

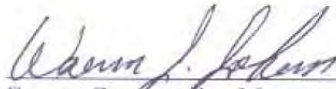
**UNIVERSITY OF NORTH CAROLINA
AT CHAPEL HILL**

**STRATEGIC ENERGY
AND WATER PLAN**

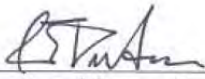
October 2007

I have read the Strategic Energy & Water Plan for the University of North Carolina at Chapel Hill. The plan, as presented, supports the reductions required in Senate Bill 668.

Implemented this 1st day of October, 2007



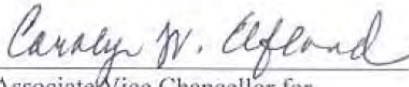
Energy Conservation Manager



Director of Energy Services



Director of Facilities Services



Associate Vice Chancellor for
Campus Services

Executive Summary

The University of North Carolina at Chapel Hill strives toward three strategic energy goals:

- Providing reliable, cost effective energy and water supply and services
- Designing and maintaining high performance buildings
- Educating and engaging the campus community in energy conservation

Data presented in Tables 1 and 2 were extracted from Energy Service’s billing records. Gross square footage represents the total space calculations from the Engineering Information Services Plan Room as of June 30, 2007. UNC Hospitals and Energy Services are not included in either consumption or gross square footage data. Energy Services’ operating costs are captured in UNC utility rates which are indirectly reflected in Table 1.

Table 1. Five-year record of progress in energy reduction

Year	Total Energy Costs	Total GSF	Energy Costs per GSF	Total mmBTU	BTU per GSF	% Change in BTU per GSF relative to baseline
2002-03	\$47,524,510	13,477,719	\$3.53	2,238,334	166,077	
2003-04	\$46,743,474	13,537,153	\$3.45	2,144,554	158,420	-5%
2004-05	\$48,554,958	13,623,133	\$3.56	2,186,333	160,487	-3%
2005-06	\$56,842,721	15,680,862	\$3.62	2,328,343	148,483	-11%
2006-07	\$64,099,991	16,292,696	\$3.93	2,485,851	152,575	-8%

Table 2. Energy Mix

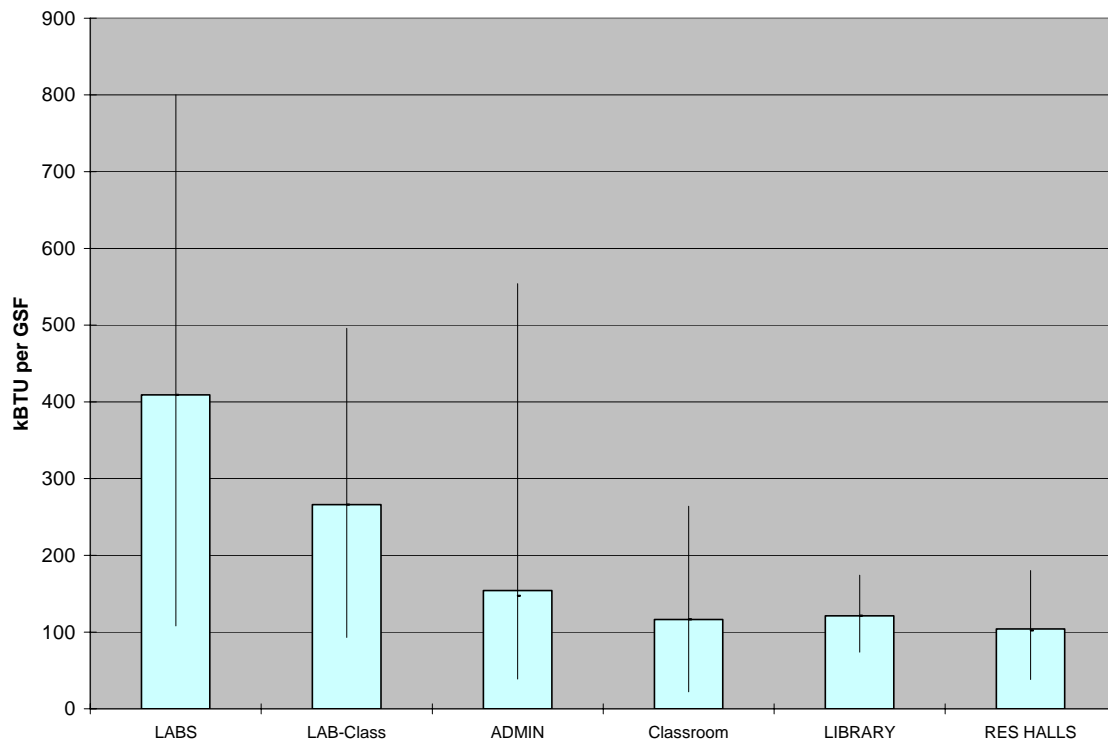
	Total mmBTU	% Electricity	% Natural Gas	% Steam	% Chilled Water
2002-03	2,238,334	36%	4%	46%	15%
2003-04	2,144,554	37%	3%	44%	16%
2004-05	2,186,333	38%	3%	42%	16%
2005-06	2,328,343	38%	3%	40%	17%
2005-07	2,502,937	38%	4%	43%	15%

Energy Use in Facilities

One million dollars in supplemental funding was provided for energy conservation projects late in FY07. Projects identified in the tables were funded through operating or capital budgets and a remainder of the FY06 energy funds. The funds were used primarily for lighting retrofits. The campus still has 40-60 buildings that have some T-12 lighting. It is our goal to retrofit the lighting in all of these buildings by 2010.

Five new capital projects, totaling 930,768 gsf, came online during FY07. Three of those buildings (362,571 gsf) are labs or data centers. Labs and data centers use 3-4 times as much energy per square feet as other campus facilities. New technologies, commissioning, and retrocommissioning are reducing the energy profile of labs over time. Over the next year, Facilities staff will investigate the energy consumption of campus data centers, which are now classified as administrative buildings.

Figure 1. Energy Intensity by Building Type Maximum; Average; Minimum



Energy Supply

Cogeneration: Energy Services has completed installation of Black Start Diesel Generators, greatly enhancing the reliability of the steam and electricity production, by allowing the plant to restart its boilers should Duke Energy's system not be available. These generators also enable the University to save money by generating more electricity when Duke's hourly prices are high.

A new cooling tower will allow the turbine generator to produce more electricity on warm days when cooling capacity currently limits generation. Additionally, Energy Services is completing a long term project to replace a significant amount of main steam and hot water distribution piping. The new piping is better insulated, and is larger where appropriate, both of which help limit distribution system energy losses.

In conjunction with other construction projects, almost 10 miles of new steam and condensate piping has been installed over the past 10 years. Yet by consolidating older, smaller networks, the overall length of pipe has remained relatively constant. This improved network has increased the amount of steam reaching customers by 7 percent since 2000. Today, approximately 91 percent of the steam leaving the central plant reaches its destination before it condenses and is returned to the plant to be re-boiled.

Nine thousand feet of aging hot water pipes and 7,000 feet of steam lines have been replaced since 2000. Because the new lines are better insulated and larger in diameter, more net energy is delivered to campus buildings. This increased thermal efficiency is equivalent to saving approximately 10,000 pounds per hour in steam production, enough to heat 1,600 average homes.

The Cogeneration Facility was recognized by the EPA's Combined Heat and Power Partnership program on January 3, 2007, for its greenhouse gas emissions reduction. The UNC facility produces 0.2458 metric tons of carbon equivalents less than a typical heat and power facility. This is equivalent to planting 15,005 acres of forest or removing the emissions of 10,003 automobiles.

Chilled Water: The Gary W. Tompkins Chilled Water Operations Center completed its first full year of service in FY07. It includes a 6,000 ton chilled water plant and a 5 million gallon stratified cold water Thermal Energy Storage (TES) system. The TES system shifts a portion of the university's chilled water production to off-peak periods, reducing the need to purchase electricity from Duke Energy during peak times and at peak rates. Operation of the new TES system has saved the University \$189,778 during FY07 and shaved the campus electrical peak by 13 megawatts.

Energy Service's replaced a section of 24" distribution piping adjacent to the S-10 vault at the South Chiller Plant. This replacement made room for a new 100kV duct bank and eliminated one of the largest distribution system leaks. Loop makeup for July was 140,000 gallons (37%) lower than the historical July average. Projected annual

distribution loop makeup water savings is 1.5M gallons with annual water and chemical cost savings of \$55,000.

Chilled Water began consumption-based billing for all customers using Energy Services' new Lodestar billing system. Real-time cooling load data for each building is collected in a database historian and provided automatically to Lodestar for monthly billing.

Electric Distribution: Energy Services continues to update the electric infrastructure system to ensure adequate capacity for all campus existing and new loads. Development and implementation of the Supervisory Control and Data Acquisition (SCADA) system, including the fiber optic metering system is underway.

Data Management

Energy Services is developing the process to provide interval consumption data for steam, chilled water and electricity to the University's Energy Management Control System for use in its new Enterprise Building Management System (EBMS). The interval data provided by Energy Services will be used for building diagnostics and to verify operational savings resulting from energy upgrades. A central data repository contains five minute interval consumption data from Cogeneration, and Chilled Water. Electric Distribution's SCADA system will provide this interval data for all service units by 2010.

Energy Services is updating its website to provide online utility cost and consumption data to its customers. Customers will be able to access and compare their current and historical monthly utility cost and consumption data by utility, account, or service unit.

Organizational Integration

Teaching: Faculty in Business, Environmental Sciences and Engineering, Public Policy, Social Work, and Physics regularly integrate issues of climate and energy into their coursework. In 2006 students in a graduate Social Work course developed an extensive rating instrument for the local Chamber of Commerce to use in setting up a Sustainable Business Certification Program, which includes energy efficient facilities and use of non-vehicular transportation. Another group of undergraduate students formed a start-up business to conduct energy audits for local businesses through the Carolina Challenge (Carolina Entrepreneurial Initiative). Capstone students in the Institute for the Environment worked with the towns of Chapel Hill and Carrboro to gather and analyze data on greenhouse gas emissions.

Research: The Institute for the Environment (IFE) houses the Center for Sustainable Energy, Environment, and Economic Development, The Center for Environmental Modeling for Policy Development, and the Center for Sustainable Community Design. These centers work with communities across North Carolina and the country to provide environmental expertise in the areas of renewable energy, transportation, air quality, and carbon reduction.

Public Engagement: Student organizations, such as the CESA, SEAC, Net Impact, S.W.E.A.T, Focus the Nation, and student government provide students with the opportunity to apply what they learn in the classroom to public service. These groups work closely with the Sustainability Office to conduct facilities inventories, staff events, and share information with the campus community.

APPENDIX

Energy Use in Facilities

Past Year Accomplishments	Measurement	Savings Actual/Anticipated	Cost	Funding Resource
Retro-commissioning assessments on 4 buildings	Energy consumption	Savings will come from implementation of recommendations which will be reported next year.	\$68,000	Operating & R&R budgets
Commissioned 3 buildings	Energy consumption	At least 5% utility expenses per building	\$500,000	Capital budget
Retrocommissioned 1 BSL3 suite	Energy consumption	At least 5% utility expenses per building	\$30,000	Capital budget
Added energy efficient motors to 3 buildings	Electric consumption	\$9,374 (2.4 years expected payback)	\$22,300	Budget Committee
Solar Hot Water	Steam Consumption	\$14,419 (27 years expected payback)	\$394,000	Capital budget
Lighting retrofits (lamps, ballasts, and fixtures) on 3 buildings	Electric consumption	\$6,766 (4.7 years expected payback)	\$32,000	Budget committee carry forward
Lighting retrofits (lamps and ballasts only) on 1 building	Electric consumption	\$17,673 (1.1 years expected payback)	\$19,000	Budget Committee
Occupancy sensors on 3 buildings	Electric consumption	\$6,787 (4.6 years expected payback)	\$31,500	Budget Committee
Light timers in ME Room Timers for 10 buildings	Electric consumption	\$22,932 (1.0 years expected payback)	\$23,100	Budget Committee
Outside air dampers on 1 building	Electric consumption	TBD	\$2,200	Budget Committee
FY08 Planned Activities				
Retro-commissioning for 3 buildings	Energy Consumption	TBD	\$100,000	Capital budget
Design Phase Retro-commissions for 6 buildings	Energy Consumption	TBD	TBD	TBD
Strategic Energy Plan	Energy Consumption	TBD	\$200,000	Budget Committee and Operating Budget
Replace all standard, non-dimmable incandescent lighting on campus	Electric Consumption	Estimated 4 month payback	\$12,000	Budget Committee
Lighting Retrofits (T-12 to T-8/T-5)	Electric Consumption	TBD	\$400,000	Budget Committee
HVAC improvements	Energy consumption	TBD	\$500,000	Budget Committee

Lighting Retrofits (T-12 to T-8/T-5) for 6 buildings (xx GSF)	Electric consumption	TBD	\$500,000	SEO request
HVAC improvements	Energy consumption	TBD	\$400,000	SEO request

Energy Data Management

2007 Accomplishments	Measurement	Savings Actual/Anticipated	Cost	Funding Resource
Implementation of Enterprise Building Management System	Energy savings	TBD	\$3,000,000	Capital project budget
Implement of new utility billing and tracking system	Billing accuracy	TBD	\$300,000	Operating budget
Installation of automated steam metering	Billing accuracy	TBD	TBD	Operating budget
Installation of automated electric metering (partial)	Billing accuracy	TBD	\$2,500,000	Operating budget
Future Planned Activities				
Energy consumption database	Energy analysis	TBD	\$200,000	TBD

Energy Supply Management

2007 Accomplishments	Measurement	Savings Actual/Anticipated	Cost	Funding Resource
Central facilities chilled water plant	Energy Savings/ Capacity	TBD June 2008	\$1,500,000	Capital project budget
New steam and chilled water lines	Capacity, Efficiency	TBD	\$40,000,000	Capital project budget
Addition of steam plant on Manning Dr	Capacity	TBD	\$30,779,300	Capital project budget
Addition of 10,000 ton Northeast Chiller Plant	Capacity	TBD	\$34,136,961	Capital project budget
Cogeneration emergency generator	Reduced outage time	TBD	\$5,000,000	Capital project budget
2008 Planned Activities				
Replace steam tunnel and piping	Capacity, Efficiency	TBD	\$50,000,000	Capital project budget
New electrical ductbanks; cable	Capacity; Efficiency	TBD	\$15,000,000	Capital project budget
Cogen cooling tower replacement	Capacity, Efficiency	TBD	\$10,800,000	Capital project budget
Replacement of gilsulate steam and hot water piping	Energy savings	TBD	\$20,000,000	Capital project budget

Organization Integration

2007 Accomplishments	Measurement	Savings Actual/Anticipated	Cost	Funding Resource
Educate the campus community on energy conservation accomplishments	<ul style="list-style-type: none"> • Sustainability Reports distributed • Website hits • Event attendees 	<ul style="list-style-type: none"> • 200 reports distributed • 	\$2,941	Operating budget
Weekly email update to listserv with energy saving tips, energy events, etc.	600+ subscribers	N/A	Staff time, materials	Operating budget
Carbon Reduction commitments: CRed 2006 and College and University President's Climate Commitment		TBD	No Cost	N/A
LEED APs certified	Certifications completed	12	No cost	N/A
Carrington Hall LEED certification	Certification completed			Capital budget
Public events to educate the campus community on ways to save energy and reduce carbon emissions	<ul style="list-style-type: none"> • Earth Day • Campus Sustainability Day • Building tours • Movies • Focus the Nation planning 	N/A	\$7,000+ Staff Time	Operating budget
Remove incandescent light bulbs from task lighting on campus	Distribution of compact fluorescent bulbs at campus events	200 CFLs	\$300	Operating budget
Energy and Environment Symposium	Attendance	150	TBD	Operating
Integrate energy conservation into the curriculum	# of courses offered	TBD	N/A	N/A
Signage highlighting green building features in Carrington Hall	TBD	TBD		School of Nursing, Sustainability Office operating budget
Interaction with students for both education and using their 'eyes on the ground' to identify energy saving opportunities	Participation in Green Games; volunteer efforts such as counting the number of single stall restrooms	N/A	\$280 + Staff Time	Operating budget
FY2008 Planned Activities				
Publish 2007 Campus Sustainability Report	Distribution	TBD	TBD	Operating budget
Campus Sustainability Day with Chancellor and Senator Cowell as speakers, public exhibits	Attendance	TBD	TBD	Operating budget
Energy & Sustainability Awareness Campaign	Awareness and commitment, energy savings	TBD	TBD	Operating budget

Campus Pledge to eliminate all incandescent lights by January 31, 2008	Number of bulbs replaced	TBD	\$12,000	Operating budget
Building level energy consumption and billing data available to campus community	Awareness	TBD	TBD	Operating budget
Expanded training program for controls technicians & HVAC staff	Problem resolution	TBD	TBD	Operating budget
Energy monitoring & feedback display system for Morrison Residence Hall and additional buildings	Awareness	TBD	TBD	Student fees, grants, operating budget

Equipment Efficiency

2007 Accomplishments	Measurement	Savings Actual/Anticipated	Cost	Funding Resource
Add VFDs to AHUs	Electric consumption	TBD	See Energy Use in Facilities table	Budget committee, Operating budget
Energy Efficient Motors	Electric consumption	TBD	See Energy Use in Facilities table	Budget committee
Boiler Controls	Electric consumption	TBD	See Energy Use in Facilities table	Operating budget
Lighting Upgrades	Electric consumption	TBD	See Energy Use in Facilities table	Budget committee
FY2008 Planned Activities				
Fumehood training for HVAC technicians	Electric consumption	TBD	None	Operating Budget
HVAC improvements	Energy consumption	TBD	See Energy Use in Facilities table	Building and Grounds, SEO
Lighting Upgrades	Electric consumption	TBD	See Energy Use in Facilities table	Building and Grounds, SEO

Water

2007 Accomplishments	Measurement	Savings Annual Actual/Anticipated	Cost	Funding Resource
Metered or infrared faucets in 5 new buildings	Water & Sewer savings	812,994 gallons	\$7,012	Capital project budget
Ultra low-flush urinals, 0.5 gal per flush (2 buildings)	Water & Sewer savings	126,685 gallons	\$1,092	Capital project budget
Low-flow showerheads in new residence halls	Water & Sewer savings	21,546 gallons	\$185	Capital project budget
Dual flush toilets in public restrooms in all in new residence halls	Water & Sewer savings	31,200 gallons	\$ 269	Operating budget
Front loading washing machines in residence halls	Water & Sewer savings	1,035,299 gallons	\$8,929	Operating budget
Closed loop stills replaced in 2 buildings	Water & Sewer savings	367,200 gallons	\$3167	
Filter backwash system replacement at indoor and outdoor pools	Water & Sewer savings	163,800 gallons	\$1412	Maintenance Funds
Love House Displaced storm water rain barrel for irrigation	Displaced storm water	2,226 gallons	\$10	Capital project budget
ITS Manning	Displaced storm water	TBD	TBD	Capital project budget
Global Education 2 green roofs, cistern, infiltration bed, rainwater to flush toilets	Displaced storm water, reduced potable water usage	TBD	TBD	Capital project budget
Daniels Students Stores renovation	No additional runoff due to change in land cover	TBD	TBD	Capital project budget
No net increase in runoff for new buildings and renovation projects. (3 new or renovated buildings)	Displaced storm water	4,897 cubic feet	\$301,666	Capital project budgets
2008 Planned Activities				
Install dual flush valves on commodes in women's restrooms (xx buldings)	Water and Sewer savings 321,864 gallons (savings based on manufacturer's estimate)	TBD	\$2776	Operating budget
Foundation Drain Water Recovery from Genetic Medicine Building for Cooling Tower Use	Water savings 3,700,000 gallons	TBD	\$16,520	Operating budget
Change Fire Pump Testing to Venturi Package, two out of every three years	Water savings	1,125,000 gallons	\$5651	Operating budget
Hanes Hall Cistern	Water savings	150,000 gallons	\$670	Capital project budget

(Water continued)

2008 Additional Drought Modified Water Use (Temporary Savings)				
Minimize condensing generation at Cogen Facility	Water savings	7,000,000 gallons	\$31,255	Operating budget
Reduced test run time on Emergency Generators and Fire Pumps to 2 to 3 minutes	Water savings	40,000 gallons	\$178	Operating budget
Hand watering using non-potable water in tanks	Water savings	36,000 gallons	\$160	Operating budget
Delayed new plantings	TBD	TBD	TBD	Operating budget
Irrigation reduction on landscape, discontinue spray	Water savings	12,000,000 gal/year	\$53,580	Operating budget
Athletics Irrigation reduction	Water savings	10,920,000 gal/year	\$48,757	Operating budget
Discontinue vehicle washing	Water savings	255,000 gal/year	\$2,199	Operating budget
Turn off decorative fountains	Water savings	168,000 gal/year	\$750	Operating budget
Discontinue Street and Sidewalk Cleaning	Water savings	10,000 gal/year	\$45	Operating budget
Discontinue Window Washing (approx. 130 buildings)	TBD	TBD	TBD	Operating budget
Reduce Quarterly fire sprinkler testing to annual	Water savings	3,000 gal/year	\$13	Operating budget
Revise food waste processing at Dining Halls	Water and sewer savings	1,560,000 gal/year	\$13,455	Operating budget
Remove Dining Hall Trays	Water and sewer savings	279,000 gal/year	\$2,406	Operating budget
Cancel Parking Deck Power Washing	Water savings	TBD	TBD	Operating budget
2009 Future Potable Water Savings				
OWASA Reclaimed Wastewater in Cooling Towers	Water savings	210,000,000 gallons	TBD	Capital project budget

