ***A Haven in the Heart of Chapel Hill: Artists Celebrate the Coker Arboretum*** was written by the new curator of the arboretum, Dan Stern, and contains the work of fourteen area artists and photographers. Art is a central theme at the Garden, where six nature-themed art exhibits and an outdoor Sculpture in the Garden show are hosted each year.

Battle Park

Since July 2004, the Garden also manages Battle Park and the stone amphitheater known as Forest Theater. New trails developed in Battle Park will reduce erosion along Battle Creek and provide dry walkways when intermittent streams fill with rain. Though not pristine forest, some of the trees in the 93-acre park predate European settlement.



MATERIALS MANAGEMENT AND RECYCLING

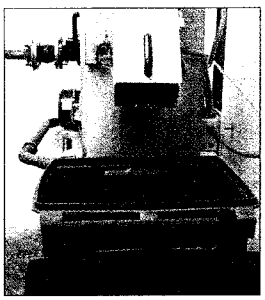


Each year the university increases the share of its discards kept out of the landfill. During the '04-'05 academic year, 41% of the total daily trash was recycled or composted. This includes paper, beverage containers, food waste, and animal bedding. The program avoids $210,000 in landfill tipping fees and waste hauling costs annually. UNC efforts have contributed to Orange County becoming the first county in North Carolina to reduce by 40% the amount of per capita waste sent to the landfill.

During '04-'05, Carolina recycled almost 2,200 tons of fiber, thereby saving 37,000 trees, 15 million gallons of water, one million gallons of oil, one million pounds of air pollution, 7,000 cubic yards of landfill space, and nine million kilowatt-hours of electricity. Paper accounted for 56% of routine materials recycled. By co-mingling the collection of beverage containers, UNC boosted recovery rates 27% between 2002 and 2005. Both indoor and outdoor recycling bins are easy to find all across campus and their appearance can be customized to the building interior. In residence halls, each room is provided with an easy-to-handle recycling tote and a list of materials the campus recycles.

The Office of Waste Reduction and Recycling (OWRR) is responsible for most of the waste management and recycling programs on campus, including the development of policies to handle construction and demolition waste. Hazardous materials management and recycling is the responsibility of Environment, Health and Safety (EHS). During '04-'05, EHS recycled 16,262 pounds of lead and 71,487 pounds of non-PCB ballasts, avoiding $88,000 in hazardous waste disposal costs. Tree and yard waste are managed by Grounds Services and returned to campus as mulch and compost. At UNC's combined heat and power plant, 25,000 tons of fly ash are produced annually and used for structural fill and sewage treatment. At the two campus service stations, waste oil and antifreeze are collected for recycling.

Food Waste



During the '04-'05 academic year, 371 tons of food waste were collected from UNC's three main dining facilities. Beyond the view of diners at the new Rams Head complex, food waste from the kitchen and dish lines is pulped and dehydrated for later composting. Dishes are scraped into a trough of fast moving water. After pulping the food, water is extracted to make the residue lighter and less costly to transport. The food waste is collected from loading docks at Rams Head, the Lenoir Dining Hall, and the Friday Center conference facility for composting by a private firm in Goldston. The compost is sold at the Orange County Landfill.

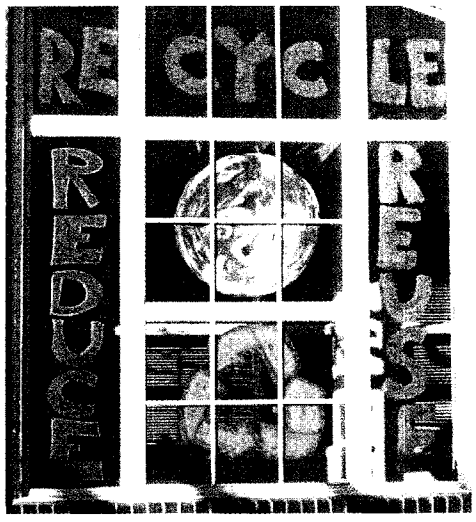
Food waste diversion is also a component of Fall Fest, the alcohol free, welcome back social event that draws over 10,000 students. Suppliers are asked to provide their food in containers that can be composted, such as paper cups and plates and pizza boxes. Styrofoam, plastic, and aluminum foil wraps are discouraged. OWRR, the Student Union, and Grounds set up and staff multiple recycling stations with tall signs visible from a distance. Each station consists of one bin for food waste, one for bottles and cans, and a smaller garbage bin. In addition to diverting waste from the landfill, incoming students are educated about the recycling programs at UNC.

Recycling at Athletics Events

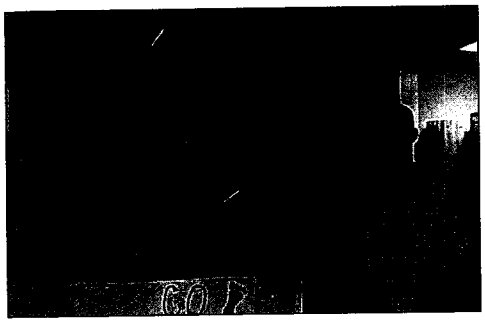
In response to a November 2003 resolution of the Student Congress, OWRR and the Athletics Department launched a pilot project to recycle plastic bottles and beverage cups and popcorn cups at football games in Kenan Stadium. Throughout the 2004 football season, an average one ton of plastics was collected each game. Workers who clean the stadium were instructed to collect trash and recyclables separately. In addition, 150 recycling bins were placed throughout the stadium. Each bin was located next to a trash can. During the games, announcements were made over the loud speakers to encourage fans to recycle. Vendors were also encouraged to recycle cardboard, a material banned from the Orange County landfill. An average three tons of cardboard were collected each game. Total discards diverted from the landfill averaged 43% (by weight) throughout the season.

Encouraged by the success at Kenan Stadium, the Athletics Department has expanded the recycling program to its other outdoor venues.

Green Games



The Green Games competition among residence halls is designed to stimulate energy and water conservation, increase recycling rates, decrease trash generation, and promote student awareness of campus sustainability initiatives. Points, and cash prizes, are given for behavioral changes that reduce resource use, for attending events, and for a variety of programming activities. Awards are given for art work, photos, essays, oratory,



t-shirts, bumper stickers, bulletin boards, best campus waste reduction campaign ideas, and the best conservation idea. To compensate for infrastructure differences among residence halls, communities compete against themselves to improve monthly performance relative to a benchmark.

A recently added feature of the competition involves battery recycling. The goal is for each residence hall to collect at least one battery per bed in the five-gallon drums provided in the lobby. Prizes are given for exceeding the goal.

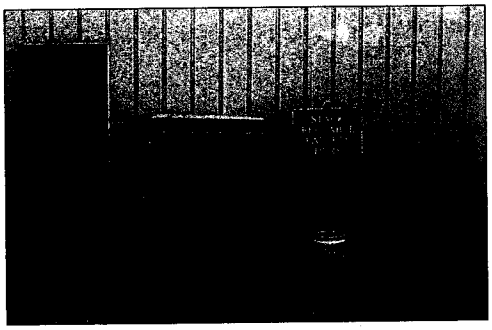
Move Out

At the end of each school year, OWRR sets up donation stations in residence hall lobbies to collect items no longer wanted by students. Bins are provided for clothing and shoes, office supplies, personal care items, non-perishable food, and textbooks. Furniture and small appliances are also collected. Food items are donated to the Interfaith Council. Some of the office and school supplies are stored by OWRR and given away to students on the first day of classes.

Textbooks are usually donated to the "Books for Africa" program, but in 2005 the proceeds from textbook sales were given to rebuild schools and libraries in tsunami-ravaged Sri Lanka. Clothes, shoes, and the remainder of the collected items are donated to the PTA Thrift Shop, which benefits the Chapel Hill-Carrboro school system.

During the past two years, improved coordination has tripled the amount of donations recovered. In 2005 this amounted to 239 65-gallon recycling bins.

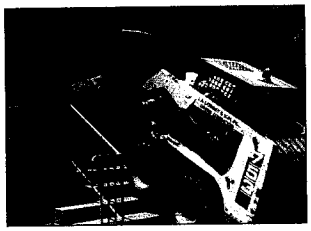
Surplus



Surplus furniture, filing cabinets, and some office equipment are sold to campus departments and the public two days per week. Computers are given to the state surplus program, which trains prisoners to refurbish them for nonprofits, or recycles them. Recently, Surplus has branched out to accept building materials and equipment from capital projects, such as doors and kitchen appliances salvaged before the demolition of Chase Dining Hall.

Building Materials

Construction and demolition (C&D) waste comprise a growing share of U.S. landfills. With $1.5 billion of construction underway at UNC, a full time waste management specialist works with contractors to recycle materials of value. For renovation and demolition projects, the first step is a walk through of the building. University personnel indicate which materials can be reused elsewhere on campus, such as hardware, wood, slate, and equipment. Next in line are nonprofits and local salvage companies. Examples of materials and equipment salvaged for reuse include generators, wood paneling, bathroom partitions, and cabinetry.



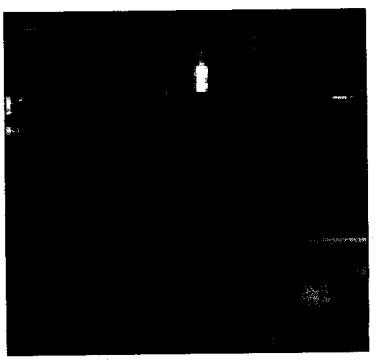
Each capital project includes a waste specification in the construction documents, requiring a solid waste management plan. Contractors then submit monthly reports detailing all salvage, recycling, and non-hazardous waste disposal.

Each contractor is informed about local markets for secondary materials and provided latitude to develop a workable plan. Because space for staging areas is often tight, some contractors use a single dumpster for all materials. The discards are then trucked to one of two local recycling facilities for physical and mechanical separation. Other contractors provide a separate dumpster for each material type. One creative contractor eliminated the need for dumpsters entirely by scheduling pickups of specific materials on designated days. The same contractor pioneered campus participation in the Armstrong ceiling tile recycling program, sending 44,000 square feet of material to be turned into new ceiling tiles.

Recovery rates for C&D waste range from 50-80%. With the cost of construction materials escalating, so are efforts to recover, store, and reuse materials on campus. Reuse of materials such as slate roofing tiles and brick pavers is under investigation and will require closer collaboration among OWRR, Surplus, the campus maintenance and construction shops, and Facilities Planning.

Tar Heel Memorabilia

UNC Chapel Hill's Woollen Gym was home to the undefeated 1957 NCAA basketball champions. Future professional players debuted on these courts, and thousands of Carolina students and staff played regular pick-up games. When it came time to renovate the facility, UNC staff and the design team worked together to require salvage. A local doctor and his sons formed a company that successfully bid on and hauled away the maple floor. The company, JBNR Partners, donated 5,000 square feet to Wake County Habitat for Humanity, which sold the flooring in their ReUse Center. JBNR Partners uses the wood to make plaques and furniture. Some of the plaques come complete with a picture of the 1957 team and their signatures. Tables made from the wood are at UNC Mail Services.



At the End Zone sports café in Rams Head, the front of the take-out food counter is faced with flooring from Woollen Gym. (How fitting that the café opened just in time for fans to watch the 2005 NCAA title game on its large screens.) Both former players and the floor they played on will be admired for years to come.

ADVANCING SUSTAINABILITY AT UNC-CHAPEL HILL

Academic Resources

Instructors who would like to incorporate sustainability and "greening the campus" into their curricula can contact the Sustainability Office for ideas. http://sustainability.unc.edu

All campus community members interested in public service can survey projects already underway at the Carolina Center for Public Service Database. http://ccps.unc.edu/database/main.jsp

Those with ideas for sustainable business opportunities can benefit from the resources at the Carolina Entrepreneurial Initiative (CEI). http://www.kenaninstitute.unc.edu/centers/cei

Transportation – Explore alternatives to the single occupant vehicle.

Commuter Alternatives Program
http://www.dps.unc.edu/dps/alternatives/CAP2/CAP.htm

Bike Map of Chapel Hill
http://townhall.townofchapelhill.org/planning/Bikemap-2003.pdf

Bus

Chapel Hill Transit – fare-free for everyone!
http://www.townofchapelhill.org/transit

Duke/UNC Express – runs every half hour
http://www.robertsonscholars.org/bus

GoTriangle.org – regional transit options
http://www.gotriangle.org

Zip Car

Drivers over 21 can join ZipCar and use a "bug" for $5 an hour!
http://www.zipcar.com/unc

Conserve Energy

Turn off the lights and other appliances when you leave the room. Close the sash on your fume hood when you leave the lab.

Energy Star appliances are among the top 25% of the market in terms of efficiency.
http://www.energystar.gov

Report leaks and other problems
http://www.fac.unc.edu/CustomerService

Get Outdoors!

Coker Arboretum - a beautiful garden located right on campus.
http://www.unc.edu/tour/LEVEL_2/coker.htm

The North Carolina Botanical Garden - a great place to walk just off campus.
http://www.ncbg.unc.edu

Carolina Adventures Outdoor Recreation Center
http://campusrec.unc.edu/OEC

Reuse

Freecycle – Orange county residents list things they are giving away, for free!
http://www.freecycle.org

Campus Surplus
http://www.unc.edu/mds/sp

PTA Thrift Shops – proceeds support local schools
http://ptathriftshop.com

Recycle

Recycling at UNC
http://www.fac.unc.edu/wastereduction

Recycling in Orange County
http://www.co.orange.nc.us/recycling

EVENTS & AWARDS

Awards and Designations

2005 Entrepreneurial Excellence Award for Community Impact from the Council for Entrepreneurial Development to the Carolina Entrepreneurial Initiative

2005 Merit Award for Excellence in Planning on an Existing Campus from the Society for College and University Planning and the American Institute of Architects Committee on Architecture for Education for the UNC Master Plan

2005 State Government Sustainability Award from NC Project Green to the UNC Sustainability Office

Award of Excellence from the National Garden Clubs to the North Carolina Botanical Garden, 2004

Best Workplace for Commuters designation by the U.S. Environmental Protection Agency and the U.S. Department of Transportation, multiple years

Beyond Grey Pinstripes Award from the Aspen Institute and the World Resources Institute for innovation in environmental stewardship and social impact management to the UNC Kenan-Flagler Business School, 2003

Edward Kidder Graham Award 2004, Non-faculty Advisor of the Year to Cindy Pollock Shea for the Renewable Energy Special Projects Committee

EPA Energy Star Combined Heat & Power Award 2003 to UNC Energy Services

Innovative Program Award from the Campus Safety and Health and Environmental Management Association to UNC Environment, Health and Safety Office, 2004

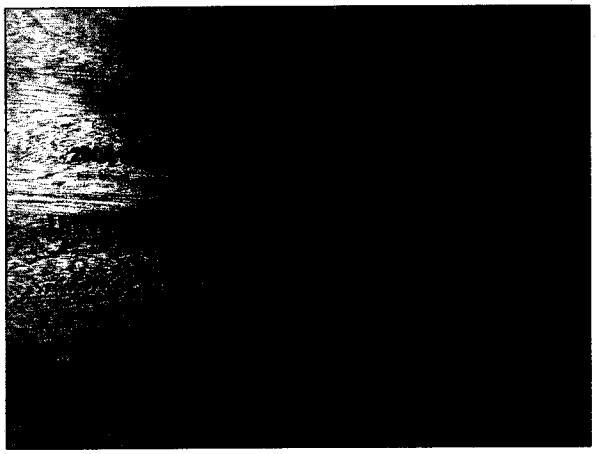
People, Prosperity, and the Planet (P3) Award from the U.S. Environmental Protection Agency to a team of students and professors in the Environmental Sciences and Engineering Department for its *Comparative Analysis of Three Sustainable Point of Use Drinking Water Treatment Technologies for Developing Nations*

Program Excellence Award from the American Association of Botanical Gardens and Arboreta (AABGA) to UNC-Chapel Hill's North Carolina Botanical Garden, 2004

Save our State North Carolina Sustainability Award 2003 for the UNC Sustainability Initiative

Senator Paul Simon Award for Campus Internationalization, 2004

Sustainable North Carolina Sustainable Business Award 2004 for the North Carolina Botanical Garden's pioneering Conservation Garden and upcoming Visitor Education Center



WORKSHOPS & CONFERENCES AT UNC

Alternative Fuels and Vehicles Videoconference, January 2005

Biomimicry: Biologists at the Design Table, May 2005

Designing Energy Efficient Buildings Using LEED Guidelines, February 2005

Got Sustainability? Plan for It! Making Sustainability a Foundation of Higher Education Learning and Practice, SCUP satellite telecast and UNC campus showcase on National Campus Sustainability Day, October 2003

Health and the Built Environment: The Effects of Where We Live, Work, and Play, Annual Minority Health Conference, February 2004 & 2005

Helping the Food Industry Fight Obesity: Research Insights and Needs, May 2005

In-House Commissioning Program Responsibilities, June 2004

Monitoring Building Resource Consumption, Lucid Design Group, March 2005

Perspectives on Environmental Values, March 2005

Southeast Renewable Energy Conference, April 2004.

SURGE Conference (Students United for a Responsible Global Environment), February 2005

Systems Thinking for Sustainable Enterprise, April 2005

Workshops on Water Wise Landscaping, NC Botanical Garden & OWASA

EVENTS

Carfree Day, September 2004

Citizen Scientists Bioblitz in Battle Park, April 2005

Creek Cleanups, various organizations and dates

Day of Action for Clean Energy, October 2004

EarthAction Fest, April 2005

Earth Day 2004 & 2005

Ecology and Social Change Seminar Series

Environmental Awareness Week, October 2004

Environmental Leadership Training Institute, April 2005

Every Day Environmentalism, various residence halls and dates

Fossil Fools Day, April 2005

Green Buildings & Products Forum, March 2004

Green Games, Spring 2004 & 2005

Human Rights Week, March 2005

Net Impact Career Fora, January 2004 & 2005

Project WET: Tar Heel Style, Water Education for Teachers, May 2005

Rams Head Tour, March 2005

Solar Meet-ups, SURGE & Million Solar Roofs, Chapel Hill, various 2004 & 2005

Sustainable Community Building Forum, February 2004

Sustainable Enterprise Career Fairs, January 2004 & February 2005

Sustainability Film Series, various dates 2005

OFF CAMPUS PRESENTATIONS

Associate Vice Chancellors of ACC Schools, College Park, MD, October 2004

Campus Ecology Workshop, Washington University St. Louis, MO, March 2004

Carolina Recycling Association Conference, Charlotte, NC, March, 2004

Earth, Air, Fire, Water & Spirit Green Building Workshop, American Association of Botanical Gardens and Arboretums, Boston, MA, June 2003

Efficient NC: Leading By Example, Raleigh, NC, March 2004

GreenBuild 2003, Pittsburgh, PA

GreenBuild 2004, Portland, OR

Greening Our Community, Businesses, and Homes, Chapel Hill Carrboro Chamber of Commerce, 2nd Annual Sustainability Workshop, April 2005

Greening the Campus V, Ball State University, Muncie, IN, September 2003

Hillel Forum on Public Policy, Washington, D.C., February 2005

Ishmael, A performance by UNC's Company Carolina, April 2005

NC Conservation Network Conference, Asheville, NC, September 2003

Renewable Energy for Economic Development: A Partnership for the Future, Raleigh, NC, April 2005

Roadmap to the Future: Tomorrow by Design, Elon, NC, October 2004

Sustainability and Green Building Workshop, Chapel Hill Carrboro Chamber of Commerce, February 2004

Sustainability, Energy & the Environment Committee, Chapel Hill Town Council, September 2004

Sustainable Sandhills Executive Conference, Fort Bragg, N.C., August 2003

Taking Campus Sustainability to the Next Level, Duke University, September 2003

Triangle Chapter of USGBC, Duke University, October 2003

EXHIBITS

High Performance Buildings, Student Union, December-March 2004

Sustainability Initiatives at UNC, Davis Library, April 2004

SPEAKERS

Michael Balick, *Plants, people, and culture: The science of ethnobotany,* Ethnobotanist, New York Botanical Garden

William Cronon, *Saving Nature in Time: The Past and the Future of Environmentalism*, University of Wisconsin – Madison

Pogo Davis, *Leading Change: Sustainable Development in the Energy Industry,* Manager of Sustainable Development, ConocoPhillips, retired

Bill Drayton, *Creating Financial Markets for Social Initiatives,* CEO, Chair and Founder, Ashoka Foundation

Jerry Greenfield, *Social responsibility and radical business philosophy*, Co-founder, Ben & Jerry's Ice Cream

Marc Gunther, *FORTUNE* magazine and author of *Faith and Fortune: The Quiet Revolution to Reform American Business*

Jim Hagan, V.P., Corporate Environment, Health & Safety, GlaxoSmithKline

Spenser Havlick, ***Transportation and Sustainable Campus Communities***, University of Colorado – Boulder, emeritus professor

Robert F. Kennedy, Jr., ***A Contract with Our Future,*** Environmentalist and Chief Prosecuting Attorney for Riverkeeper

Robert Miller, ***Managing and Protecting Trees in an Urban Environment***, Editor, Journal of Arboriculture

Sam Moore, ***"Integrating Sustainable Development and Business Strategy"***, VP, Research and Development, Burlington Chemical Company

Riki Ott, ***Sound Truth and Corporate Myth$: The Legacy of the Exxon Valdez Oil Spill,*** Scientist and Author

Seth Reice, ***A First Hand Look at Global Environmental Issues,*** Biology Professor, UNC-Chapel Hill

Judith Samuelson, ***Leaders for Global, Sustainable Society: The Role of Business Education,*** Business and Society Program, Aspen Institute

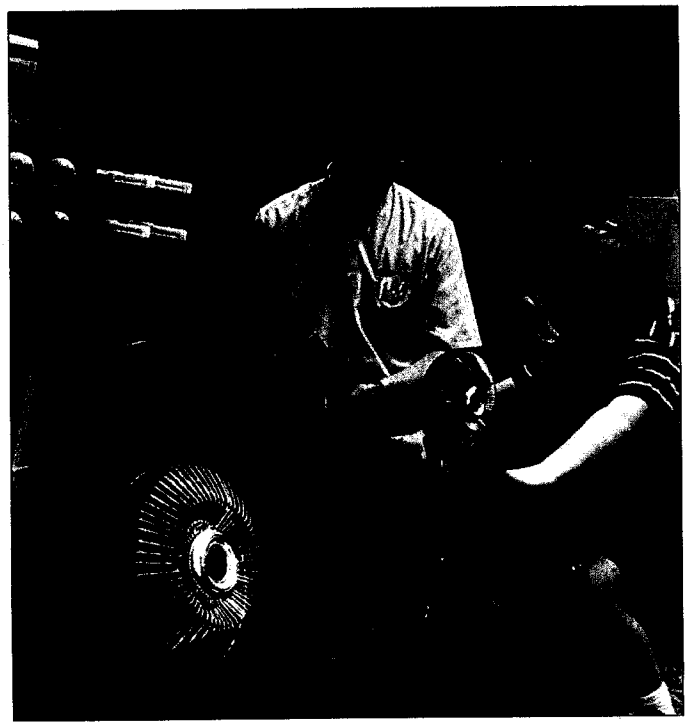
Hernando de Soto, Economist and Author of ***The Mystery of Capital***

David Vogel, ***Trading Up or a Race to the Bottom? The Impact of Globalization on Environmental Standards,*** University of California – Berkeley .

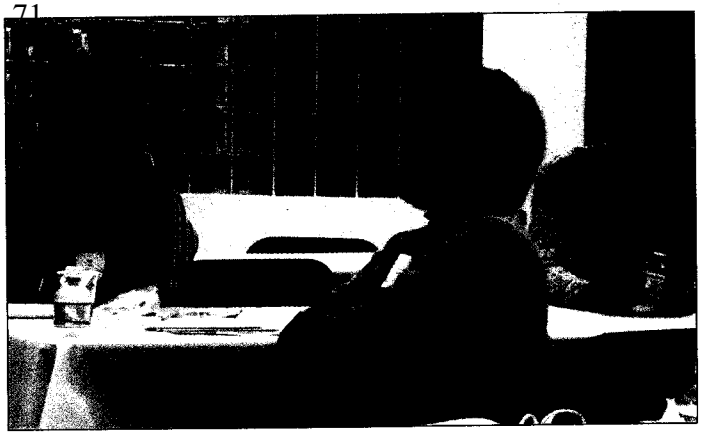
Robert Watson, ***Sustainable Community Building,*** Natural Resources Defense Council, US Green Building Council

Spenser Weart, ***The Discovery of Global Warming,*** Director of the Center for History of Physics, American Institute of Physics

E.O. Wilson, ***Diversity of Species***, Two-time Pulitzer Prize Winner, Research Professor and Honorary Curator of Entomology for Harvard University's Museum of Comparative Zoology



71



BROWN BAGS

Brian Chossek, President, Seven Oaks Ranch

Build It and They Will Walk? Physical Activity and the Built Environment, Daniel Rodriguez, UNC

Can't We All Just Get Along?: A Unique Demonstration of Inter-Regional Collaboration in North and South Carolina. The Sustainable Environment for Quality of Life (SEQL) Program, Centralina Council of Governments & EPA

Daylighting, Alicia Ravetto, Architect

Eco-tourism in Nicaragua, Richard Harkrader, Developer

Emory's Green Building Experience, John Wegner, Campus Environmental Officer, Emory University

Energy Awareness in a Laboratory Setting, Ralph Taylor, UNC Energy Manager

Energy Star, talks by Steve Jurovics and online conferences

Jack Blackmer, Environmental Affairs Manager, Novozymes

Jacob Halcomb, Green Building Consultant, Group Six

LEED for Existing Buildings, Paul Van Paumgarten, Johnson Controls, U.S. Green Building Council

Life Cycle Costs of Building Commissioning, Brian Ketchum, Scott Weaver, Chris Wedding, Students in MBA Life Cycle Management Class

Performance Contracting for State Agencies, Vince Throop, State Energy Office

Promoting Safe Walking & Cycling to Improve Public Health: Lessons from Europe, John Pucher, Rutgers University

Rich Roberts, Managing Director, Urban Investment Fund, Goldman Sachs

Urban Revitalization Barcelona Style: Implications for Planning in the US, Bill Rohe, UNC, Director of the Center for Urban and Regional Studies

Why now is the time to build a clean energy future: An Indigenous Perspective on Climate Change in the Arctic, Elaine Alexie, 25 Year Old Film Maker and Member of the Tetlit Gwichin First Nation from Fort McPherson, Northwest Territory, Canada

RESOURCES

Guidelines

Greening Federal Facilities
http://www.eere.energy.gov/femp/technologies/sustainable_resources.cfm

High Performance Guidelines:Triangle Region Public Facilities
http://www.tjcog.dst.nc.us/hpgtrpf.htm

NC Executive Order 156
http://www.sustainablenc.org/main/orders.htm#156

The Greening Curve: Lessons Learned in the Design of the New EPA Campus in North Carolina
http://www.epa.gov/rtp/new_bldg/environmental/thegreeningcurve-new.pdf

UNC Design & Construction Guidlines
http://www.fpc.unc.edu/DesignGuidelines.asp

US Green Building Council
Leadership in Energy & Environmental Design (LEED) Rating System
http://www.usgbc.org/

UNC Chapel Hill

Carolina Center for Public Service
http://www.unc.edu/cps/

Center for Healthy Student Behaviors
http://www.shs.unc.edu/chsb/index.html

Commuter Alternatives Program
http://www.dps.unc.edu

Energy Services
http://www.energy.unc.edu/

Environment Health and Safety
http://ehs.unc.edu/

Facilities Planning and Construction
http://www.fpc.unc.edu

Facilities Services
http://www.fac.unc.edu

North Carolina Botanical Garden
http://www.ncbg.unc.edu/

Office of Waste Reduction and Recycling
http://www.fac.unc.edu/wastereduction

Our Community
http://www.unc.edu/community/

Surplus Property Office
http://www.ais.unc.edu/msd/mmd/Surplus/Surplus.htm

UNC Sustainability Office
http://sustainability.unc.edu

ACADEMICS 72

Active Living by Design
http://www.activelivingbydesign.org

APPLES Service Learning Program
http://www.unc.edu/apples/

Carolina Environmental Program
http://www.cep.unc.edu/

Carolina Entrepreneurial Initiative
http://www.kenan-flagler.unc.edu/KI/cei.cfm

Center for Community Capitalism
http://www.ccc.unc.edu

Center for Environmental Health and Susceptibility
http://www.sph.unc.edu/cehs/

Center for Environmental Modeling for Policy Development
http://cf.unc.edu/cep/empd/index.cfm

Center for Sustainable Enterprise
http://www.cse.unc.edu

Center for Urban and Regional Studies
http://www.unc.edu/depts/curs/

City and Regional Planning Department
http://www.planning.unc.edu/

CRed – The Community Carbon Reduction Project
http://www.cep.unc.edu/cred/

Environmental Resource Program
http://www.sph.unc.edu/erp/

Institute for Advanced Materials, Nanoscience and Technology
http://www.advancedmaterials.unc.edu

Interdisciplinary Obesity Center
http://www.cpc.unc.edu/idoc

Urban Investment Strategies Center
http://www.kenan-flagler.unc.edu/KI/urbanInvestment/index.cfm

STUDENT GROUPS

Carolina Environmental Student Alliance
http://www.unc.edu/student/orgs/cesa/

Net Impact
http://www.net-impact.org/

Renewable Energy Special Projects Committee
http://respc.unc.edu/

Student Environmental Action Coalition
http://www.unc.edu/student/orgs/seac/

Students United for a Responsible Global Environment
http://surgenetwork.org/

North Carolina

Chapel Hill-Carrboro Chamber of Commerce Council on a Sustainable Community
http://www.carolinachamber.org/csc/draft_report.html

N.C. Green Power
http://www.ncgp.org/

N.C. Project Green
http://www.sustainablenc.org

North Carolina Solar Center
http://www.ncsc.ncsu.edu/

North Carolina Sustainable Energy Association
http://www.ncsustainableenergy.org/

Sustainable Fort Bragg
http://www.bragg.army.mil/sustainability/

Higher Education

APPA: The Association of Higher Education Facilities Officers
http://www.appa.org/

Association for the Advancement of Sustainability in Higher Education
http://www.aashe.org/

Campus Consortium for Environmental Excellence
http://c2e2.org/

EPA Sector Programs – Colleges and Universities
http://www.epa.gov/sectors/colleges/

National Association of College and University Business Officers (Search Sustainability)
http://www.nacubo.org/search/

National Wildlife Federation Campus Ecology Program
http://www.nwf.org/campusecology/

New Jersey Higher Education Partnership for Sustainability
http://www.njheps.org/

Northeast Campus Sustainability Consortium

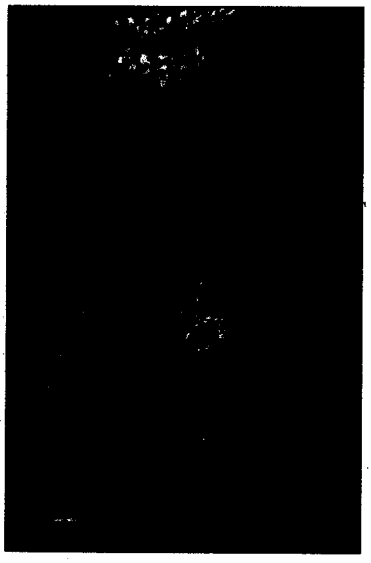
Pennsylvania Consortium for Interdisciplinary Environmental Policy
http://www.paconsortium.state.pa.us/

Society for College and University Planning
http://www.scup.org/

United Nations Decade of Education for Sustainable Development
http://www.uspartnership.org/

ADD THIS TO THE BOTTOM OF YOUR WEBSITE

[My Department] is a campus sustainability partner



UNC Sustainability Office

Facilities Services
103 Airport Drive
UNC Chapel Hill
Chapel Hill, NC 27599-1800

919-843-7284
sustainability@unc.edu
http://sustainability.unc.edu

Sustainability at UNC-Chapel Hill