Tulane Climate Action: A Roadmap to Reductions

Tulane University ♦ 2011

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SUMMARY

In 2008, Tulane University joined the American College and University Presidents' Climate Commitment, an alliance of universities that are working to more fully engage their students, faculty and staff in addressing the challenge of climate change. At the center of this commitment is an effort to develop a plan to reduce the impact of our activities on climate change down to zero.

This document analyzes and recommends potential measures that can be taken to reduce greenhouse emissions. The planning process attempts to quantify the CO2 that would be reduced by each measure, the cost of the measure, and the cost per ton of CO2 reduced.

After reviewing suggestions from the university community, investigating best practices at other universities and comparable facilities, and estimating the costs and potential reductions of different measures, we recommend that the university adopt the following reduction targets:

- By 2015, reduce emissions to 7% below 2007 levels.
- By 2020, reduce emissions to 15% below 2007 levels, including the adoption of renewable energy sources to that provide the equivalent of 5% of campus electricity use.

In order to achieve these targets, we note the following actions that are underway and recommend the following major actions.

Major initiatives now underway:

- Large-scale energy efficiency improvements on the uptown and downtown campuses.
- Reducing the energy use of new buildings and major renovations by using energy modeling, building commissioning and building metering as outlined by the LEED certification process.
- Strengthening the pedestrian-friendly character of the Uptown campus, an initiative that includes converting the center of the uptown campus to a pedestrian way, bicycle improvements, and creating an Office of Shuttle and Transportation Services.

Measures to implement by 2015:

- Put in place the expertise and informational structure to achieve the next level of energy efficiency. An energy management program should include:
  - Developing in-house capacity in building energy efficiency with an energy engineer.
  - Installing energy meters on uptown campus buildings and using energy use data to operate buildings efficiently.
  - Begin a retrocommissioning program of major buildings, "tuning up" buildings by testing the settings and performance of the building's energy systems.
- Review and implement best practices in computer power management.
- Continue to improve bicycle infrastructure and offer bicycle safety and encouragement programs.
- Continue to enhance shuttle and transportation programs that help students, staff and faculty reduce driving to and from campus.
- Initiate the first campus renewable energy project, such as a solar photovoltaic or solar thermal system.

Measures to research for 2015 -2020:

- Research best renewable energy options to provide the equivalent of 5% of campus electricity use. Solar photovoltaic, geothermal heat pumps, and solar hot water present the best opportunities.
- Use building energy metering data to integrate energy efficiency priorities into planning for building renovations

INTRODUCTION

In 2008, Tulane University joined the American College and University Presidents' Climate Commitment, an alliance of universities that are working to more fully engage their students, faculty and staff in addressing the challenge of climate change. At the center of this commitment is an effort to develop strategies to reduce the impact of our activities on climate change down to zero.

A climate action plan analyzes and recommends potential measures that can be taken to reduce greenhouse emissions. The planning process attempts to quantify the CO2 that would be reduced by each measure, the cost of the measure, and the cost per ton of CO2 reduced. This process identifies measures that will have the largest impact and the measures that can be achieved most cost-effectively. In recommending particular measures for future action, additional benefits are considered, such as furthering other university goals, potential for student and faculty involvement, additional environmental benefits, local economic benefits and visibility.

A university climate action plan can be an important educational tool, for it can be used by the university community to understand the impact of particular building, planning and sustainability strategies by using a familiar model--the campus itself. Universities that have undertaken this commitment have made reductions in greenhouse emissions and have begun major planning efforts that will reduce emissions even more. Participating universities are working hard to achieve the next level of building energy efficiency and are replacing high-emission fuels with cleaner sources.

As an initial study, conducted in-house, with student involvement, this document identifies areas for future action and further research. It is advisory and aspirational, representing suggestions of actions that have promise for the greatest potential reductions with our local context. In reviewing measures, we identified actions are that underway, actions that are feasible in the short term, and actions that need to be assessed and tested for implementation in the longer term. As we are in a moment when the future policy context for energy use and greenhouse gas reductions is very uncertain, it will be important to continue to examine possible long term strategies as policy develops and local capacity increases.

PROCESS

A Climate Commitment Advisory Committee was appointed in May 2008. Committee members included a faculty member from each school, administrators from offices that influence campus energy use, and representatives from student government and student environmental organizations.

In a Fall 2008 "Tulane Talk" all-campus email, President Cowen solicited ideas and suggestions from the Tulane community. Over 100 suggestions were received, and can be read here. At its meetings, the Climate Commitment Advisory Committee learned about climate action planning, learned about actions already underway, recommended tangible actions that the university could take in short term to reduce emissions, and made suggestions drawn from their own experience and work. One sub-committee meeting was held on the topic of building energy use and one on the topic of transportation.

Staff from the Office of Environmental Affairs and Center for Bioenvironmental Research first analyzed the university's overall impact on climate change by collecting data on the university's energy use and use of chemicals that have a global warming potential, producing a Greenhouse Gas Emissions Inventory. Next, staff analyzed potential actions to reduce greenhouse gas emissions, estimating the amount of carbon dioxide that could be reduced and, when available, the possible costs.

Students were involved in this analysis in several ways. Representatives from student government and environmental student organizations serve on the Climate Commitment Advisory Committee. Sociology students conducted a telephone survey of the transportation habits of Tulanians. The results of the survey were used to estimate greenhouse gas emissions from commuting and to estimate the possible impact of different alternative transportation programs. Students in a Management Communications course developed communication strategies for an Energy Star purchasing policy. MBA students conducted an initial review of renewable energy technologies and prioritized them for adoption in our local region.

This document was completed in 2011. While a university climate action plan can also include education, research and public service measures, this initial document focuses on actions that will result in measurable emissions reductions.

CURRENT EMISSIONS

An inventory of the greenhouse gas emissions that result from university activities has been conducted for the entire university since 2006. The university is directly responsible for the greenhouse gas emissions that result from using fossil fuels on campus--creating and releasing carbon dioxide--and using other chemicals that are greenhouse gases, such as the refrigerants HCFC-22 and HCF-134a. A greenhouse gas emissions inventory also assesses the greenhouse gas emissions for which the university is indirectly responsible, such as the emissions released by utilities as they generate the electricity we use and the emissions that result from Tulanians commuting to and from campus. The inventory process involves collecting all energy bills and using a set of emission factors for how much CO_2 is released when a unit of the fuel is used. The table below shows Tulane's greenhouse gas emissions for 2006 through 2010 in metric tons of carbon dioxide equivalent (MTCO2e). Tulane's complete Greenhouse Gas Emissions Inventory and updates are available on Green.tulane.edu.

Tulane University Total Greenhouse Gas Emissions by Sector (MTCO2e)					
Sector	**2006**	**2007**	**2008**	**2009**	**2010**
Buildings	105,672	89,583	87,444	97,798	100,458
Travel	32,931	41,128	43,136	38,794	35,153
Commute	9,374	9,731	10,276	11,214	10,622
Waste	955	955	972	895	1,231
Study Abroad	1,986	1,986	1,986	1,986	4,444
Fleet	581	576	533	1,347	754
Offsets	-	-	-	-82	-
Total	**151,498**	**143,959**	**144,347**	**151,951**	**152,644**

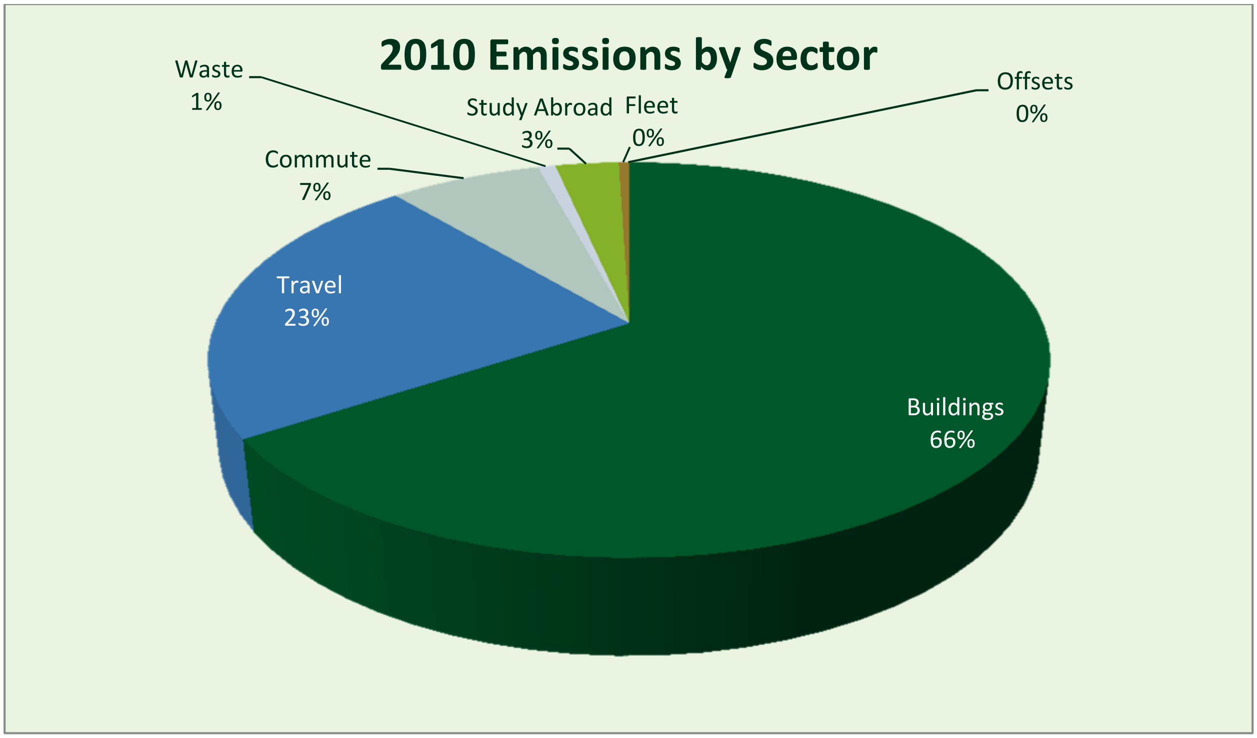
As the university recovers from Hurricane Katrina, total emissions have grown from a low of 143,959 metric tons carbon dioxide equivalent in 2007. Emissions per student and per square foot of building area have steadily decreased.

Normalized Emissions						
	2006	2007	2008	2009	2010	ACUPCC Average*
Full Time Enrollment (FTE)	9,704	9,642	10,091	10,695	10,945	
Per Capita Emissions (MTCO2e/FTE)	**15.61**	**14.93**	**14.31**	**14.21**	**13.95**	**8.71**
Total Building Area (sq. feet)	6,713,508	6,746,734	7,038,007	7,156,328	7,068,754	
Emissions (MTCO2e) Per 1000 Square Feet	**22.57**	**21.34**	**20.51**	**21.23**	**21.59**	**20.93**

*As reported on the ACUPCC Reporting website May 12, 2010.

A university greenhouse gas emissions inventory is both an educational and a management tool. It can help students, staff and faculty better understand how and which human activities contribute to global climate change by using a familiar institution as a case study. It is a relatively accessible introduction to basic concepts in climate change policy.

A greenhouse gas emissions inventory establishes a baseline that can be used to assess the results of measures to reduce emissions. Reviewing the emissions by sector can be used to prioritize actions to reduce emissions. For example, Tulane's inventory shows that the energy used by university buildings comprises two-thirds of our emissions. Surprisingly, Tulane's inventory also shows that travel funded by the university is the second most significant source of emissions.



EMISSION REDUCTION TARGETS

The most recent report of the Intergovernmental Panel on Climate Change (IPCC) assesses future greenhouse gas emission scenarios and the warming and other impacts that would result from these emissions. The IPCC is an international organization of scientists who work to collaboratively assess and summarize current knowledge of climate change for policymakers. In their report, they projected that substantial emission reductions of 50-85% below 2000 levels by 2050 would be needed to stabilize the global average temperature at 2-2.4 degrees celsius above pre-industrial levels. It should be noted that their scenarios are very conservative; greater levels of reductions may be needed. The more quickly the reductions are made, the lower the ultimate global temperature will be.[1]

While Tulane would not be subject to direct regulation of greenhouse gas emissions, it is instructive to consider the emissions targets that were proposed in the American Power Act as we formulate the university's goals. Legislation introduced into the Senate in May 2010 proposed the following national emission reduction targets: 3% below 2005 levels by 2012; 20% by 2020; 42% by 2030; and 83% by 2050. Through an Executive Order, the Federal Government has established an emission reduction target for its own facilities of 28% below 2008 levels by the year 2020.[2] A review of Tulane's peer institutions and other doctorate-granting universities in the South finds that many have set targets that are similar to those outlined in the American Power Act.

[1] Climate Change 2007: Synthesis Report 5.4: "Emission Trajectories for Stabilisation" http://www.ipcc.ch/publications_and_data/ar4/syr/en/mains5-4.html

[2] http://www.whitehouse.gov/the-press-office/president-obama-sets-greenhouse-gas-emissions-reduction-target-federal-operations

From the assessment of possible measures done during the past year, we propose the following targets:

- By 2015, reduce emissions to 7% below 2007 levels.
- By 2020, reduce emissions to 15% below 2007 levels, including the adoption of renewable energy sources that provide the equivalent of 5% of campus electricity use.

In addition to the reductions from actions on our campuses, the university's emissions will be influenced by external changes, such as improvements in vehicle fuel efficiency, airline industry efficiency improvements, and actions taken by electric utilities to reduce emissions. The table below estimates how improvements in utilities and vehicle fuel efficiency beyond campus will add to campus reductions.

Year	Reductions from University Actions	Reductions with Emissions Standards and 5% Cleaner electricity	Reductions with Emissions Standards and 25% Cleaner Electricity
2015	7.4%	8.4%	12.2%
2020	9.8%	11.9%	20.5%

Longer range planning for emission reductions is very difficult, particularly at this historical moment and in this particular place. Without a national climate and energy policy, the future shape of energy prices, incentives, disincentives, and other policies is unknown. In New Orleans and Louisiana, experience with clean energy, green building, and energy efficiency is just beginning. Additionally, the very particular climate and geography of New Orleans make it difficult to draw from expertise and model projects elsewhere. As experience with these strategies and technologies increases in our area, longer term opportunities for reductions will change.

For these reasons, it is important to set significant short term targets while beginning to build capacity, conduct research and develop pilot projects for reduction measures beyond 2020.

PROJECTED EMISSION REDUCTIONS

We began by estimating Tulane's future greenhouse gas emissions if no actions were taken to reduce them. This estimate is based on 2010 actual emissions per student and projections of future enrollment. This method anticipates a jump in emissions in 2011 commensurate with enrollment increases and a steady small annual increase until 2025.

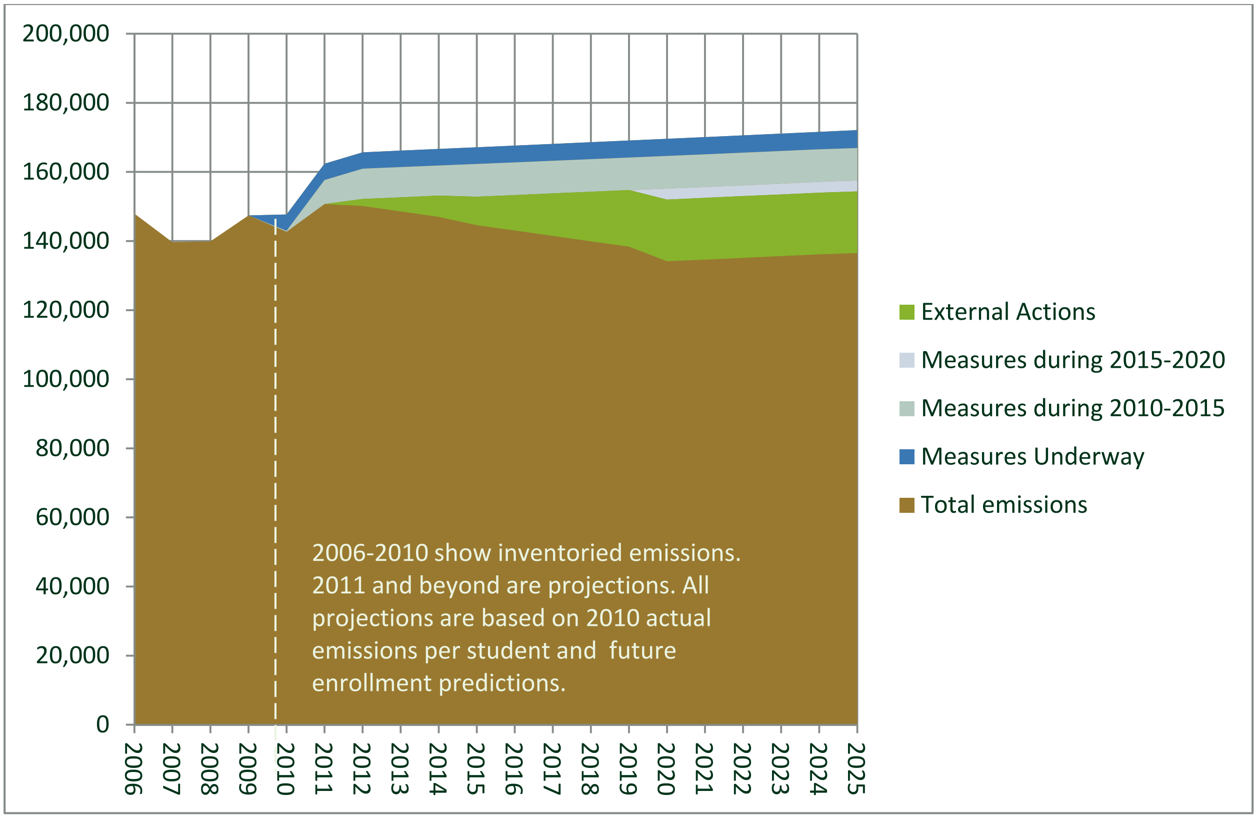
In Chart A below, we show four "wedges" of expected emissions reductions: actions underway, actions proposed for 2010-2015, actions proposed for 2015-2020, and external actions. [3] The length of the

[3] The concept of the greenhouse gas emission "stabilization wedge" was introduced by Robert Socolow and Stephen Pacala in their article "Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies," Science, 13 August 2004, 305 (5886): 968-972. Though their article examined the potential of current technologies to reduce greenhouse gas emissions globally, the wedge graph has been adopted on many scales in climate mitigation planning to visually represent the impact of different reduction measures over time.

wedge is correlated to when each group of actions is projected to start and end. The height of each wedge represents the amount of carbon dioxide equivalent that each measure will prevent from entering the atmosphere.   The top line of the chart represents expected emissions if nothing is done, while the bottom line--Total Emissions—represents expected emissions if actions are taken. Overall, the chart provides a visual representation of the emissions reductions outlined in this document.

The rest of this document details the measures included in each wedge. A table showing the assumptions made in estimating the impact of these measures is posted on Green.tulane.edu.

Chart A: Projected Impact of GHG Emission Reduction Measures



MEASURES COMPLETED OR UNDERWAY

During the years since Hurricane Katrina, numerous offices and department have implemented measures to reduce campus energy use and further research and education opportunities in the area of climate change. Some of these projects emerged from discussions and collaborations among the members of the Climate Commitment Advisory Committee. The list below inventories projects that are underway or completed.

Building Energy Efficiency

Uptown Campus Energy System Improvements

Major energy system improvements were completed on the Uptown campus in 2008. The project included the installation of a more efficient chiller in the power plant, improvements to the system that pipes steam to campus buildings for heating, replacement of about 4,000 light fixtures in eight residence halls, installation of occupancy sensors to control lighting in dorm rooms, and installation of equipment that allows better control of the flow of chilled water into campus buildings. The project also included upgrades of toilets, faucets, and showerheads that were estimated to save 20 million gallons of water each year. The project was funded by Johnson Controls and will be repaid from an estimated annual utility cost savings of $2.35 million. In addition to reducing the energy use of lighting and equipment, the project changed the use of equipment in the power plant, shifting some of the uptown campus' energy use from natural gas to electricity. The project was estimated to reduce annual greenhouse gas emissions by 6,400 metric tons. Because this project is completed, these emission reductions are already counted in the greenhouse gas emissions inventory.

LEED Green Building Guidelines with High Energy Efficiency Goals

Using the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) Green Building standard will ensure that new buildings and major renovations address energy efficient operation from schematic design. Tulane's "Green Building Design and Construction Standards and Guidelines" set a standard of LEED Silver for new construction and major renovations; the guidelines include energy efficiency targets of 28% energy cost savings for new construction, 24% energy cost savings for major renovation projects, and a target for laboratory projects of 300 kBtu/square foot/year. (See Appendix B.) The green building guidelines will also install a process that will help the university learn from each project and use that experience to make each subsequent project more efficient. Most basically, these steps include:

- Using computer modeling to predict a new building or renovations' future energy use.
- Engaging a Commissioning Authority to review and test the building's energy-using systems
- Installing metering in the building to ensure that it operates efficiently and as designed, and so learning from the building can inform future projects.

Energy modeling of the renovated Dinwiddie Hall suggests that the building will be 14% more efficient (by energy cost) than a baseline building as defined by LEED. Weatherhead Hall is expected to be 28.6% more efficient, and the new Hertz Center basketball and volleyball facility is expected to be 36% more efficient. With increasing experience, Tulane should aim for increasing levels of efficiency in future buildings.

Annual C02 reduction: 137 metric tons/year initially, followed every five years with an additional annual reduction of 137 metric tons (Assumes 3% of building stock renovated every 5 years)

Downtown Energy Efficiency Retrofits

The Downtown campus is undertaking a large-scale, multifaceted energy conservation project that parallels the improvements undertaken on the uptown campus in 2007. Energy plant upgrades will include energy efficient chillers, pumps, variable frequency drives, cooling tower, air handling units, boilers and electrical gear. There will be HVAC upgrades in the Medical School Building, Deming Pavilion, J. Bennett Johnston Building and Tidewater Building. The project will include water conservation improvements. Campus-wide lighting system improvements--including 2271 new fixtures/occupancy sensors—will be done. The $27 million cost of the project will be paid back in energy savings in 12 years; the savings are guaranteed by Johnson Controls, the company undertaking the improvements.

Annual C02 reduction: 3843 metric tons

Uptown Power Plant Well Water Treatment System and Campus Boiler Replacement

A project that upgrades an existing well to provide the uptown campus with a water supply independent from city service includes the replacement of a circa-1963 boiler. The project will decrease natural gas use in the power plant, though there will be an increase in electricity use, which will be used by the well's pumps.

Annual C02 reduction: 403 metric tons

Energy Star Purchasing Policy

An Energy Star purchasing policy was approved in July 2009, and in Fall 2010 a Management Communications class developed excellent communications strategies for the plan. An "Energy Star Smart Shopping for College" website encourages incoming students to look for energy efficient electronics and appliances as they prepare to come to Tulane.

Annual C02 reduction: 411 metric tons

Technology Services

Technology Services has undertaken a number of measures that reduce the energy use of its own operations, reduce the energy use of Tulane technology users, and use information technology to reduce emissions from other sources:

- Green Data center. By the end of 2008, 81 servers had been virtualized, which reduced the physical servers used by Tulane by 92%. This measure reduced electricity use by 155,332 kWh per year.
- The creation of a Green IT site provides Technology Services users with easy information on purchasing Energy Star labeled computers, using power management features, and recycling electronics. The site includes a guide to teleconferencing and videoconferencing. The site can be found at http://tulane.edu/tsweb/GreenIT/index.cfm
- Energy Star compliant photocopy machines were installed in Howard Tilton. They use less energy and are set to print double sided.
- Computers in computer labs are set to show a screen server after ten minutes, and then shut the monitor off after 30 minutes without use.

Other units on campus have taken action to reduce the energy use of their computers and electronics:

- In the A. B. Freeman School of Business, all of the computers in labs and classrooms are remotely shut down at midnight and then powered on at 7:00 AM in preparation for classes. The Director of Information Technology encourages Freeman faculty and staff to shut down their office computers at the end of the workday.

Transportation

McAlister Place

The McAlister Place project closed the uptown campus' central street to vehicle traffic, creating a pedestrian and bicycle friendly central campus. The project included the creation of an intra-campus shuttle that connects the center of campus with parking, public transportation, and businesses on Claiborne Ave.

Shuttle and Public Transit Services Coordination and Improvement

University Services engaged a transportation consultant to review existing shuttles and routes and identify opportunities for improving efficiency, vehicle maintenance, and customer service (for example, using GPS to run management reports and allow riders to see where vehicles are on the routes). Shuttles run by TUPD and the Center for Public Service have been transitioned to University Services. The initiative includes the following actions:

- Working with Loyola to incorporate them into Tulane's shuttle system, specifically their service learning sites.
- Mapping where all the Tulane faculty and staff and students live, along with their primary campus. A similar study will be done at Loyola. This will allow us to see where shuttle routes are and if they can incorporate a larger population to lessen the driving to campus, parking problems, etc.
- Working with RTA to review routes and coordinate with shuttle services, and possibly offer a transit pass.
- Working with students to develop an overall transportation web site to show all the options available to our community

We Car "Car Sharing" program

Hourly vehicle rentals are now available for Tulane students, staff and faculty members. Three Toyota Prius Hybrids are available on the Uptown campus, and service for the downtown campus is being explored. Car sharing reduces emissions by enabling more people to live without owning a car by having an easy rental option available for occasional trips. Vehicles are accessed through memberships and website reservations. See www.wecar.com

Education

Courses and Majors in Environmental Fields

Each of Tulane's environmental degree programs addresses climate change in some way. These include a top-ranked Environmental Law program, Environmental Health Sciences degrees at the graduate and undergraduate levels, and studios and courses that focus on sustainable design in the School of Architecture. The Ecology and Evolutionary Biology and Earth and Environmental Sciences departments have strong programs that address coastal sustainability and global environmental change. A B.A. in Environmental Studies is offered in the School of Liberal Arts and a B.S. in Environmental Science is offered in the School of Science and Engineering

Interdisciplinary Climate Change Course

An undergraduate course that includes work on the university's climate commitment will provide students with an introduction to key concepts in climate policy and mitigation. A pilot course was offered as an Honors Colloquium in Fall 2010. This course combines guest lectures by faculty working on climate change in different disciplines with hands-on work on Tulane's greenhouse gas emissions inventory. To further the reach of a course, it could be tied to a speaker series that is open to the public.

Communicate Climate Action Research Needs

Research needs to assist the university with advancing sustainability are identified each year, shared with the relevant academic programs, and posted on the Green.tulane.edu site under "Student Action." These could provide starting points for student research papers, class projects, theses, public service internships and master's projects. For example, the Masters of Public Health has a culminating experience requirement. Students in the Environmental Health Sciences program with interests in climate change, environmental management, and environmental policy may be interested in projects related to the university climate commitment. The "Student Sustainability Research" page on Green.Tulane.edu posts research on climate change and campus sustainability by Tulane students.

Library Resources

The library can support academic programs by creating reading lists and study guides related to sustainability and through course-related instruction in the research tools and information management skills needed to achieve environmental literacy.

Research

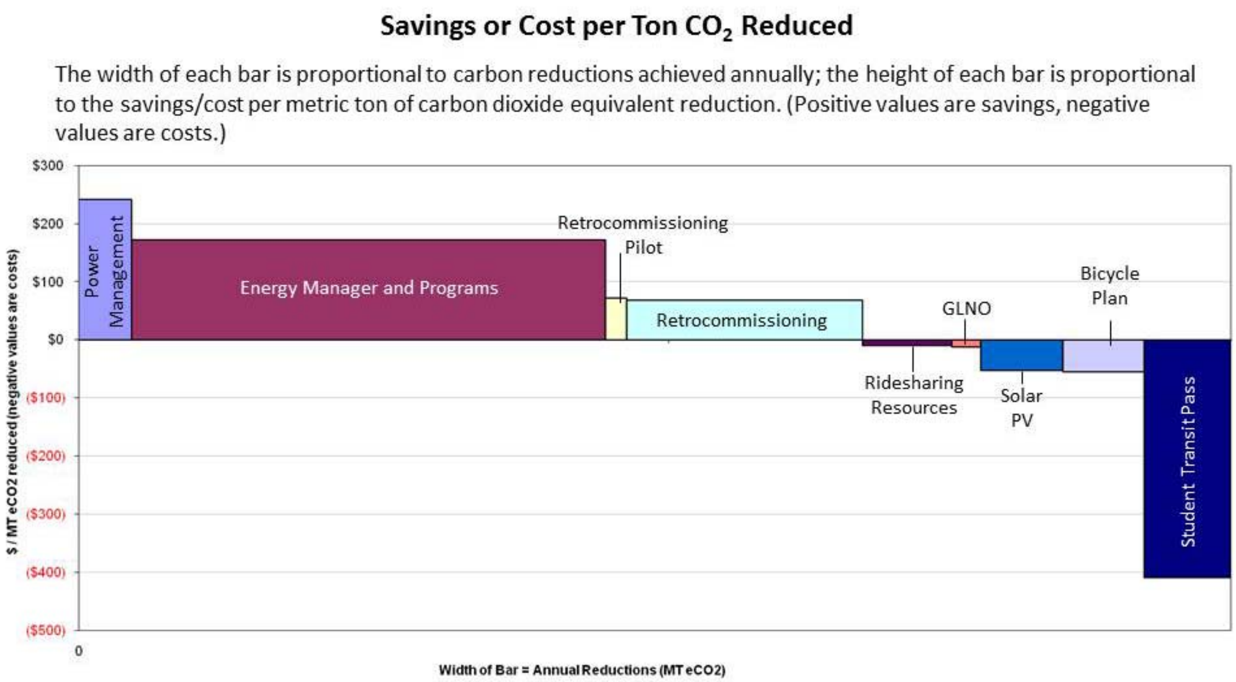
Energy Day

To foster interdisciplinary research in clean energy, the Provost's Office, the Tulane Energy Institute and the Center for Bioenvironmental Research held a one-day Tulane Energy Summit in Spring 2010. At the summit, researchers from disciplines across the university gave presentations about their energy-related research. The event laid groundwork for building multidisciplinary teams that can pursue research funding opportunities in clean energy fields. One Tulane team is already working on processes to produce the alternative fuel butanol from cellulose. The Tulane Energy Institute is a member of Louisiana's Clean Power and Energy Research Consortium.

MEASURES TO IMPLEMENT BY 2015

The following measures are recommended for implementation within the next five years. The first section includes measures for which preliminary costs, savings and C02 reductions could be estimated; the second section includes educational recommendations; and the third section includes emission reduction measures that need further study to estimate costs or potential savings. Chart B allows comparisons between the recommended measures, showing savings/cost per ton of C02 saved and the magnitude of the annual emission reduction. A preliminary draft of costs and savings for these projects is presented in detail in Appendix B; the Project Tables showing the assumptions made in analyzing these measures are available at Green.tulane.edu.

Chart B: Comparison of Recommended Measures



Measures with Estimated C02 Savings

Energy Manager and Program

Tulane has implemented major energy efficiency retrofits in recent years, focusing on the large systems that provide cooling and heating to buildings. To achieve the next level of energy efficiency, it will be necessary to regularly meter the energy use of campus buildings and to delegate responsibility for monitoring and reducing building energy use. Hiring a dedicated energy engineer would ensure that the university operates existing buildings in the most energy efficient ways possible, and that the university continually assesses best practices in emerging efficient and clean energy technologies. Under an Energy Engineer, an Energy Management program would include implementing a building metering program, developing university energy policies, and addressing energy efficiency opportunities in laboratories. To ensure continual improvement, the results of all energy efficiency efforts must be measured and evaluated in a way that informs future efforts. The goal for energy efficiency efforts should be very ambitious, aiming to create buildings that are so efficient that the equipment for cooling and heating them can be scaled down in the future. The Energy Management program could include the following components.

Energy Engineer

A dedicated energy engineer would enable Tulane to better assess and implement energy efficiency and renewable energy projects. Many universities have this position, including LSU Health Sciences Center in New Orleans. The following responsibilities are drawn from a job description advertised by Stanford:

- Coordinate activities aimed at reducing purchased energy through improved efficiency and conservation.
- Work cooperatively with colleagues within utilities, maintenance, and project management organizations to optimize energy performance in existing campus buildings and implement new construction performance standards.
- Assess new energy efficiency technologies, maintain energy management software applications, support student projects, perform life-cycle cost analyses, ensure meter installation and accuracy, conduct energy data analyses, and carry out a mix of field work, analysis, and management/coordination for energy efficiency projects.

Building Metering on Uptown Campus

The energy use of most of the buildings on the uptown campus is unknown. Most buildings are served by the campus power plant, receiving electricity, chilled water for cooling, and steam for heat and hot water through the campus power plant, rather than directly from Entergy. To measure the energy use of a building, three different types of meters must be installed, calibrated and monitored. Many buildings on the uptown campus have some or all utility meters installed; an inventory of existing meters and their status is needed. New buildings and major renovations such as Weatherhead Hall and Dinwiddie Hall have complete energy metering incorporated as part of LEED certification. The Richardson Memorial building is metered through a Smart Building Solution pilot project with IBM.

Building metering programs can be used to reduce energy use in campus buildings in different ways. Metering the energy use of a new building can be used to assess the performance of the design and provide feedback for future projects. For existing buildings, calculating the Energy Use Intensity (EUI) of a building (annual kBtu/square foot) is a simple way to assess the energy performance of a building relative to other buildings of its type. ENERGY STAR publishes average EUIs for different types of buildings in different climate zones. Both Duke University and the EPA's facility at Research Triangle Park in North Carolina have established target EUIs for different types of buildings (e.g. laboratory buildings, office/classroom, and housing).[4] In short, metering campus buildings will allow their relative performance to be assessed.

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[4] See "Going Green: Becoming a Carbon Neutral Campus." Duke University Climate Action Plan, October 2009, pp. 43-47; and "EPA-Research Triangle Park Performance Parameters," December 2007.

A building metering program can also drive operating and behavioral measures that reduce building energy use. The Tulane community has identified a number of ways that building energy use data could be used:

- Building metering can be used to quickly spot equipment malfunctions that increase energy use and cause discomfort to occupants.
- Rice University uses software that tracks the curve of daily energy use of a building against the expected energy use based on the day's weather. A multi-departmental energy committee reviews these graphs regularly to identify building problems and develop energy saving measures.
- Two student environmental organizations, the Green Club and Tulane Environmental Action League, are interested in bringing back the residence hall electricity use reduction competitions that were done in the early 2000s.
- Architecture faculty and students are interested in using building energy data in their teaching and research.
- Business school faculty are interested in investigating "smart metering" and studying how data about energy use influences people's behavior.
- With submetering, departments could be charged for their energy use or rewarded with their energy savings. [5]

A metering program could begin with all LEED certified buildings, buildings that are occupied by one unit, and energy intensive buildings, such as those that house laboratories.

University Energy Policy, including Building Temperature Policy

The suggestion most frequently submitted to the Climate Commitment Advisory committee was addressing uncomfortably cold campus buildings. This can be a complex problem, resulting from remodeling changes, low set points, the need to maintain low humidity to prevent mold growth, not reheating the chilled water that enters the building, or differences in personal comfort levels between co-workers who share a thermostat. Because of the many kinds of impacts that cold temperatures have on productivity and energy use—from outright discomfort, to causing cynicism about energy conservation efforts, to the use of electric space heaters in offices—this is an issue that should be systematically addressed in conjunction with energy conservation efforts. Establishing a policy that outlines target temperature ranges and communicates these to the university community will help Facilities Managers operate the buildings in a more energy efficient way. Rice University adopted a university-wide temperature policy during the summer of 2009 and will be a good source of information, both on the energy savings of the policy and experience implementing it.

More broadly, adopting and publishing a comprehensive university energy policy will clearly communicate the commitment of the university to building and operating its facilities in an energy

[5] For a useful discussion of the different possible goals of submetering programs, see Michael Kinsley and Sally DeLeon, "Accelerating Campus Climate Initiatives," Rocky Mountain Institute and AASHE, November 2009, p.42.

efficient way. It could function as a kind of pact between facilities managers and building occupants: the university is striving to use energy wisely in its buildings, and expects building occupants to also make energy efficient choices.

Energy Expert Walter Simpson's Components of an Aggressive Campus Energy Policy

- Heating and cooling season temperature settings
- Building HVAC and fan operating schedules
- Computer operations and "green computing"
- Ban on all incandescent bulbs and halogen torchiere lamps (the latter is also a safety issue)
- Energy purchasing (including buying green power)
- Energy efficiency purchasing standards for various types of equipment -- hopefully going beyond Energy Star compliance
- Improved space utilization to avoid new construction or heating/cooling of underused space
- Energy efficiency standards for new construction
- Restrictions on the use of portable space heaters
- Energy practices in on-campus residence halls and student apartments
- Residential appliance policies (e.g. load limits per room, ban refrigerators, TVs, microwaves, etc.)
- Curtailment periods when campus use is minimal and energy shutdowns can be implemented

From Cool Campus! A How-To Guide for College and University Climate Action Planning. For a sample university energy policy, see the University of North Carolina at Chapel Hill Energy Use Policy.

Laboratory Energy Efficiency

Measures to reduce the energy consumed by laboratories and laboratory buildings have potentially large savings. These may include:

- Encourage researchers to close a fume hood's sash when not in use[6]
- Evaluate existing fume hoods for removal or replacement
- Measures to reduce the energy use of fume hoods, including control systems
- Purchase of energy efficient laboratory equipment
- Following the Labs 21 guidelines for new construction or major renovation.

On the uptown campus, Stern Hall is being evaluated for replacing and removing fume hoods. On the downtown campus, the renovation of labs in the JBJ building is following LEED standards for renovating interiors.   Labs 21, a program of the U.S. Environmental Protection Agency and U.S. Department of Energy, provides resources for improving the environmental performance of laboratories. Their "Environmental Performance Criteria" builds on LEED for New Construction by outlining additional,

[6] For an example of a successful program, read about Harvard's "Shut the Sash" program at http://green.harvard.edu/node/792

specific measures for laboratory buildings; it provides suggestions of environmental measures that should be considered during the design process.

Retrocommissioning

Tulane has experience with building commissioning for new buildings and major renovations. “Retrocommissioning” applies the commissioning process to existing buildings; it is a process of reviewing a building’s energy systems to ensure that the building is operating as it should. It is often referred to as a building tune-up. A study of a national database of commissioning projects found that the average cost of a retrocommissioning project was $.30/square foot, with an average savings of 16% of a building’s energy use and a payback of 1.1 years. Retrocommissioning has benefits beyond energy savings, such as improving equipment performance, increasing staff expertise, and improving indoor environmental quality in the building.[7] High-tech buildings such as laboratory buildings were found to be particularly cost effective to commission. The author of the study, a scientist at the Lawrence Berkeley Laboratory, asserted in conclusion that “Commissioning is arguably the single-most cost-effective strategy for reducing energy, costs, and greenhouse gas emissions in buildings today.”[8] The study suggests that buildings should be commissioned every five years.

The Commercial Building Re-tuning project of the U.S. Department of Energy’s Building Technologies Program provides online training in building re-tuning, a basic version of building commissioning. [9] A number of universities employ in-house commissioning teams to regularly “tune-up” buildings.[10] Wall Residential College may be an appropriate first retrocommissioning or re-tuning project for the university. As the building is about five years out from construction, needed documentation would be available, and it is an appropriate time to check its systems. The building has energy metering installed, so the resulting savings could be measured.

Annual CO2 Reduction: 1,998 metric tons

Power Management of Computers

The energy use of computers and peripherals is a significant part of each building’s energy use. Efforts to encourage the purchase of energy efficient computers, to encourage the use of power management features, and to reduce the energy use of data centers should be ongoing. The potential impact of developing and implementing a Power Management standard—guidelines for enabling the software that turns off monitors and CPUs when left unused—should be assessed, possibly including a pilot program to measure potential savings. Computers with Windows 7 will ship with power management features enabled; IT professionals must prepare computers for campus users without disabling power

[7] Adrienne Thorpe, “Retrocommissioning.” Presentation at Tulane, April 16, 2010.
[8] Evan Mills, “Building Commissioning: The Stealth Energy Efficiency Strategy,” Climate Progress, August 12, 2009.
[9] See “Re-tuning Commercial Buildings: A Low-Cost Path to Energy Efficiency and Cost Savings” http://www.pnl.gov/buildingretuning/
[10] These include the LSU Health Sciences Center, Texas A & M, the University of North Carolina-Chapel Hill, and Penn State.

management. EPA's Energy Star program provides free consulting for institutions implementing power management programs. [11]

Annual CO2 Reduction: 451 metric tons

Bicycle Plan & Programs

Select infrastructure improvements and policy actions are needed to accommodate an increasing number of bicyclists on the Tulane campus and safely support new cyclists. Students have expressed strong support for bicycle infrastructure and programs during the climate planning process. The following measures are recommended:

- Bicycle Circulation Design and Engineering Study. A traffic and engineering study is needed to complete the campus bicycle circulation system and develop design solutions for several areas where bicycle travel is problematic.
- Bicycle racks. The Office of the University Architect and TUPD have assessed areas where more bike racks are needed in the middle campus, and new racks will be installed. Providing the Facilities Services/Grounds department with a regular budget for installation and maintenance of bicycle racks would ensure that adequate capacity is maintained.
- Continue to add showers to renovated and new buildings. Look for an opportunity to add a bicycle commuter "hub" with facilities such as a shower and changing room.
- Bike racks on shuttles. Installing bike racks on shuttles (or allowing bikes in baggage areas) provides a safe alternative after dark or in inclement conditions.
- Bicycle Policy. An enforceable bike policy that addresses registration, circulation, and conduct of bicyclists is needed.
- Safety program. Offer a cycling 101 course each semester and make discounted helmets available at a campus location.
- Bike rental program. In Fall 2010, the Green Club began a low-cost bike rental program for students using abandoned bikes collected by TUPD each spring.

Annual CO2 Reduction: 688 metric tons

Ridesharing Resources

In Spring 2009 Visiting Assistant Professor Rick Duque and student David Gray presented the results of a Tulane transportation survey conducted by Prof. Duque's sociology students. In their recommendations, they stressed the importance of transportation measures that address staff. Staff travel to work five days a week, and the survey found that 70% of staff drive the least fuel efficient type of vehicle. The survey found that "Over 40% of staff would consider using a web based carpool

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[11] Resources for implementing power management programs, including a video of a useful webinar held on April 19, 2010, are available at "Implementing IT Power Management 2: Tips for Moving Forward in Your Organization."

system."[12] The basic elements of a ridesharing program would include a website to help match drivers and adjusting parking permit registration procedures so that drivers in a carpool could share a permit if they share driving. The Regional Planning Commission, the Metropolitan Planning Organization for our area, has made available a regional ridesharing website. The site will allow major employers in the New Orleans area to establish their own rideshare programs with the site. Alternately, a password protected website could be created as a pilot for the Tulane community at almost no-cost, or a rideshare software package could be purchased. "Zimride," for example, uses Google maps, Facebook and Twitter to help people find reliable people along their route.[13]

Annual CO2 Reduction: 757 metric tons

Public Transit Services and Pass

As noted above, University Services has begun a transportation services program that aims to make shuttle and transit use available and convenient to the Tulane community. They are working with RTA to review routes and coordinate with shuttle services, and possibly offer a transit pass. A pass program that enables Tulane students to use their university id to board buses and streetcars would reduce the emissions of off-campus students traveling to campus, and help all students who live in New Orleans without a car.

Annual CO2 Reduction: 732 metric tons

Renewable Energy Pilot Project

MBA students conducting a scan of renewable energy technologies in the New Orleans area found solar photovoltaic and thermal systems to be the most feasible for installation on a Tulane campus. Federal and state tax credits for homeowners have spurred the installation of solar at the residential scale; however, without financial incentives for commercial or nonprofit entities, few large scale solar installations have been installed in our area. The largest solar photovoltaic systems in the area are installed at local schools, including Warren Easton High School, L.B. Landry High School, Craig Elementary and Wilson Elementary. The installation at Warren Easton is a hurricane-resistant, 28 kilowatt array that generates 37,000 kilowatt hours/year and was installed with a hurricane-resistant roof.

The students investigated the possible installations of a solar thermal/hot water system at the Reily Center. They found that installing solar hot water collection on Reily for the pool would be difficult, as it may require reinforcement to handle the weight of the system. However, a solar hot water system may be appropriate to apply in new projects or major renovations of buildings that have very large hot water demands, such as residence halls and buildings with pools.

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[12] Gray and Duque, "Transportation choices of Tulane commuters," presentation, April 2009. The "2008-2009 Tulane Transportation Survey" summarizes the survey's results.

[13] An article in the Indiana Daily Student describes the university's recent adoption of Zimride, funded by the student government. See http://www.zimride.com/rideshare/university See also http://www.nctr.usf.edu/clearinghouse/ridematching.htm; http://www.carpoolworld.com/groups.html; and http://magiscorp.com/ridesharesolutions.html

MBA student teams have recommended that the university investigate a power purchase agreement to finance a solar photovoltaic system. "In the power purchase agreement, a third party pays for the PV system, the maintenance, and assumes all risk related to the performance of the PV system. Tulane would pay a fixed monthly rate for the electricity provided by the PV system. This rate is usually less than the current rate that is paid to Entergy. There is typically a 15-20 year term set for the power purchase agreement."[14] A third party may be able to leverage tax incentives for installation of renewable energy systems. The team suggested that the large area of flat roof owned by Tulane should be seen as an asset for potential solar development, especially if incentive programs for solar photovoltaic are expanded.

All new construction and major renovations with appropriate roof space should be designed "solar ready" to accommodate systems in future years.

Annual CO2 Reduction: 697 metric tons

Community-based Offsets

Carbon offsets enable an entity to reduce their emissions through funding an emission-reducing activity done by someone else. An MBA student team that reviewed the purchase of carbon offsets as a possible action for Tulane writes that "Carbon offset markets are an important part of the solution to climate change namely because of their economic and environmental efficiency."[15] Offsets can be less expensive or more feasible than reducing emissions that result directly from university activities; however, the purchaser receives only the carbon credit and not the additional benefits that can come with investing in energy efficiency, renewable energy and transportation projects on campus. In the United States, carbon offsets can be purchased through a voluntary carbon market. When purchasing offsets, it is important to purchase them from a source that has high credibility and follows protocols for ensuring that these are actual, non-additional reductions (e.g. they would not have been done without the funding provided by selling the offsets).

Many Tulane public service projects--such as tree planting, wetland restoration and energy efficient design and construction projects--sequester carbon or reduce greenhouse gas emissions. While these projects may not participate in formal offset registries, supporting them by purchasing the measurable carbon reductions they create could support local sustainability and provide an educational benefit to the university community. For example, Green Light New Orleans (GLNO) is a local non-profit organization that helps low- and middle-income families by replacing their incandescent light bulbs with compact fluorescent bulbs. It is a partner organization of the Center for Public Service, and hundreds of

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[14] Nick Cope, Mario Coronel, Domnik Knoll, Ruth Yomtoubian, "Solar Photovoltaic: A Proven Energy Solution." March 2010.

[15] Daniel Fletcher, Noah Lewis, and Spencer Wood, "St. Landry Parish Landfill." March 3, 2010.

Tulane students have been involved with GLNO as interns and volunteers. An informal, local offset project could fund all the energy efficient light bulbs installed by Tulane students volunteering with Green Light New Orleans each year. At a minimum, the climate impact of public service projects should be tracked and reported in the university's Greenhouse Gas Emissions Inventory.

As there is perhaps no better way to learn about climate change policy than to review particular offsets for purchase, establishing a fund or budget for offsets and asking a class or committee of students to review possible purchases would provide a unique, hands-on educational experience in climate policy.

Educational Measures

Undergraduate Curriculum

The Provost's Office and the Office of Environmental Affairs will conduct an inventory of sustainability in the curriculum, following the guidelines of AASHE's "STARS" university sustainability rating system. This inventory will provide a useful guide to students and faculty to courses offered across the curriculum, and it could be used to identify opportunities for enhancing course offerings in climate change and sustainability. There is a great demand for courses related to sustainability and climate change, and a need for courses in Environmental Studies and that provide sustainability-related service learning. For example, the popular "Sustainable Urban Infrastructure" offered by the Department of Earth & Environmental Studies provides a model course in sustainability and serves students in Environmental Science, Environmental Studies, and Architecture.

Green Jobs events

While "green jobs" will be an area of growth and opportunity for students in the future, more attention is needed to helping students identify and prepare for opportunities in emerging fields. Organizing panels that bring people working in sustainability fields to campus would be of interest to students. Student members of the committee suggested events that are in the LBC over lunchtime at the end of the week, feature brief remarks, and address topics such as green building, clean energy, and urban agriculture. By recording brief interviews, a library of advice could be built for students. These events should be offered in partnership with Career Services and the Social Entrepreneurship initiative.

Annual University-Wide Climate Change Event

An annual event that focuses on Tulane's climate commitment efforts would help continue to build and sustain campus attention in the climate change initiative. The event could address the operations, academic, and public service dimensions of Tulane's climate change efforts:

- Provide an update on Tulane's progress towards reducing greenhouse gas emissions.
- Highlight campus and public service sustainability initiatives
- Include interdisciplinary panels of faculty speakers
- Could include "Tech Day" type demonstrations of energy efficient equipment

Near-Term Measures for Further Analysis

Investigate a Telecommuting Policy

Policies that allow employees to work from home occasionally can reduce the emissions from commuting. Further research is needed to understand how such policies could be administered in a workplace with such a great diversity of activities.

Video and Teleconferencing

Video and Teleconferencing can reduce the emissions that result from business travel. Technology Services has included a useful guide to video and teleconferencing services on its Green IT website. To further the use of video conferencing services, Technology Services should be asked to develop recommendations for videoconferencing features that Tulane purchasers should specify when purchasing computer workstations for Tulane offices.

MEASURES TO RESEARCH FOR 2015-2020

Scale up renewable energy use

To help advance clean energy technologies in our region, the university should aim to provide the equivalent of 5% of its electricity use from renewable energy by 2020. The technologies described below should be investigated as ways to achieve these reductions. If the university is unable to meet this goal through the installation of renewable energy systems, it should investigate mechanisms for investing in local or regional renewable energy, such as purchasing green electricity from utilities, investing in renewable energy funds, or purchasing Renewable Energy Certificates (RECs). RECs are a mechanism for purchasing the carbon savings from renewable energy systems in other places. Typically, RECs represent a premium that is paid on top of the standard electric rate.

Scale up Photovoltaic

After installing an initial system, extend photovoltaics to other flat roofs on campus. Architect and alumni member of the Climate Commitment Advisory Committee, John Williams has done a preliminary evaluation of the Uptown campus and has suggested that 7MW could be installed on the flat roof surfaces.

Investigate Geothermal Heat Pumps for Uptown Campus

Also known as ground source heat pumps, geothermal heat pumps take advantage of the steady temperature of the earth to provide cooling in the summer and heating in the winter. According to John Kelly of the Geothermal Heat Pump Consortium, installation of these systems has steadily grown, even through the recession, because "they are feasible throughout the U.S." and because they have the lowest lifecycle costs of any HVAC system.[16] In New Orleans, numerous residential geothermal heat pump system systems have been installed, and a system has been in operation at the Audubon Zoo Earth Lab building since the 1990s. Nationally, Ball State University in Indiana has received considerable attention for a project replacing coal-fired boilers with a campus wide geothermal system. The project received $5 million in Recovery Act funds from the DOE.[17] Projects are being done at K-12 schools around the country, with the pipes drilled beneath ball fields and playgrounds.[18]

Student review of these systems found that geothermal heat pump systems have low maintenance costs, the underground piping can last for 50 years, and in hot humid climates they are used in combination with a chiller. They found estimates that geothermal systems can reduce energy costs by 40-70% (though it is unclear if this is based on heating and cooling costs or overall energy costs).[19] Several questions need to be investigated to determine the appropriateness of geothermal heat pumps at the institutional and commercial scale in the New Orleans area:

- The systems must be designed so that the heating and cooling demand balance; otherwise the temperature of the ground around the system could be raised in the longer term. In areas with hot climates and large cooling loads, systems are designed to entirely meet the heating load, and then the additional cooling load is provided by a chiller. Is Tulane's heating load significant enough that a system designed in this way would save much energy?
- The thermal conductivity of the ground in this area must be assessed. The design of these systems is based on building loads, moisture content of the ground, and the water table.
- Can it be integrated with the existing district heating and cooling system?

A recent overview of the technology was done by the Oak Ridge National Laboratory in December 2008. It concluded that "GHPs use the only renewable energy resource that is available at every building's point of use, on-demand, that cannot be depleted (assuming proper design), and is potentially affordable in all 50 states." [20]

Solar Thermal in New Residence Halls

As noted above, a solar hot water system may be appropriate to apply in new projects or major renovations of buildings that have very large hot water demands, such as residence halls and buildings with pools.

[16] John Kelly, "Geothermal Heat Pump Fundamentals & Applications," ENERGY STAR Monthly Partner Web Conference, March 17, 2010. Mr. Kelly is with the Geothermal Heat Pump Consortium.
[17]See http://www.energy.gov/news2009/8233.htm and
http://www.energy.gov/news2009/documents2009/338M_Geothermal_Project_Descriptions.pdf
[18] http://www.yorkcountyschools.org/greenYCSD
www.yorkcountyschools.org/greenYCSDgreen.yorkcountyschools.org
[19] Leslie Johns, Katie LaCorte and Jonas Sorensen, "Geothermal—Tulane's Better Energy Alternative" March 2010.
[20] Patrick J. Harris, "Geothermal (Ground-Source) Heat Pumps: Market Status, Barriers to Adoption, and Actions to Overcome Barriers," Oak Ridge National Laboratory, December 2008.

Building Energy Efficiency Renovation and Retrofit Program

By 2015, the university should aim to have an active building metering program, a retrocommissioning or building re-tuning program, an experienced energy engineer, and staff with extensive experience in energy efficient design and operation. With these components in place, the university will have the information and expertise to retrofit or renovate existing buildings in a systematic way to drastically reduce their energy use. With the metering data, buildings can be prioritized based on their energy use per square foot, both relative to other campus buildings and to buildings of their type nationwide. Each future renovation should aim to significantly scale down a building's heating and cooling needs, so that ultimately the size of the equipment serving the building can be reduced in the future.

REDUCTIONS RESULTING FROM EXTERNAL ACTIONS

The greenhouse gas emissions that result from Tulane's activities are shaped by the policies and technologies of our larger society. Most notably, the emissions that result from the electricity we buy depend on the fuels or energy sources used by our utility. When the utility takes steps to reduce its emissions, the emissions counted in our inventory fall as well.

It is important to include some accounting of these actions and estimates of how they will reduce Tulane's future emissions. First, it will help produce a more accurate plan and a more specific sense of future emissions and needed action. Second, it is an important reminder that emissions levels result not solely from the choices and actions of individual and institutions like a university, but also from the infrastructure and products that are available to us.

Emissions from Purchased Electricity

In our accounting of the university's greenhouse gas emissions, the emissions from our purchased electricity are estimated by multiplying the number of purchased kilowatt hours by an emission factor—an amount of carbon dioxide released per kilowatt hour generated. The types and mix of fuels used by the power plants determines the emission factor. Utilities that use renewable energy sources such as wind and hydroelectric have very low emission factors, while utilities that use coal have very high emission factors. Because of its use of nuclear and natural gas, Entergy, the utility that serves Tulane's main campuses in uptown and downtown New Orleans, has one of the lowest emission factors of all utilities in the country.

Because electricity is received through a grid that is fed by multiple power plants, it is difficult to determine the exact amount of carbon dioxide released to generate the electricity we use. The selection of an emission factor is a choice that is made in the inventory process. In Tulane's current greenhouse gas emissions inventory, we use an emission factor from the EPA that is an average for our sub-region. This region is similar, but not identical, to the region served by Entergy.

As Entergy and other electricity generators in the region choose cleaner sources of energy and improve efficiency at their power plants, the emission factor will be reduced. Entergy has actively worked to reduce its emissions since 2000. The utility is now reaching the end of its second voluntary greenhouse gas emissions reduction commitment. In its first commitment, it sought to hold emissions below 2000 levels during the period 2001-2005. In its current commitment, it is seeking to hold emissions to 20% below 2000 levels during the years 2006-2010.[21] As the utility acquired some nuclear power plants in the northeast in the early 2000s, some figures showing its emissions reduction reflect the addition of these large, distant facilities. However, the utility has made many improvements at power plants in our region, and CO2 emission factor for its regulated utility (its operations in Arkansas, Louisiana, Mississippi and Texas) decreased from 1.08 lb/kWh in 2000 to .91 lb/kWh in 2005.[22] These improvements mean that each kilowatt hour of electricity that we use on campus has caused lower emissions of greenhouse gases.

In the future, working with Entergy to use utility emission factors and to collaborate on emissions reductions can substantially reduce Tulane's greenhouse gas emissions. Though Entergy has not announced any emission reduction targets beyond 2010, they have been a leader in climate action planning and can be expected to continue their efforts. One possible area of collaboration would be encouraging Entergy to add renewable energy choices to its regional generation portfolio. For example, in recent years Entergy offered a "Geaux Green" program to customers in the Baton Rouge area. For a small additional fee, customers could choose to purchase electricity that had been generated from a biomass plant. These kinds of reductions "upstream" from university facilities could help reduce our emissions substantially over the longer term.

In establishing our targets, we conservatively assumed that our utilities would incrementally implement a 5% improvement in emissions from generating electricity before 2020.

New Vehicle Fuel Efficiency Standards

The Obama administration increased fuel efficiency standards for cars and light duty trucks, and in May 2010 the President issued a memorandum that directed agencies to begin developing a fuel efficiency standard for medium and heavy trucks.[23] The fuel efficiency standard for cars and light trucks will first apply to the 2012 model year, and it will be ramped up each year to reach 35.5 miles per gallon by 2016—42% more efficient than the current standard of 25 miles per gallon.[24] The new fuel efficiency standard for medium and heavy trucks will be announced in 2011, and it will be implemented beginning with the 2014 model year. These actions will most significantly impact Tulane's greenhouse gas emissions by improving the fuel efficiency of the vehicles that Tulanians drive to and from campus.

[21] http://www.entergy.com/content/our_community/sustainability_report/environment.html#our_environmental_performance

[22] Jeff Williams, Manager, Corporate Environmental Initiatives, email to Liz Davey, 17 May 2006.

[23] http://www.whitehouse.gov/the-press-office/presidential-memorandum-regarding-fuel-efficiency-standards

[24] http://climateprogress.org/2010/04/01/energy-and-global-warming-news-for-april-1-us-fuel-rules-spur-hybrids-auto-engine-efficiency-biggest-step-the-u-s-government-has-ever-taken-to-cut-co2/An an unnamed source said that the new fuel efficiency standard will improve fuel efficiency of vehicles about 5% annually. See http://climateprogress.org/2009/09/15/white-house-rolls-out-details-of-fuel-economy-emissions-standard/

Airline Fuel Efficiency Improvements

The Duke Climate Action plan incorporates fuel efficiency improvements planned by the airline industry into their forecasts of future air travel emissions. The International Air Transport Association (IATA), an industry organization that represents airlines providing over 90% of the world's international travel, has set a fuel efficiency goal and a greenhouse gas reduction goal of 25% by 2020 (based on 2005 levels).[25]

Conclusion

This document presents a list of the most promising projects for reducing our greenhouse gas emissions in the near term, winnowed from many recommendations from members of the Tulane community. It identifies particular next steps in the key areas of climate action: energy efficiency, moving to cleaner energy sources, transportation, and offsetting our emissions by helping others reduce.

The projects listed in this document could be funded through a mix of strategies. Some will require commitment of university operating funds, with careful monitoring to assess energy savings that result. A number of the recommended projects may be of interest to university donors. Students who have served as Climate Commitment Advisory Committee members have expressed interest in involving student government in funding components of the plan through a student fee or the Reserve Fund. Renewable energy projects could potentially be funded through innovative financing tools such as power purchase agreements, where a third party owns and operates the system, selling the electricity to the university at a negotiated, long-term rate.

Energy efficiency projects can have a major impact and produce long-term savings. The barriers to energy efficiency go beyond the upfront cost, as these projects require capacity building, information, and designation of responsibility within an organization to achieve. In the longer run, investing in energy efficiency, and then dedicating the savings to the next most cost-effective reduction projects will most steadily and sustainably decrease our impact on climate change.

It is important that the university approach the climate planning as both a management tool and an educational process. While the development of this document involved many students, largely as researchers, student committee members have noted that there should also be involvement of students in the implementation of measures. The climate planning process should at a minimum involve students in the annual update of the greenhouse gas emissions inventory, make the tools of climate action planning available to faculty and students, and regularly communicate research needs to faculty and students.

This document marks a first step towards a longer-term goal of reaching carbon neutrality: net zero in the university's impact on climate change. Longer range planning for emission reductions is very difficult, particularly at this historical moment and in this particular place. In New Orleans and Louisiana, experience with clean energy, green building, and energy efficiency is just beginning. Additionally, the very particular climate and geography of New Orleans make it difficult to draw from expertise and model projects elsewhere. As experience with these strategies and technologies increases in our area,

[25] http://www.iata.org/whatwedo/environment/Pages/fuel_efficiency.aspx

longer term opportunities for reductions will change. The university should work toward specific reduction goals during the next ten years, while continually investigating and planning measures that can achieve reductions in future decades.

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Appendix A: Costs, Savings and Emissions Reductions

Preliminary draft of costs, savings, and emissions reductions of measures to be implemented by 2015. The last column allows comparisons between measures of the savings or cost of each metric ton reduction of greenhouse gas emissions.

Project Name	Start Year	Duration (years)	Total Annual Operating Cost	Total Capital Cost	Total Capital Cost Including Incentives	Average Discounted Annual Cash Flow	NPV	IRR	Discounted Payback Time (years)	Annual Reductions (MTCO2e)	Discounted Cost per Reduction ($/MTCO2e reduced)
All Projects	2010	35	(784,500)	($6,365,000)	($6,365,000)	$156,267	$5,625,601	13%		(3,613.1)*	$44.49
Energy Manager and Program	2011	10	($150,000)	($150,000)	($150,000)	$627,270	$6,899,974	483%	0.21	(4,017.1)	$171.77
Retrocommissioning Pilot	2011	1	-	($25,000)	($25,000)	$6,504	$13,008	52%	0.66	(179.8)	$72.34
Retrocommissioning of all lg. Buildings	2012	20	($282,000)	-	-	$130,708	$2,744,869	-	0.00	(1,998.0)	$68.69
Power Management	2011	5	($2,000)	($10,000)	($10,000)	$90,838	$545,029	1144%	0.09	(450.1)	$242.16
Bicycle Plan	2011	10	($20,000)	($180,000)	($180,000)	($34,545)	($380,000)	-	N/A	(688.7)	($55.18)
Student Transit Pass	2011	10	($300,000)	-	-	($272,727)	($3,000,000)	-	N/A	(732.3)	($409.69)
Ridesharing resources	2011	10	($7,500)	-	-	($6,818)	($75,000)	-	N/A	(757.1)	($9.91)
Solar PV (est. to show cost per reduction, other financing options available)	2015	30	($20,000)	($6,000,000)	($6,000,000)	($35,719)	($1,107,278)		N/A	(696.2)	($53.01)
Carbon Offsets (i.e. Green Light New Orleans light bulbs)	2010	5	($3,000)	-	-	($2,500)	($15,000)	-	N/A	(246.0)	($12.20)

*Average annual reduction for all projects over 35 years, from initiation of first measure through the life of the solar photovoltaic system.

Appendix B: Tulane Green Building Guidelines

FINAL 2.17.11

TULANE UNIVERSITY

GREEN BUILDING DESIGN AND CONSTRUCTION

STANDARDS & GUIDELINES

Over the past ten years Tulane University has enacted a set of practices for environmentally responsible design and construction. Early efforts have been followed by more specific and consistent university practices and project requirements. Three years ago the university established a LEED Silver standard as a minimum for its major building projects.

Objectives

Tulane University would like to clarify its commitment, standards and practices for sustainable design and building. In doing so the following objectives can be realized as part of every building project:

- Substantially reducing energy use and the resulting greenhouse gas emissions,
- Providing a healthier, more comfortable and productive environment for building occupants,
- Ensuring that the design and construction of Tulane buildings are informed by best practices for reducing the overall environmental impact of buildings throughout their life cycle,
- Providing educational and research opportunities in green building design, construction and operation to the Tulane community.

The primary way we intend to meet these objectives is to articulate our LEED standards and guidelines.

LEED Certification Standard

All new buildings, major renovations and major interior rehabilitations on Tulane campuses and properties that meet certain criteria (see Criteria below) should be designed to achieve the LEED Silver standard or better. Tulane University will work carefully with architects, contractors, subcontractors, project consultants and sub-consultants to ensure that LEED standards for design and construction are understood, supported and achieved throughout the building process.

Criteria for Applicability of LEED Standard

The LEED Silver minimum standard will apply to projects that meet any of the following (2) two criteria:

- All new buildings over 2000 square feet, having at least 5 full-time equivalent occupants, and with a construction cost of $500,000 or greater.
- All renovations, including major HVAC renovations, significant modifications to the building envelope, and major interior rehabilitations that have a project cost of $1 million or greater.

*Projects of more limited scope—for example, HVAC, plumbing, envelope upgrades, or landscape projects—should meet the standards LEED establishes for that specific scope item.

The University's Priority Credits for LEED BD+C projects:

The university has identified a list of priority credits to be earned for every project. Completion of these credits will protect indoor environmental quality and ensure the operation of an energy efficient building. These credits are in addition to the prerequisites required of every LEED certified project and in addition to any other LEED credits particularly suited to the project type.

Priority Credits:
WEc3 – Water Use Reduction, 30% (2 points)
EAc1 – Optimize Energy Performance, 28% / 24% (9 points) (Buildings with labs exempt)
EAc3 – Enhanced Commissioning (2 points)
EAc5 – Measurement and Verification (3 points)
MRc2 – Construction Waste Management, 50% (1 point)
EQc3.1 – Construction IAQ Management, During Construction (1 point)
EQc4 – Low Emitting Materials (4 points)
IDc1—Innovation in Education (1 point)
IDc2—LEED Accredited Professional (1 point)

Strongly Recommended Credits:
SSc1 – Site Selection
EQc8.1 – Daylight and Views, Daylight 75% of Spaces (1 point)

[*BD+C = Building Design + Construction]

For projects that include laboratory space, Labs 21 Environmental Performance Criteria should be reviewed and adopted to the greatest extent possible in the project.

Renovation projects that have a project cost of $1 million or greater that do not qualify for the LEED Building Design + Construction standard should follow the LEED Commercial Interiors standard.

The sustainability goals and possible design options should be reviewed and discussed at the project kick-off or during schematic design.

Indoor Environmental Quality

As a standard practice all building interior finish materials—for example, paints, adhesives, flooring -- shall be low-emitting materials. .

The objective of this practice for the LEED EQ4 series is to "reduce the amount of indoor air containments that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants."

Energy Efficiency Goals

All new buildings should have at least a 28% energy cost savings from a baseline building performance according to Appendix G of ANSI/ASHRAE/IESNA Standard 90.1-2007, earning 9 points for LEED Energy & Atmosphere Credit 1.

The intent of this credit is to "achieve levels of energy performance above the baseline in the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use."

All major renovations should aim to have at least a 24% energy cost savings from a baseline building performance according to Appendix G of ANSI/ASHRAE/IESNA Standard 90.1-2007, earning 9 points for LEED Energy & Atmosphere Credit 1.

Laboratory buildings are exempt from these energy efficiency goals. In these cases, project teams should consult the Labs 21 Environmental Performance Criteria and seek to have an energy intensity of less than 300 kBtu/gsf/year.

Building Commissioning

All projects shall be commissioned by a third party Commissioning Authority that will oversee the entire commissioning process including fundamental and enhanced commissioning. The Commissioning Authority will begin the commissioning review process for a project no later than the beginning of the Design Development phase.

Energy Modeling

All major construction and renovation projects will develop an energy simulation model of the building early in the design process. The energy modeling, in relation to LEED EA prerequisite 2 and credit 1, will be used to estimate and to improve the design's energy performance as it progresses through the design stages. The energy model allows the design team to assess the energy implications of different design strategies. Energy modeling services that include testing of multiple high performing building systems and alternatives should be secured concurrent with the selection of the design team.

Life Cycle Costing

Lifecycle cost analysis will be used to assess strategies and design alternatives that affect the building's energy use in total over time. Life Cycle Costing forecasts and assesses energy costs, maintenance costs, and energy savings for the life of the system. These are often significant when considering alternatives that have a high upfront cost. Life cycle costs and savings should be assessed within the extended time frames that characterize the university context and standards.

The priorities and procedures that comprise the university's green building standards and guidelines will help to ensure that the university will achieve and maintain its goals for sustainable design and building. As advances are made in renewable energy and resources, as well as building practices, the university will continue to research and to study developments in the design and building professions that will continue to educate the Tulane community and to enhance its environment.