



THE UNIVERSITY  
of NORTH CAROLINA  
at CHAPEL HILL

October 29, 2010

Chancellor Holden Thorp  
UNC-Chapel Hill  
103 South Building  
Chapel Hill, NC 27599

Dear Chancellor Thorp:

On behalf of the 2010 UNC-Chapel Hill Energy Task Force, I respectfully submit the final report of findings and recommendations for your consideration. There were two phases to our deliberations: the first focused on “supply-side” or energy generation opportunities; the second, on “demand-side” or energy efficiency opportunities to reduce greenhouse gas emissions, while meeting cost and technical parameters that are largely inflexible.

The energy landscape is changing rapidly, with new and improved technologies arising almost daily to meet the energy demands of a state that is adjusting to a carbon constrained future. For that reason, our recommendations are not intended to be prescriptive as to technologies or fuels that might meet those lower carbon targets. On the other hand, we have provided timetables, where appropriate, that we believe are reasonable to reduce demand and transition from carbon intensive fuels to a range of alternatives.

We recognize that under the highly constrained budget environment that the University faces, implementation of some demand-side recommendations may be impossible in the near-term. However, the rapid payback of these measures is likely to yield long-term savings that should prove helpful in out-years.

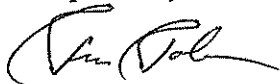
We wish to commend our students for the vigor and passion with which they have pursued this issue on campus. Our report has greatly benefited from their active participation. We offer hearty congratulations to both the students and the administration for winning the Environmental Protection Agency’s first national building competition. This national recognition speaks volumes to UNC-Chapel Hill’s leadership standing among universities for energy and carbon reduction.

We also wish to thank the Campus Services Division, in particular Associate Vice Chancellor Carolyn Elfland and her superb staff, for their presentations, responsiveness, and creativity as we looked to find real solutions to meet the needs of

a changing community and state. We wish to further commend the University for acting boldly in May, 2010 to adopt the interim recommendations of this task force.

The Task Force asked me to convey our gratitude for the opportunity to serve. It is noted that the final report was endorsed by the full Task Force. Special thanks go to our student representatives, Elinor Benami and Mary Cooper, as well as to Ms. Tanya Moore for her exceptional talent and diligence organizing the process and the work product from a diverse and prolific membership. It was an honor to Chair this body.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Tim Toben", written in a cursive style.

Tim Toben, Chair  
UNC Energy Task Force

## ENERGY TASK FORCE FINAL REPORT, OCTOBER 2010

### **Background**

In January 2010, Chancellor Holden Thorp appointed an Energy Task Force to study energy and carbon reduction plans at UNC-Chapel Hill. Though UNC-Chapel Hill has won numerous awards for being a national leader in campus sustainability, the Chancellor charged this body with assessing current and future energy plans to determine if more could yet be done and on a more ambitious schedule.

### **Energy Task Force Appointees**

The task force includes faculty, students, a trustee, a member of the community-at-large, a former mayor and Secretary of the N.C. Department of Environment and Natural Resources, the State Director of N.C. Chapter of the Sierra Club, and the Chair of the N.C. Energy Policy Council.

- Tim Toben – Chair, N.C. Energy Policy Council and Chair, Board of Visitors, UNC-Chapel Hill Institute for the Environment
- Richard (Pete) Andrews – Professor and Chair, Department of Public Policy
- Elinor Benami – 2009-2010 senior adviser to the executive branch of student government
- Mary Cooper – 2009-2010 co-chair of student government's Environmental Affairs Committee
- Molly Diggins – State Director, N.C. Chapter of the Sierra Club
- Jonathan Howes – Former Special Assistant to the Chancellor for Local Relations and former Secretary, N.C. Department of Environment, Health and Natural Resources
- David McNelis – Research Professor and Director, Center for Sustainable Energy, Environment and Economic Development, UNC-Chapel Hill Institute for the Environment
- Royce Murray – Kenan Professor of Chemistry, College of Arts and Sciences
- John Cooper – Board of Visitors, UNC-Chapel Hill Institute for the Environment, and Program Director, MDC Inc., Expanding Opportunity, Advancing Equity.
- Alston Gardner – Member, UNC-Chapel Hill Board of Trustees and Managing Partner, Fulcrum Ventures

### **Purpose of the Task Force**

The UNC-Chapel Hill Energy Task Force was asked to evaluate campus energy issues and plans to become climate neutral by 2050 and to make its recommendations within 6-9 months. UNC-Chapel Hill is a signatory to the American College and University's Climate Commitment (ACUPCC), which pledges climate neutrality by mid-century.

## **Meeting Structure and Delivery of Final Report**

The first half of Task Force deliberations focused on energy generation at UNC-Chapel Hill. References to generation are referred to in the report as “supply-side.” The second half focused primarily on campus energy usage patterns and energy efficiency and conservation, though the Task Force has continued to monitor issues related to energy generation. References to energy efficiency are referred to in the report as “demand- side.” The final report summarizes findings to date and make recommendations largely based on secondary research and testimony from subject matter experts. These final recommendations are part of the university's overall commitment to phase out fossil fuels and fulfill the goals outlined in the 2009 Climate Action Plan.

## Section I: Supply-side Report

The interim report focusing on energy generation contained six recommendations that Chancellor Thorp adopted in May. From this point forward, the Task Force will refer to the “interim report” as the “supply-side report.” The Task Force subsequently added a seventh recommendation for Chancellor Thorp’s consideration, which is noted separately from the previously approved recommendations. All recommendations are consistent with the University’s overall commitment to phase out fossil fuels.

### Baseline Assessment

According to the 2009 Climate Action Plan, and based on results from the 2008 greenhouse gas inventory, UNC-Chapel Hill emitted approximately 570,000 metric tons of carbon dioxide equivalents (MTCDE) in 2008. Of those annual emissions, about 330,000 tons, or roughly 58% of total GHG’s, came from a single source -- burning coal at the UNC-Chapel Hill Cogeneration Plant on Cameron Avenue.

The UNC-Chapel Hill Cogeneration Plant is one of the most efficient coal burning plants in the country, with almost 70% efficiency, as compared to electricity-only generating plants that operate at only 35-38% efficiency. This improvement is enabled by using the steam after it drives the turbines, which is typically wasted, for beneficial purposes, such as sterilization in UNC-Chapel Hill’s medical facilities, and research laboratories, operations in the food service venues, and heating buildings. Ultimately, the steam produces chilled water after condensing, which is then used to cool buildings and equipment. Cogeneration is also referred to as “combined heat and power,” or CHP, and is recognized by the U.S. Environmental Protection Agency (EPA) and N.C. Department of Natural Resources (DENR) as one of the more effective methods for reducing greenhouse gas emissions.

In addition to its highly efficient Cogeneration Facility, several other initiatives have earned UNC-Chapel Hill recognition as a campus sustainability leader. These include:

- Development of a district energy system;
- Ambitious composting, recycling, and waste diversion programs;
- Development of a reclaimed and non-potable water system;
- Innovative stormwater management practices to substantiate UNC-Chapel Hill’s commitment to a no net increase in stormwater runoff on campus despite major new building construction;
- Green building commitment: All non-healthcare buildings at Carolina North designed to meet or exceed LEED-Silver standard;
- Development of a campus/community mass transit system and a commuter alternatives program;
- The student-initiated and managed renewable energy fee, which amounts to approximately \$200,000 per year and has contributed to projects such as the

solar array on Morrison Residence Hall, a geothermal heating and cooling system at the new N.C. Botanical Garden Education Center, biodiesel use in the University bus fleet, energy-efficient lighting renovations, and other projects;

- Development of campus-wide bike lanes, pedestrian paths and crosswalks;
- Development of individual building energy “dashboards” to report real time energy consumption with automated metering;
- A 174-panel solar thermal array on Morrison Residence Hall--one of the largest arrays in the Southeastern United States.

### Supply-side Findings

Despite its extraordinary efficiency, the cogeneration plant still burns coal—the most carbon intensive of the fossil fuels and the target of increased state, national, and international regulation. Coal is the primary source of greenhouse gas emissions from the electric sector. New and proposed regulation will undoubtedly increase its cost. Previous regulation, which increased the cost of coal use include Title IV of the 1990 Amended Clean Air Act, which established a cap and trade system to regulate sulfur dioxide and North Carolina’s 2002 Clean Smokestacks Legislation, which required coal-fired power plants in North Carolina to reduce their nitrogen oxide emissions by 77% in 2009 and sulfur dioxide emissions by 73% in 2013.

Southern Appalachian coal is reported as nearly twice as expensive as western coal, because the cost to extract the smaller seams is higher (Appalachian Voices presentation 4/14/10 and April 16, 2010 Argus Coal Weekly (p. 10) Powder River Basin verses Central Appalachia coal prices). The effect of recent and likely US EPA rulings is that more and more of the cost of negative “externalities” associated with coal extraction, use, and waste disposal will be assigned to coal, which should make alternatives to coal more cost-competitive. These rulings include:

- December 2009: US Environmental Protection Agency Endangerment Finding for six key well-mixed green house gases. The finding could result in the regulation of CO<sub>2</sub> emissions from power plants.<sup>i</sup>
- January 2010: US Environmental Protection Agency proposed new ozone standards, which would reduce allowable ground level ozone from 75 ppm to between 60-70 ppm.<sup>ii</sup> Power plants produce nitrogen oxides, which are the major precursor of ground-level ozone.
- April 2010: US Environmental Protection Agency issues revised guidance on water quality standards that restricts the practice of “valley fills” associated with mountain top or surface mining of coal.<sup>iii</sup>
- Likely 2010-11: US Environmental Protection Agency to increase regulation on mercury emissions and coal ash from power plants.<sup>iv</sup>

The UNC-Chapel Hill 2009 Climate Action Plan identifies four long-term alternative energy plans (p.9), two of which enable cessation of coal use by 2020. It is in the strategic best interest of the university to pursue these or other lower carbon alternatives, in light of the preponderance of climate science and increased public demand and expectation to move away from carbon intensive fuels. Such a shift would be consistent with the University's history of leadership in sustainability.

## **Conclusions and Supply-side Recommendations**

Based on secondary research and expert testimony, the Energy Task Force makes the following six near-term supply side recommendations:

### **Supply-side Recommendation #1: End all use of coal on the UNC-Chapel Hill campus by May 1, 2020.**

Once a firm date for conversion is established and an alternate fuel supplier is contracted, UNC-Chapel Hill may be able to convert from coal to its replacement fuel at a date earlier than May 1, 2020. An aspirational target of May 1, 2015 or before is recommended, pending successful test fires and scaling of the alternate fuel regime. *(Accepted and adopted as UNC-Chapel Hill Policy, May 2010)*

### **Supply-side Recommendation #2: UNC-Chapel Hill will seek to accelerate conversion from coal to a cleaner fuel or fuel mix.**

Because the Circulated Fluidized Bed (CFB) boiler in the Cogeneration Plant requires 50% solids to operate as specified, it is possible that some form of biomass (wood pellets or torrefied wood) may be substituted for coal. Yet given the rapid pace of developments in renewable markets, the Task Force recognizes that UNC-Chapel Hill may move in a different direction in order to meet the primary goal of ending coal use by 2020. Since we wish to ensure that one problematic fuel is not substituted for another, the committee encourages life-cycle analyses to be conducted prior to the adoption of any new fuel source. The goal is to convert from coal to an alternate, cleaner fuel or fuel mix at an earlier date if financially feasible. *(Accepted and adopted as UNC-Chapel Hill Policy, May 2010)*

### **Supply-side Recommendation #3: If "biomass" is utilized as the alternate fuel, it will be sourced from certified "sustainably managed" forests, as determined by third party verification.**

Woody biomass is a potentially large source of renewable energy for UNC-Chapel Hill and the state, but along with opportunity comes a new set of challenges. There are a lot of "undermanaged" forests in NC. Even as UNC-Chapel Hill is considering this source of lower-carbon fuel, moreover, all the state's major electric utilities will likely be considering it as well, in order to meet their legal mandate under the 2007 Renewable and Efficiency Portfolio Standard (REPS) target of 12.5% generation from renewable fuels by 2021. Currently, there is a debate emerging as to the

appropriate level of controls on sourcing to ensure that burning wood for energy does not have the unintended consequence of adversely affecting the state's forest resources and wildlife habitat.

Ideally the production of woody biomass for renewable energy could produce a revitalized commercial forest industry in North Carolina, with certified sustainable management practices and attendant benefits in jobs and revenues replacing widespread forestland that is not well managed either for human use or for wildlife. Without appropriate policies to assure this result, however, this increased demand could instead simply create incentives for more rapid and careless deforestation with attendant ecological and aesthetic damage. UNC would need contractual assurances that it source wood only from forests which are certified as "sustainably managed." Should UNC-Chapel Hill pursue woody biomass in the form of torrefied wood or wood pellets as an alternative fuel, the University has an opportunity to play a leading role in how this energy source is utilized and managed in the future in our state. *(Accepted and adopted as UNC-Chapel Hill Policy, May 2010)*

**Supply-side Recommendation #4: UNC-Chapel Hill will make best efforts to identify and secure coal that is certified by a third party and sourced from deep mines only. (i.e., not from surface or mountain top removal (MTR) mining).**

There will be a significant period of time (perhaps several years) during this transition that UNC-Chapel Hill will continue to burn coal. In the summer of 2008, UNC-Chapel Hill's Energy Services made a commitment not to purchase coal supplied via Mountain Top Removal mining practices. Mountain Top Removal can cause significant damage to surrounding human communities and entire ecosystems downstream from surface mines and is therefore not a practice UNC-Chapel Hill desires to support. To further clarify UNC-Chapel Hill's commitment that any purchased coal does not originate from practices that resemble Mountain Top Removal (valley fill, contour mining, etc.), UNC-Chapel Hill will make best efforts to purchase coal sourced from deep mines only.

There are still numerous open questions about MTR Coal, including (1) the sulfur content of deep mined coal vs. surface coal, (2) the cost to extract and transport deep mined vs. surface coal, and (3) the premium to the University for requiring deep mined coal. It was not clear that there was a supplier or certification authority who could/would verify "deep mined" coal, and typically coal is blended. The annual premium cost of \$1,000,000 for specifying deep-mined coal was suggested by Ray Dubose at the April 14 meeting, but our consultants suggested the cost might be even higher. All of these issues must be sorted out with the goal of eliminating the use of MTR mined coal.

To this effect, the Task Force further encourages 1) the use of "bonus points" or other contract incentives for non-MTR sourced coal and 2) a transparency/disclosure requirement that indicates where the coal is mined. *(Accepted and adopted as UNC-Chapel Hill Policy, May 2010)*

**Supply-side Recommendation #5: Optimize use of natural gas as supplies and costs warrant**

During the summer of 2009, coal consumption was cut dramatically and substituted with cleaner burning natural gas. Consistent with the CAP objectives, this model of optimizing gas is preferred, particularly when the coal/gas price is comparable. *(Accepted and adopted as UNC-Chapel Hill Policy, May 2010)*

**Supply-side Recommendation #6: Periodic (once every two years) reviews of the potential for solar thermal and solar PV system installations will be undertaken.**

The cost of solar thermal and solar photovoltaic systems continues to drop. Between 2007 and 2010, the cost of installed solar PV has dropped from approximately \$0.20/kWh to \$0.10/kWh, according to the North Carolina Sustainable Energy Association.

Moreover, third party financing has made these systems profitable in public institutions. These systems can clearly play a central role on the Carolina North Campus, but they may also provide retrofit opportunities on the main campus. *(Accepted and adopted as UNC-Chapel Hill Policy, May 2010)*

**Supply-side Recommendation #7: Develop public-private partnerships to advance energy generation and efficiency technologies on campus.**

Examples include:

- a) Creating third-party agreements for companies to install their renewable energy or energy efficiency technologies on university property, allowing the businesses to retain ownership of the devices for tax purposes.
- b) Collaborating with NC State University and the forestry industry to develop sustainable sourcing and transportation guidelines for biomass.
- c) Working with the Town of Chapel Hill and municipal solid waste (MSW) pelletizers to explore MSW as an alternative fuel option.

## Section II: Demand-side Report

### Baseline Assessment

#### Administrative initiatives

Cogeneration Systems Efficiencies: Cogenerating Systems is engaged in a project to increase production efficiencies. New high efficiency variable frequency drives are being installed on large boiler auxiliary motors, auxiliary energy usage is being reduced by 10%, and the combustion of the fluidized bed boilers is being optimized. In addition, improvements and replacements to the steam distribution system have reduced thermal losses by 7% to date, and this amount will increase significantly when the new tunnel from the cogeneration plant to the campus is completed.

Chilled Water Systems Efficiencies: Chilled Water Systems is engaged in a project to increase production efficiencies, with a goal to increase chiller efficiencies by more than one-third. During cooler months the efficiency of the Cobb Chiller Plant has exceeded that target through reduction of the condenser water temperature cooling the chillers. The same process will be used at the other chiller plants. The North Chiller Plant is being renovated now, with new equipment being installed, and will be the most efficient plant when the project is complete. Next, a plate and frame heat exchanger will be installed at the Tomkins Center. Chilled Water Systems also operates a 5 million gallon thermal energy storage system, where water for the campus cooling system is chilled at night and stored until daytime peak demand. By cooling the water at night, the electricity used is mainly from Duke Energy's baseload nuclear plants, which produce no CO<sub>2</sub> during operation, and the electricity also is lower in cost. Through the first two months of 2010-11, \$287,724 was saved in electricity costs.

Imaging Research Building (IRB) District Energy Plant: A small district energy plant is being installed in the IRB utilizing heat recovery chillers. The IRB will have a great deal of research equipment that will produce large amounts of heat. These areas will be cooled with a chilled water system but, instead of rejecting the excess heat to the atmosphere via cooling towers, the heat will be recovered and used to produce hot water for building heating. Initially the heating will be for the IRB, but the system will be capable of being expanded to heat about a half dozen surrounding buildings. This system will reduce demand for steam, thus reducing the amount of coal burned.

Energy Conservation and Efficiency Measures: [see glossary on last page] Energy conservation measures implemented in 2009-10 resulted in cost reductions of \$3.914 million. Only \$212,222 was spent out of pocket to achieve this total, along with 8,449 labor hours by Facilities Services engineers and HVAC technicians. This is anticipated to result in an annualized cost reduction of \$5 to \$6 million, equivalent to about a \$66 million energy savings performance contract based on a 12 year payback. Facilities Services has an annual recurring budget of \$200,000 for energy conservation initiatives and will continue to work on additional energy conservation measures in 2010-11. Efforts will focus on the remaining T12 lighting conversions, including preliminary

design for the Kenan Center; ductwork modifications in the Fed-Ex Global Education Center and Chapman Hall; airflow reductions at the Neurosciences labs; and on ARRA projects. Some of the recurring funding allocation was used to fund the match for an ARRA grant, with a resulting total of \$865,843 being available for lighting and HVAC projects. An additional \$100,000 in projects have been identified in case supplemental funding becomes available. These include a steam trap survey with replacements as needed, HVAC controls in Wilson Library, variable speed drives on HVAC equipment in Phillips and Beard Halls, and preliminary design of a heat recovery system for MBRB. Two other projects include Morrison residence hall, entered in the EPA's national building energy reduction competition and leading at the halfway point with a 19.2% reduction, and the kick-off of an education and incentive program for the campus community aimed at energy awareness and conservation.

*Energy Savings Performance Contract (ESPC):* ESPCs involve contracting with an energy savings contractor to identify an energy savings project, having the contractor guarantee the energy savings from the project, then constructing the project using debt financing and using the energy savings to service the debt. ESPCs are at a minimum a two-year process under State of North Carolina regulations, including identifying the target buildings, receiving detailed cost proposals, selecting the best proposal, then completing a detailed analysis of all the measures, entering into a final contract, and completing construction. The University is responsible for proper operation, and the savings are certified annually with the contractor liable to pay the university for any savings shortfall. At this point, we have screened all the potential buildings and selected 26 final candidates having a total of 2.7 million square feet and \$14.2 million in annual utility costs (variable portion only). Twenty of these buildings were included in the 09-10 ECM program, so we are sure we are not proposing any buildings with low hanging fruit savings. All will require investment in infrastructure we are unable to make because of lack of funding. The energy savings performance contractors will be invited to quantify the remaining savings in Fall 2010, followed by finalizing the candidate buildings and continuing with the ESPC process. The initial focus will be building controls upgrades, laboratory ventilation optimization, and heat recovery systems.

*Dashboard:* After defining requirements, issuing an RFP, and opening bids for software that would allow collection, aggregation, downloading, and display of building energy consumption data in a number of formats, the decision was made to reject all bids because of cost. Instead an agreement was negotiated with the Computer Science Department to have masters students write the system in conjunction with current applications programmers for Energy Services. The schedule called for a prototype by the end of the Fall 2010 semester, a beta version by the end of the Spring 2011 semester, with the final system going live by Fall 2011. Unfortunately, we were notified by Computer Science shortly after the start of the semester that they are unable to provide masters students because of high demand for projects. We are now considering what other options might be available to complete this project, including waiting until the Spring 2011 semester to see if students are available or hiring temporary programmers with the required skills.

## Student-Led Initiatives

### *Renewable energy and energy efficiency equipment installation and promotion:*

- a) **Renewable Energy Special Projects Committee (RESPEC)**—Funding of installation of photovoltaic panels on Morrison Residence Hall and the Belltower Parking Lot, Lab Fume Hood Energy Efficiency Campaigns, occupancy sensors in laundry rooms, lighting renovations in Playmakers Theatre, and a geothermal heating and cooling system at the NC Botanical Garden Education Center, among others.
- b) **NetImpact**—Installation of occupancy sensors in Kenan-Flagler Business School.
- c) **School Of Government (SoG) Environmental Group**—Installation of occupancy sensors, low-flow toilets, water faucet aerators, energy efficient hand dryers, improving recycling efforts, etc. through School of Government Building. The group also conducts annual waste audits in the spring.
- d) **Environmental Affairs Committee of Student Government**—Creation of energy conservation videos, working with Energy Management on promoting [save-energy@unc.edu](mailto:save-energy@unc.edu), collaboration with GreenGames to consider incorporating energy conservation elements into the program
- e) **Environmental Law Project**—Working with town to weatherize low-income houses in Chapel Hill
- f) **Powering a Nation**—Creation and content maintenance for award winning new media journalism project reporting on pressing energy issues in the United States (<http://unc.news21.com/>).

### *Student-led renewable energy and energy conservation seminars, fora, and conferences:*

- a) **NetImpact**—Hosted a Business School “Green Week” which included a waste audit, a green energy technology showcase, and a keynote address from the CEO of Duke Energy Jim Rogers.
- b) **Student Environmental Action Coalition**—Hosted a Renewable Energy/Green Jobs Forum in the Spring

### *Environmental activism, sustainable energy policy advocacy, voter awareness on energy issues:*

- a) **Sierra Student Coalition**—Creating a NC Student Energy Network for statewide communication among college environmental groups on relevant initiatives; lobbying for UNC-system Energy Task Force; & encouraging UNC-Chapel Hill’s accountability in energy transition
- b) **Student Environmental Action Coalition**—Aiding with PowerVote, an initiative to support energy transformation through political activism; advocating for Light Rail transportation in the Triangle
- c) **Roosevelt Institute:** Helped establish revolving loan fund ability for university energy and energy efficiency funds; evaluating possibilities to support electric

vehicles in Chapel Hill; presently evaluating and reviewing University policies to develop more innovative clean tech and energy policies and practices.

## **Conclusions and Demand-side Recommendations**

Based on secondary research and expert testimony, the Energy Task Force makes the following recommendations:

### **Demand-side Recommendation # 1: Periodic reviews of approved and adopted demand-side recommendations.**

The Chancellor should assign the task of periodic assessment of approved recommendations and their results and performance outcomes to a senior member of his administration.

### **Demand-side Recommendation #2: Explore ways to increase energy literacy among the University community.**

**a) Implement accessible and intuitive energy management displays/energy dashboards**— A common phrase among researchers is “if you can’t measure it, you can’t improve it.” Along similar lines, if students, staff, and faculty cannot easily determine how much energy and resources their activities consume, they may not know how much their behavior affects the university and planet. Unveiling the link between the University community and the “invisible infrastructure” is the first step toward energy reduction. Additionally, providing access to granular University energy usage data may aid faculty or student research and inquiry.

The Task Force is aware that the University has tried to bring this type of display system to campus, but the project is on hold. We encourage the University to revisit this project when possible.

**b) Recruit more faculty in energy-related disciplines and increase energy-related academic offerings**— Energy sources, transformation, and use play fundamental roles in modern society, both in the United States and globally, and it is now in a period of profound transition in its availability, affordability, security, climate-change impacts, and environmental and economic sustainability. There is a significant shortage of an educated workforce to help design and staff this transition, both in the private and public sectors, and the North Carolina Department of Commerce is now investing actively in initiatives to promote the development of a North Carolina workforce with energy expertise. Despite this central economic importance of energy, however, and the fundamental transition now underway from fossil fuels to greater energy efficiency and more diversified sources of renewable energy, UNC-Chapel Hill’s academic curriculum is deficient in courses related to energy.

One course is now offered through the Curriculum for the Environment and Ecology (ENST 307, *Energy and Material Flows in the Environment and Society*,

limited to 24 students and overenrolled at 30) but by a fixed-term faculty member who is retiring; a first-year seminar is being taught in Physics (PHYS 71, *Cheap Oil*); another introductory course is being team-taught by a physicist and a marine scientist (PHYS 108, *Our Energy and Environmental Crises*); and one course in the physics of energy is being taught (PHYS 131, *Physics of Energy*). UNC also is now home to a major Solar Energy Research Center based in the Chemistry Department, but its focus is research and not teaching.

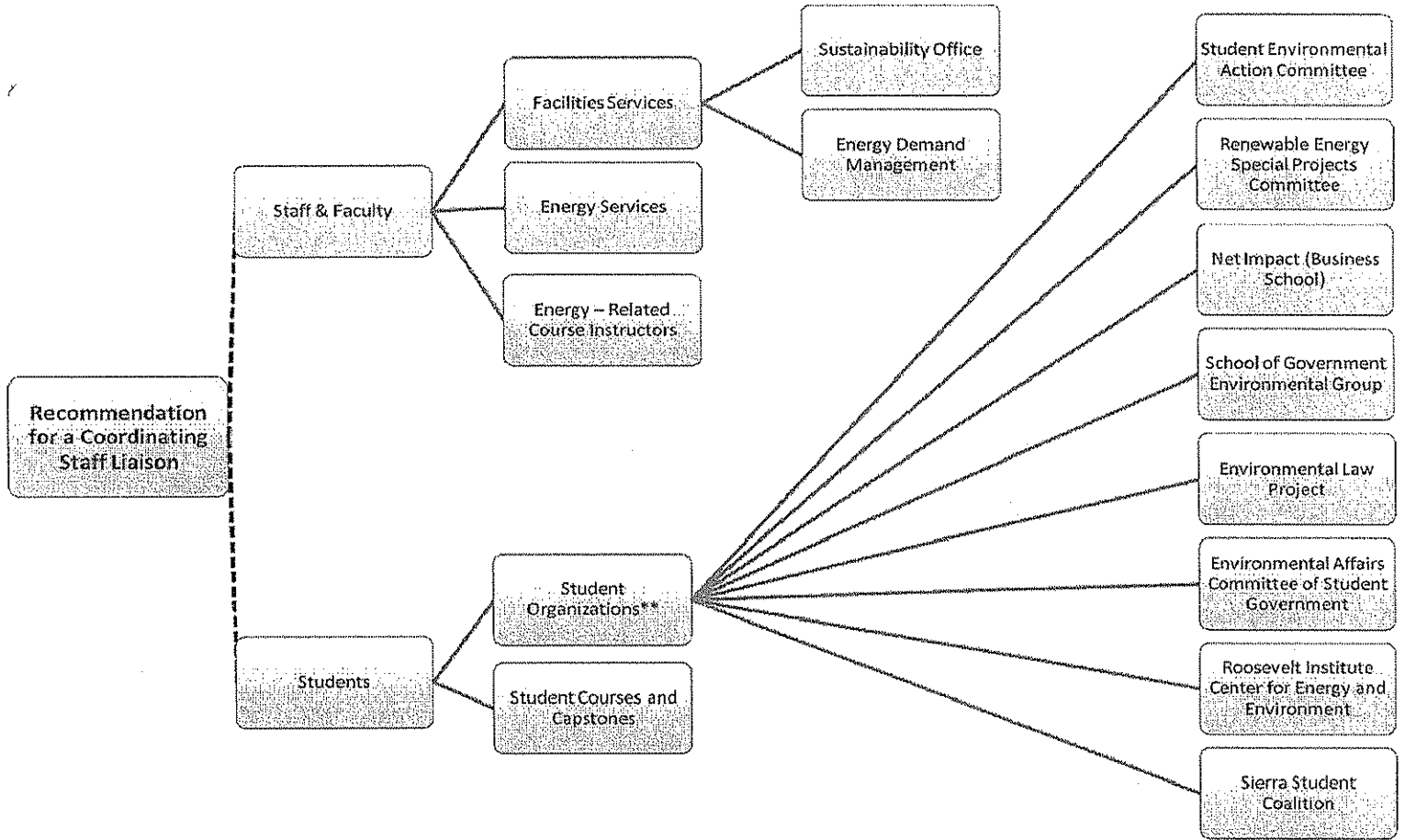
Other courses, including those beyond the introductory level as well as ones in other aspects of energy and the economy, are lacking: courses in energy efficiency and use, in the technical and economic aspects of the various energy sources for both building and transportation use (solar and wind, coal and nuclear, liquid hydrocarbon fuels and biofuel alternatives), and in energy economics and policy and economic development strategies for transitioning to a more sustainable energy foundation for the emerging economy of North Carolina, the United States and the world economy.

**Demand-side Recommendation #3: Appoint a coordinator for student and staff collaboration on energy initiatives.**

The University could benefit from facilitating increased collaboration and communication among energy end-users. Len Hoey from the State Energy Office said that based on decades of observations from energy efficiency programs—none had a greater effect than the student behavioral initiatives.

Numerous student organizations help make UNC-Chapel Hill an energy leader in the community, state and nation, but it's difficult to maintain program continuity between student leaders from year to year. The Task Force recommends that the Chancellor appoint a coordinator to track student and administrative initiatives. The coordinator could help student organizations navigate available resources and benefit the staff by serving as a liaison with the students. A diagram representing this relationship is shown on the following page.

## Pieces in UNC-Chapel Hill's Energy Coordination Puzzle



\*\*Several additional student organizations have been involved in energy conservation efforts at UNC-Chapel Hill in recent years but did not respond to the requests of the Energy Task Force's student members in time for inclusion in the final report. These include: The Sustainability Living and Learning Community in Morrison Residence Hall, Students Working for Active Transformation in the Environment (SWEAT) in the Campus Y, the newly-formed EcoReps Program based out of R.E.S.P.C., Epsilon Eta Co-Ed Honors Environmental Fraternity, the Greek Sustainability Council, and the Carolina Environmental Student Alliance-(CESA).

**Demand-side Recommendation #4: The University should look for opportunities to develop and promote demonstration projects in renewable energy and energy efficiency.**

Examples include:

- a) *A SmartHome demonstration in a University residence hall.* Duke University's SmartHome is both a live-in student research laboratory for new technologies as well as an educational environment for visitors to learn about renewable energy, energy efficiency and some sustainable building practices. The Task Force recommends that UNC-Chapel Hill create an open-access model residence hall room based on the same principles. Students can learn strategies for minimizing their energy consumption while living comfortably.
- b) *An "Envision Center"-type display in the Frank Porter Graham Student Union.* Duke Energy has a SmartHome demonstration lab at the Advanced Energy Facility on the Centennial Campus at NC State University referred to as the "Envision Center." Visitors learn how new energy technologies are transforming today's power delivery system into tomorrow's smart grid. Duke Energy or Progress Energy may be willing to fund a similar project at Carolina.

**Demand-side Recommendation #5: Explore ways to develop and implement campus energy conservation incentive programs.**

The Task Force encourages the University to explore opportunities for University departments to retain energy savings as an incentive for energy conservation. To that end, the recently passed North Carolina House Bill 1292-Session Law 2010-196, which permits state universities to retain energy savings that meet specific criteria, can and should form a part of the University's energy conservation plans.

The Task Force encourages the University to consider the practices and recommendations of other institutions in developing its own program. As one example, Stanford University maintains an Energy Conservation Incentive Program that assigns energy budgets to each department based on historical and projected needs, and then incents the departments to manage to these budgets. <sup>v</sup> This model may not exactly fit the UNC-Chapel Hill campus, but the principle is worth studying.

Resource conservation incentive programs that draw upon competition—either among units of the University or departments competing against their own historical patterns of consumption—could drive energy reduction efforts.

**Demand-side Recommendation #6: Engagement in state and national energy policy initiatives**

The Task Force recognizes that UNC-Chapel Hill is a leader in many of its energy efficiency and sustainability practices. The Task Force encourages the administrators, faculty, staff and students to serve as a resource for other schools and institutions.

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## Endnotes

<sup>i</sup> USEPA (2009). "Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act." Retrieved April 2010 from: <http://www.epa.gov/climatechange/endangerment.html>.

<sup>ii</sup> USEPA (2010). "Fact Sheet Proposal To Revise The National Ambient Air Quality Standards For Ozone" Retrieved April 2010 from: <http://www.epa.gov/groundlevelozone/pdfs/fs20100106std.pdf>.

<sup>iii</sup> USEPA (2010). "April 1, 2010 Memorandum: Improving EPA Review of Appalachian Surface Coal Mining Operations Under the Clean Water Act, National Environmental Policy Act, and the Environmental Justice Executive Order (Detailed Guidance)." Retrieved April 2010 from: [http://www.epa.gov/wetlands/guidance/pdf/appalachian\\_mntn\\_top\\_mining\\_detailed.pdf](http://www.epa.gov/wetlands/guidance/pdf/appalachian_mntn_top_mining_detailed.pdf)

<sup>iv</sup> Dewan, S. (2009). Administration Plans New Regulations on Coal-Ash Ponds. New York Times 9 March 2009. Retrieved April 2010 from: <http://www.nytimes.com/2009/03/08/us/politics/08ash.html>.

<sup>v</sup> Sturgeon, J. (2006, June). "Going Green While Saving Green: Team Energy." Retrieved 25 September 2010 from: <http://www.universitybusiness.com/viewarticle.aspx?articleid=293>

## Glossary

### *Efficiency*

*Under the First Law of Thermodynamics, efficiency is the ratio of work or energy output to work or energy input, and cannot exceed 100 percent. Efficiency under the Second Law of Thermodynamics is determined by the ratio of the theoretical minimum energy that is required to accomplish a task relative to the energy actually consumed to accomplish the task. Generally, the measured efficiency of a device, as defined by the First Law, will be higher than that defined by the Second Law.*

### *Efficiency (Appliance) Ratings*

*A measure of the efficiency of an appliance's energy efficiency.*

### *Conservation*

*To reduce or avoid the consumption of a resource or commodity.*

USDOE: Energy Efficiency and Renewable Energy Glossary