

**The Woodrow Wilson School of Public and International Affairs  
Princeton University**

**Development of Policy Initiatives  
for the Sustainable Use of Energy at Princeton University**

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**Summary Report**

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**Individual reports available at:**

[http://www.princeton.edu/~mauzeral/WWS402d\\_Spr07/PTF%20Webpage%203.html](http://www.princeton.edu/~mauzeral/WWS402d_Spr07/PTF%20Webpage%203.html)

Princeton's climate change research programs are among the most advanced and well funded in the world. The Carbon Mitigation Initiative, the result of a \$20 million grant from British Petroleum and Ford Motor Company, continues its work on carbon capture and storage as well as other cutting edge climate change research projects. The university has also been aggressively expanding its teaching offerings to undergraduate, graduate and postdoctoral students interested in climate change issues. The Geophysical Fluid Dynamics Laboratory, which is part of the National Oceanic and Atmospheric Administration and is affiliated with Princeton University, is one of the top climate modeling laboratories in the world. The Princeton Environmental Institute coordinates much of the research, teaching and outreach activities related to environmental issues at Princeton.

Operationally, however, Princeton has been slow to integrate climate change awareness into the workings of the university. Although there have been efforts to reduce carbon emissions, Princeton has no comprehensive carbon policy. This summary report has been prepared by the Development of Policy Initiatives for the Sustainable Use of Energy at Princeton University Task Force ("the Task Force") to describe what a carbon policy for Princeton should look like and how it should be implemented.

Princeton does not need to reinvent the wheel. Many other colleges and universities both in the United States and abroad have made ambitious commitments to reduce, and in some cases eliminate, carbon emissions. For the most part, these institutions have succeeded in meeting their targets and developing sustainable cultures on their campuses. Many universities have reduced—or made substantive plans to

reduce—their emissions using resourceful and creative policies. The Task Force studied the policies of other universities and then contextualized the best elements of them to the Princeton operating environment to develop a carbon policy for Princeton.

The Task Force was comprised of seven undergraduate students and one graduate student of the Woodrow Wilson School of Public Policy and International Affairs at Princeton University. It was led by Professor Denise Mauzerall. Six of the undergraduate Task Force members studied specific areas of Princeton's carbon emissions and developed policies to reduce emissions within that area. The research of these students serves as the basis of this summary report which was written by the seventh undergraduate member.

The recommendations of the Task Force are structured around an organizing principle that sets targets for carbon emissions reductions. The structure of the summary report is as follows. First, the organizing principle is laid out. Second, the costs and technical means of meeting this principle are explored. Third, policy recommendations are offered for how to meet the principle most effectively.

### **Organizing Principle**

Princeton's approach to carbon emissions reduction should be framed by an organizing principle, or overall emissions reduction goal. The organizing principle establishes the level of commitment that the university is willing to make to address its climate impact by setting clear emissions reduction targets. It also serves to provide a framework within which emissions reduction policies can be measured. The Task Force proposes an ambitious, dual-prong organizing principle incorporating both Governor

John Corzine's Executive Order No. 54 and the University Presidents Climate Commitment.

- *Element 1: Governor John Corzine's Executive Order No. 54*—On 13 February 2007, Governor John Corzine signed an executive order committing the state of New Jersey to a set of emissions reduction goals: by 2020 New Jersey is to be emitting greenhouse gases (GHG) at 1990 levels (approximately a 20% reduction from current levels) and by 2050 the state's GHG emissions are to be 80% below their 2006 levels. As one of the first states in the nation to subscribe to such stringent goals, New Jersey is setting a trend that eco-friendly policymakers hope will soon be made a national mandate. While implementation of the reduction goals is not strictly dictated by the executive order, some guidelines are supplied for development of an implementation plan. Over the first six months that the order is in place, potential policies and measures for achieving the goals will be evaluated; an inventory of 1990 emissions will be taken and a program for continuing emissions inventories will be established; every other year progress will be evaluated and recommendations will be made to the Governor and the Legislature with the purpose of restructuring policy to achieve the emissions targets.
- *Element 2: University Presidents Climate Commitment*—After identifying the potential for universities to play a leadership role in reducing emissions and in increasing demand for under-demanded renewable energy, the Association for the

Advancement of Sustainability in Higher Education (AASHE) established the American College & University Presidents Climate Commitment (PCC). The PCC expresses the commitment of the signatory president's college or university to eventual climate neutrality and institutes a series of phases, the deadlines for which will aid the signatory institution in developing a comprehensive plan for achieving climate neutrality. An institution achieves climate neutrality when its net climate impact is reduced to zero through a combination of on-site emissions reductions and off-site offset or REC purchases. To date, 202 colleges and universities are signatories, including such prestigious institutions as the University of California and the University of Pennsylvania. This number is growing rapidly. Unlike Executive Order No. 54, the PCC has a set of binding guidelines for the development of a policy plan. Within two months of signing the commitment, the signatory school must create the necessary institutional structures for the actualization of climate neutrality; within one year and every year following, the school must take an emissions inventory; within two years, the school must create a plan for becoming carbon neutral including (1) a target date, (2) intermediate target goals and dates, (3) integration of sustainability in the educational experience of all students, (4) efforts to augment research efforts, and (5) an institutionalized method for tracking effectiveness of programs. While this overarching plan is being created, the commitment requires that the signatory school implement at least two of a list of six other policies: these include establishing LEED Silver or equivalent as the baseline for new construction on campus or pledging to offset emissions from university-related air travel. The

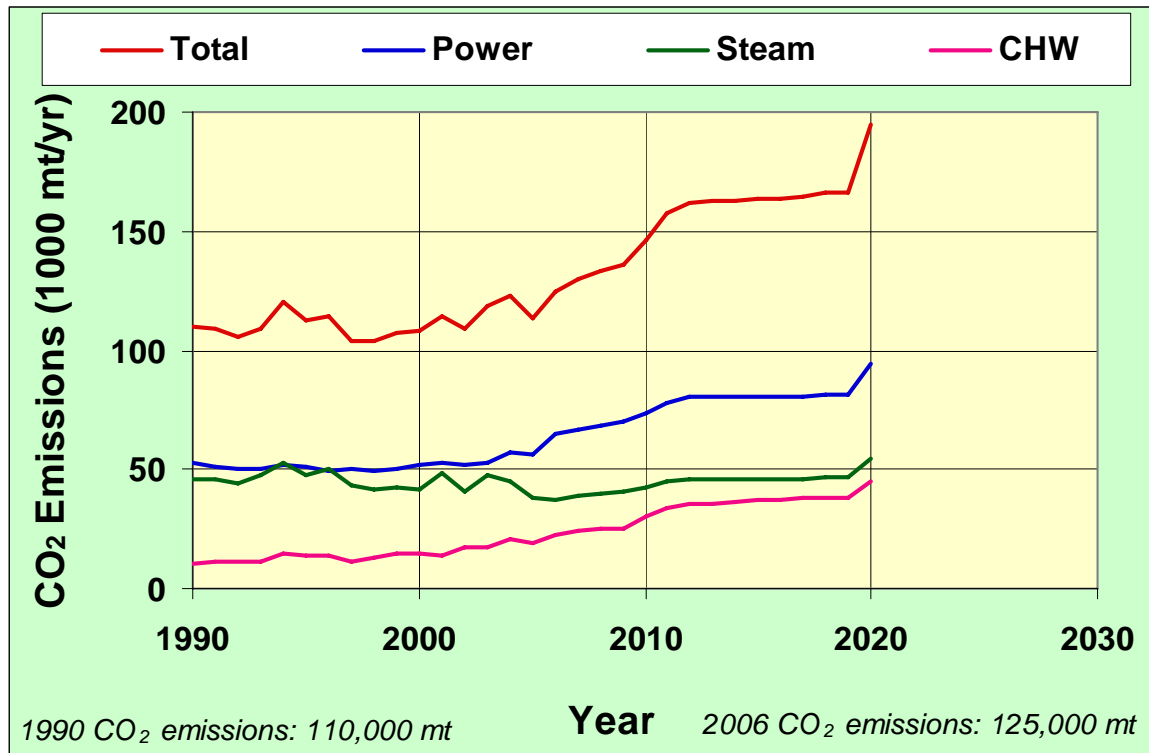
PCC also carries a transparency requirement: a signatory school must make evidence of their progress relative to their plan available to AASHE, which will make these progress reports public.

The Task Force recommends that President Tilghman sign the Presidents Climate Commitment as soon as possible, committing Princeton to climate neutrality immediately through offset purchases. Simultaneously, we recommend that Princeton commit to Governor Corzine's Executive Order No. 54 through on-campus emissions reductions. By imbedding Corzine's goals for on-campus emissions reductions in the PCC's requirements for climate neutrality, Princeton can pointedly work to develop an ambitious strategy for campus sustainability.

### **Emissions Inventory**

In order to meet either the Presidents Climate Commitment or Executive Order No. 54, Princeton must first have a baseline from which to measure emissions reductions. Figure 1 displays Princeton's historical and projected CO<sub>2</sub> emissions from the operation of the cogeneration plant and off-the-grid electrical purchases. The emissions are broken down by end-product: power, steam and chilled water.

Figure 1: CoGen Plant and Electrical Purchases CO<sub>2</sub> Emissions



Princeton's emissions have grown significantly since 1990 and they are expected to continue to grow through 2020. Under business as usual (BAU) assumptions, Princeton's 2020 emissions will be 73% greater than those of 1990, hitting 190,000 metric tons of CO<sub>2</sub>. Meeting Executive Order No. 54 through on-campus emissions reductions demands reducing CO<sub>2</sub> emissions by 15,000 metric tons from 2006 emissions or 80,000 metric tons from BAU 2020 emissions over the next 13 years. As will be shown, this is an ambitious, but achievable, target. Going carbon neutral to meet the Presidents Climate Commitment demands reducing CO<sub>2</sub> emissions by 125,000 metric tons immediately through offset purchases. Although costly, this goal is certainly feasible. The next section examines the means and costs of meeting both of these targets.

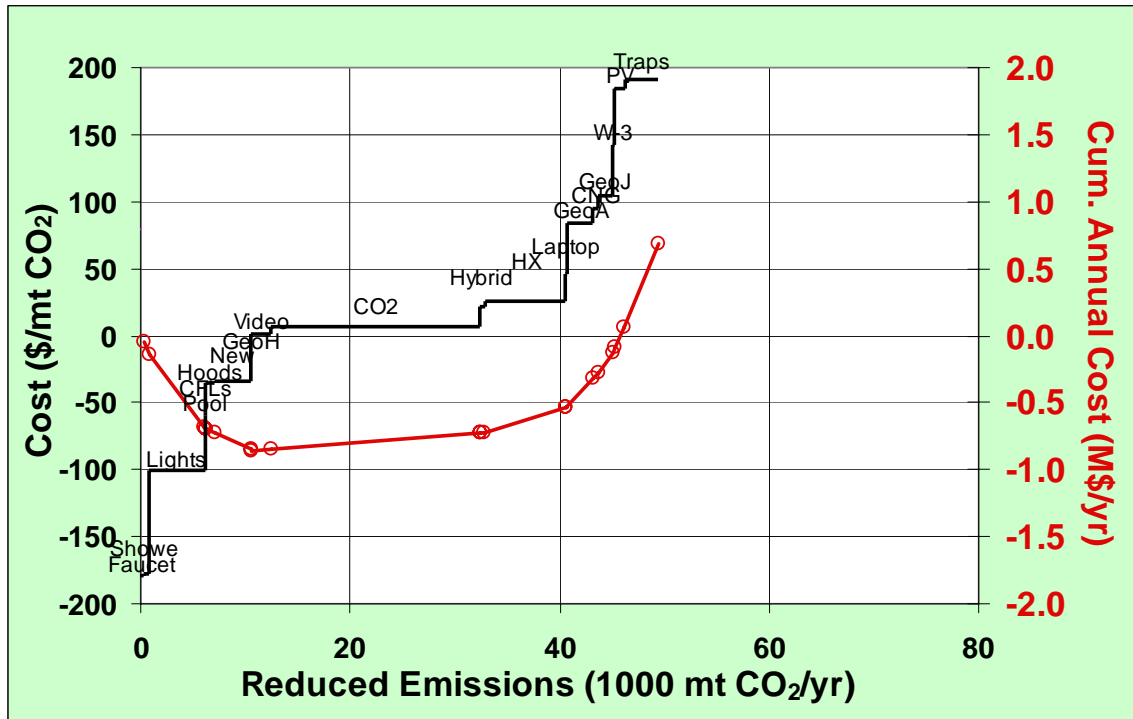
## **ENV-ST01 Results**

ENV-ST01, a student initiated seminar led by Tom Kreutz and Michael Gillenwater in the fall of 2006, examined the potential for on-campus emissions reductions at Princeton. The seminar examined a number of potential emissions reducing projects and estimated the emissions reduction potential and cost of each. The approach was not exhaustive—there are certainly many opportunities for emissions reductions that the seminar never discovered and many opportunities that it discovered which it could not quantify. Nonetheless, the results provide a starting point for understanding how Princeton could reduce its emissions to comply with the Presidents Climate Commitment and Executive Order No. 54.

The primary output of the seminar was a supply curve of all the emissions reduction options examined and measured. This chart reproduced in Figure 2.



Figure 2: Supply Curve of ENV-ST01 Emissions Reduction Projects



The bottom axis of Figure 2 measures annual reduced emissions of CO<sub>2</sub> in thousands of metric tons. The left axis, which applies to the black line, measures the cost for reduction options in dollars per metric ton of CO<sub>2</sub> not emitted. The right axis, which applies to the red line, measures the cumulative annual cost of emissions reduction projects. For any given level of CO<sub>2</sub> emissions reductions, charted on the x-axis, the black line shows the marginal cost of additional emissions reductions and the red line shows the cumulative cost of emissions reductions. As you move from left to right across the supply curve, projects go from being cost saving to cost positive. Therefore, the cumulative annual cost curve first falls below zero as money-making projects are implemented and then begins to rise as these projects are exhausted and additional emissions reductions become costly. Examples of cost saving projects include low flow showerhead installation, lighting renovation and installation of a pool dehumidifier in

DeNunzio. More expensive projects include installing solar PV panels on campus and replacing the current university vehicle fleet with one that burns compressed natural gas.

In total, ENV-ST01 found around 50,000 metric tons of potential CO<sub>2</sub> emissions reductions that could be achieved on-campus. Implementing all of these projects would cost around \$690,000 annually. As discussed above, to meet Governor Corzine's Executive Order No. 54 the university will need to reduce emissions by around 80,000 metric tons of CO<sub>2</sub> from 2020 BAU assumptions. The projects discovered by ENV-ST01 get Princeton a little more than halfway there. It is important to note that these projects were discovered by a student seminar over the course of a single semester. It is highly probable that over the next 13 years Princeton will be able to find projects that will reduce emissions an additional 30,000 metric tons annually, allowing for compliance with Executive Order No. 54 by 2020. The recommendations in the latter half of this summary report will assist in this task.

ENV-ST01 also examined the potential for Princeton to go carbon neutral immediately as advocated by the Task Force in order to meet the Presidents Climate Commitment. To help finance this, the seminar found 12,500 metric tons of emissions reductions that could be achieved through only cost saving project. These would net the university around \$850,000 a year. The seminar estimated that by partially financing offset purchases with these revenues, Princeton could completely eliminate its carbon footprint at a cost of only \$350,000 a year.

The results of ENV-ST01 show how achieving the dual part organizing principle is possible. Princeton could meet the Presidents Climate Commitment with offset purchases which would immediately eliminate the university's carbon footprint at a net

cost of only \$350,000. The cost of meeting Governor Corzine's Executive Order No. 54 through on-campus reductions is less certain, but the results of ENV-ST01 show how Governor Corzine's ambitious targets could begin to be achieved. Projects costing \$690,000 a year could reduce CO<sub>2</sub> emissions by 50,000 metric tons annually. This is more than half of the 80,000 metric tons of CO<sub>2</sub> emissions reductions from 2020 BAU that Executive Order No. 54 demands.

The remaining sections of this summary report offer recommendations for how Princeton should go about meeting the dual organizing principle. First, offsets are examined and recommendations are offered for how Princeton should initially offset its carbon emissions to meet the Presidents Climate Commitment. Second, the report offers recommendations for how Princeton could begin to close the 30,000 metric ton gap between the on-campus CO<sub>2</sub> emissions reduction opportunities discovered by ENV-ST01 and the reductions necessary under Governor Corzine's Executive Order No. 54.

### **Carbon Offsets**

In order to achieve climate neutrality immediately under the Presidents Climate Commitment, Princeton will need to engage in significant off-site purchases. It will be impossible to go carbon neutral through on-campus projects exclusively for the foreseeable future. The Task Force compared and contrasted two off-site purchasing options, Renewable Energy Certificates/Credits (RECs) and offsets, and examined their pros and cons within the context of Princeton's environmental goals. The importance of ensuring additionality—the quantified difference between the amount of carbon that would have been emitted had the REC/offset not been purchased (the business as usual

trajectory) and the amount of carbon that is emitted with the REC/offset purchase – was of particular concern. Ultimately, the Task Force found that offsets are a better investment for Princeton than RECs, unless RECs are purchased as part of a multi-university initiative where ensuring additionality of the purchases is given top priority, because of the guaranteed additionality of offsets.

Ethically, however, RECs and offsets cannot be the long-term solution. As a leader in academics and research, Princeton should set an example for other institutions in the realm of sustainable development. Building a culture of sustainability on campus and incorporating environmental sustainability into the Princeton education is of utmost importance. Because Princeton graduates will be among the next generation of world leaders, the environmental practices they learn at Princeton can have a significant impact upon the future of global sustainability.

The Task Force has two recommendations regarding off-site purchasing programs.

- *Recommendation 1: Immediate Climate Neutrality through Offset Purchases*—Princeton should jump start its sustainability program with offset purchasing. Offset purchasing is favored over REC purchasing because additionality is obligatory and can be more certainly determined. However, careful certification, self-policing of offset quality, and balancing of ethical, practical, and economic concerns is necessary. Off-site purchases supporting projects that involve building renewable energy plants, or large-scale forest conservation or restoration (be they domestic or international) are recommended. Because economic, ethical,

and benefit optimization considerations should guide investment, carbon offsets can be domestic or overseas. As long as additionality and other key criteria for offset quality are met, the university has a degree of freedom in choosing the type of offset it chooses to purchase. Possible offset projects include funding wind farm construction and subsidizing large-scale forest restoration or conservation.

- *Recommendation 2: Explore the Possibility of a Multi-University REC Purchase*—RECs are particularly troubling because they create a poorly regulated market for intangible goods. Extensive and nationally cohesive certification and regulation is required to ensure that intangible goods markets are functioning fairly and efficiently. Unfortunately, no such regulation is yet exerted upon the REC market. Government regulation and oversight in the REC/offset market is needed, and Princeton is responsible for self-policing its purchases until such laws are put in place. However, REC purchasing could be considered under certain, specific conditions which guarantee additionality. For example, Princeton could mimic the Pennsylvania schools initiative and adopt a wind farm or solar PV field as part of an Ivy League or New Jersey University partnership.

Offset purchases will allow Princeton to become carbon-neutral immediately and fulfill the Presidents Climate Commitment, but they must not deter the university from ambitious on-campus emissions reduction projects. As soon as Princeton's sustainability program is established, the university should rapidly move away from REC/offset purchasing. Instead, the university should emphasize campus programs that increase awareness and education and use its financial and research resources to lead the charge in

the development of novel renewable energy solutions. Further, the university should be willing to spend more for on-campus emissions reductions than could be achieved through offset purchases. This is particularly true given the resources at Princeton's disposal. On-campus emissions reduction projects may initially be more expensive, but they will set a good example among the academic community, and eventually lead to reduced energy use on campus and thus reduced energy costs.

The second part of the organizing principle put forth by the Task Force calls for compliance with Governor Corzine's Executive Order No. 54. The remaining sections of the report offer recommendations for meeting this target through on-campus reductions.

### **Development of the Office of Sustainability**

Offices of sustainability are becoming increasingly important as institutions of higher learning have begun to recognize their obligation to reduce carbon emissions. Many universities have realized that to attain their sustainability goals, they must institutionalize their offices of sustainability in ways that give them authority, autonomy, and the potential for maximum creativity. In order to determine how best to do so, six principal structural and operational elements of campus sustainability efforts appear to be important. The following are descriptions of the six elements of office of sustainability institutionalization.

- *Element One: Commitment from Top Management*—Without endorsement by top management, sustainability is seen as an optional extra; with endorsement, it is placed within the university's corporate strategy, formally recognized as an end-

goal that influences how decisions are to be made. The initial endorsement, which may take the form of the Presidents Climate Commitment, is transformed into a more detailed environmental policy plan that includes both guidelines outlining how to conduct business in order to minimize environmental impact as well as aspirations to institutionalize sustainability efforts, usually through the work of sustainability professionals. Top management also needs to embody the commitment to sustainability.

- *Element Two: Administrative Chain of Command*—Because many universities began sustainability initiatives with varying motivations and without substantial input from established programs, administrative chain of command varies considerably among institutions. The Task Force developed a five-level scale to express the degree of institutional authority given to sustainability efforts; each successive level reflects increasingly higher-level university officials to whom sustainability advocates or employees report. In a level one administrative structure, sustainability professionals do not exist in practice; in a level five structure, at least one sustainability professional reports directly to the university president. Princeton’s office of sustainability is a level three structure.
- *Element Three: Metrics for Success*—When tackling a goal as multi-faceted as reducing a campus’s carbon footprint, metrics are crucial in compartmentalizing efforts, aiding goal-setting and measuring progress. Compiling an initial inventory of factors contributing to the campus environmental footprint, including total

greenhouse gas emissions, establishes a baseline from which to derive metrics. Using a combination of metrics to track progress towards quantifiable goals and of indicators to judge programmatic success allows sustainability professionals to evaluate successes at both micro and macro scale levels.

- *Element Four: Funding*—The frequent lack of funding for offices of sustainability results in budgets devoted almost entirely to staffing costs and with little discretionary income available for outreach, travel, books, printing, or environmental awards—many of the elements that allow for greater impact. Establishing an endowment for an office of sustainability is one way to combat funding granted annually for person- and project-specific purposes only. The university administration, students and alumni can contribute funds to such an endowment. In addition, a revolving loan fund can be established to finance cost-saving, environmentally-beneficial projects that require capital investment.
- *Element Five: Publicity*—Publicizing campus sustainability efforts adds legitimacy to an office of sustainability; builds a broader support base by encouraging voluntary involvement from students and faculty; generates awareness about the office of sustainability that might result in additional funding; promotes accountability of sustainability professionals; and becomes an avenue through which to showcase a university-wide commitment to sustainability. Multiple medium can be used to publicize sustainability efforts, including online content, newsletters, university-wide emails, and press releases



distributed to local media.

- *Optional Element Six: Active Engagement of Students and Faculty*—This element is important only for universities working to change systemically the way each member of the community views his or her environmental footprint. An office of sustainability can take measures to increase student participation by: (1) partnering with student government, (2) organizing inter-dormitory competitions to reduce energy consumption, (3) sending letters home to freshman encouraging them to buy purchase green products, and (4) creating high-profile sustainability awards. Faculty members often incorporate aspects of local, regional, or global sustainability into their individual curricula if provided with the tools and incentives to do so. Emory University's Piedmont Project, in which faculty participate in a two-day sustainability edification workshop, demonstrates how this can be accomplished.

Princeton University has made crucial steps in institutionalizing sustainability efforts. Its office of sustainability was created in December 2006, only three months before New Jersey Governor Jon Corzine signed Executive Order No. 54. To date, Princeton's president has issued a statement voicing support for environmental stewardship; sustainability professionals report to the facilities department, are developing a sustainability inventory for ten key areas, have organized a series of metrics and indicators to evaluate success, and are spearheading numerous networking and publicity efforts; and student-run environmental groups also have begun work on

grassroots initiatives. Princeton could further progress by signing the Presidents Climate Commitment; increasing the number of sustainability professionals; changing the reporting structure of the Office of Sustainability to make it a level four structure; including metrics to evaluate sustainability research and education; expanding considerably funds devoted to sustainability initiatives; creating a revolving loan fund; exploring new channels of communication to increase publicity; and providing incentives to students and faculty that encourage broader involvement in sustainability efforts.

### **Encouraging Student Grassroots Efforts**

Student grassroots sustainability organizations have thus far played a relatively insignificant role in Princeton's administrative efforts to increase campus energy efficiency. By endorsing student-run energy awareness initiatives as part of a coherent, long-term energy conservation strategy, the administration gains access to a widespread and highly motivated labor supply dedicated to reducing the university's carbon footprint.

Student energy conservation initiatives at other schools have yielded significant results in all areas of monetary savings, energy conservation, CO<sub>2</sub> emissions reduction, and positive national media attention. The establishment of an environmentally savvy, or "green" culture on Princeton's campus will not only improve campus energy efficiency and public image, but it will imbue graduating students with a sense of their own commitment to adopting sustainable lifestyles. The following are the recommendations of the Task Force for how the university can endorse and encourage student grassroots sustainability efforts.

- *Recommendation 1: Install Energy Sensors with Real-Time Data Feeds in Student Dormitories*—Currently, Bloomberg and Scully are the only dorms on campus with energy sensors; no other dorms have accurate ways of measuring their individual energy consumption. This makes it very difficult to measure any kind of impact that grassroots or administrative initiatives might have on student energy usage. It is important to note that Princeton’s Facilities Manager Tom Nyquist has already begun planning the installation of energy sensors in campus dormitories simply to track the efficiency of lighting and heating in each building. However, it is important that Princeton not delay in installing these sensors in order to take advantage of energy savings and to reduce carbon emissions. In addition to providing useful information to the Facilities Department, these sensors should be hooked up to monitors in every dormitory so students can view their energy use in real-time. Oberlin College experienced a remarkable decrease in dorm energy usage after the introduction of its real-time energy monitoring system. Assuming that Princeton could have similar success with such a program, the cost of installing those monitors and the real-time program software could easily be recouped in several years.<sup>1</sup> And more importantly, campus energy awareness would increase significantly as a result.

- *Recommendation 2: Create Options for Sustainable Living on Campus*—  
Providing students with sustainable living options guarantees the University

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<sup>1</sup> Energy monitors cost ~\$15,000. As Princeton has about twice the student undergraduate population as Oberlin, if Princeton were to reduce energy even by three quarters that of Oberlin over an entire year, the payback would amount to \$90,000, or 6 dorms annually. This is likely an underestimate, as Oberlin is predicting increased savings year-to-year as campus energy awareness grows – there is no reason Princeton’s savings would not grow as well. Still, as there are 36 dorms on campus that do not have energy monitors, the payback process might take approximately 6 years (not accounting for inflation).

significant energy savings and carbon emissions reductions from those students, as well as possibilities for substantial energy and carbon emissions reductions from the greater student body as campus energy awareness increases. Students living in sustainable housing would set an example for the rest of the school on how individuals ought to model their lifestyles in the 21<sup>st</sup> century. The creation of the Princeton sustainable housing program would be akin to that of substance free housing, except that there would be an application process for it. Students in sustainable housing would also have the option of working for the university to increase student body energy awareness. The university could choose to either renovate existing student housing to conserve energy and outfit it with sustainable appliances and living products, or to build a new sustainably-designed dormitory as a model for energy conscious living on campus.

- *Recommendation 3: Construct a Carbon Neutral or Zero-Emissions Environmental Campus Center*—The construction of a green campus center would create a physical location for environmental discourse and activity on Princeton's campus. The office of sustainability would be based inside it and environmental student and research groups could have their meetings there. The building would function as a hub both for campus and community environmental activism, and for student and/or administrative sustainability conferences and lectures given by experts and representatives from all over the world. Beyond functioning as a centralized space for idea and information exchange, the Princeton green campus center would also be a model of energy efficiency—

either carbon neutral or zero-emissions. The center would promote energy awareness within the University, as well as immediately establish Princeton as one of the nation's leading universities in sustainable development.

- *Recommendation 4: Establish a Revolving Loan Fund to Provide Up Front Capital for Student Sustainable Design Projects*—A Princeton revolving loan fund would provide students with the up front capital to begin sustainable design projects and initiatives they would never otherwise have been able to afford. In addition, the benefits of their efforts would be reaped by the University in terms of energy savings, carbon emissions reductions, and positive press. The fund would function according to the same principles as Harvard's Green Campus Revolving Loan Fund with a greater emphasis on supporting student sustainability projects and initiatives in efforts to cultivate a green campus culture. The advantages of a fund to promote sustainable design projects are twofold: first, it increases the visibility of sustainability efforts and offers the student body an incentive to develop energy saving projects; and second, the energy savings accrued by successful sustainability initiatives subsidized by the fund could be more easily tracked and reused for further campus energy conservation projects.

## **Green Building**

Princeton University's energy needs will naturally increase as its campus and community grow. By taking action to reduce its energy needs, Princeton can save money, improve its public image, and make a real contribution to the global effort to retard global

warming. As the main component of Princeton University's energy demand, improving campus buildings will be an important component of this effort. While expensive, overhaul of existing buildings will be necessary to reduce emissions and energy use. Building any new structures will set back initiatives to curtail energy use, so the university's planned expansion must be conducted with the utmost concern for environmental impact. Princeton University can ensure that this effort is successful by improving the process by which donors, designers, university decision makers, and university client programs interact. These adjustments can be made in ways that do not impinge upon capital contributions, architectural ingenuity, or academic need. On the contrary, improving Princeton University's design standards can result in buildings that are better suited to their users, more economical for the university, more sustainable, and that contribute to the university's public image as a leader among institutions of higher education. The Task Force has several recommendations to increase the efficiency of new buildings.

- *Recommendation 1: Incorporate Expectations of Cost Increases*—Energy costs are rising, as global demand for fossil fuels increases and supply fails to keep up. In the US specifically, utilities are raising rates for electricity, and fuel prices are increasing. On top of this, the Regional Greenhouse Gas Initiative (RGGI) carbon-trading scheme is soon to go into effect, acting as a tax on carbon-emitting power plants. The result is a high likelihood of energy price increases to be borne by Princeton University. If the university incorporates these expectations into its plans, more ambitious conservation projects will appear more attractive. This will

enable Princeton to accurately plan for its future, and avoid both high costs and environmental impacts in the years, decades, and centuries to come.

- *Recommendation 2: Incorporate Sustainability in the Pre-Staging of Projects—* Existing design rules assume that projects are identified, initiated, and funded outside the sustainability framework. This results in projects that are less necessary getting built, where a sustainability viewpoint could help redirect construction funds to more essential projects, or curtail projects to their essential scope. While donors are often generous in funding construction of new buildings, the university must cover operating costs out of the operating budget, where every dollar spent on utilities could be better spent on academics. Therefore, the rules for project identification and prioritization should be formalized, and made to include sustainability as a priority. Donor-initiated projects should be examined fairly, and less necessary or unsustainable projects should be politely redirected toward areas that better serve Princeton University's academic mission and sustainability commitments.
- *Recommendation 3: Adjust the Lifecycle Cost Comparison Studies (LCCS) System for Transparency, Predictability, and Results—* Using a discount rate based on Princeton's return on endowment hampers energy efficiency projects because opportunity costs on up-front invested capital are so high. This is also an unrealistic standard because most construction costs are covered by donations that the university would not have received were the project not pursued. Further,

Princeton has used a pick-and-choose approach to LCCS studies. Many building projects proceed with no lifecycle cost analysis. To remedy these shortcomings, Princeton should incorporate lifecycle cost studies, utilizing a reasonable hurdle rate, in all new building construction projects.

- *Recommendation 4: Seek Outside Certification of Projects Through LEED*—Since their inception in 1999, LEED standards have been looked upon warily by the university. The criteria have been criticized as too haphazard, with insufficient weighting for elements most beneficial to the environment. It has been argued that chasing LEED points could become a distraction, and open the university to charges of greenwashing. The university also hesitated because both the original and second edition standards were incompatible with the Princeton campus' district energy system. Finally, LEED certification has also been considered prohibitively expensive. All of these critiques can be addressed. The latest LEED standards are adapted specifically for campuses and district power systems. Credit for the central power plant will give any campus project a boost of six or more LEED points. Further, if the university retains its internal system for design standards, LEED cannot become an overpowering force in the design of buildings. Similarly, if LEED criteria are addressed after the design phase, then the process is less susceptible to greenwashing accusations. The existing standards in some ways overlap the LEED criteria, so Princeton buildings are required to meet nearly half the available LEED points already. Thus, there is no good reason not to pursue LEED certification. On the other hand, pursuing LEED



certification would force the university to consider sustainability issues as part of the design process and publicize the university's green building efforts. Further, Princeton's decision to pursue LEED certification would legitimize the standards and push other institutions to attempt to meet them as well. Therefore, Princeton ought to attempt to achieve LEED certification for all of its new buildings.

## **Transportation**

The Task Force examined six different sectors of campus transportation and their effect on Princeton's carbon emissions: employee commuter travel, student travel, food transport, faculty air travel, on-campus vehicles and transportation demand management. The following summarizes the recommendations of the Task Force within these six sectors.

- *Sector 1: Employee Commuter Travel*—Employee commuting travel currently accounts for 10% of total campus emissions in Princeton's current carbon inventory. Commuting is thus a significant part of emissions occurring due to operating the university. In addition to the potential for carbon reduction, greening commuting is an ideal mechanism for fostering a green campus culture by exposing Princeton's employees to sustainability on a personal and daily level. In 2006, the Environmental Protection Agency and the Department of Transportation named 72 colleges as "Best Workplaces for Commuters." To qualify for this distinction, schools must implement a number of initiatives that provide alternatives to single-occupancy vehicle commuting. Instituting these

initiatives has resulted in significant emissions reductions at other schools and would do the same at Princeton. Dartmouth, Cornell, Columbia, Stanford, Rutgers, MIT, Harvard, and Yale were among the 72 schools given this distinction in 2006. These schools are Princeton's peer institutions and the university should join their ranks. Thus, the Task Force recommends that Princeton become a "Best Workplace for Commuters." To do this, Princeton must, among other things, begin charging for parking, develop a carpool or vanpool service, create a coordinator of commuting on campus who is in charge of commuting and alternative transportation, and commit to a 14% reduction in single-occupancy commuting within an 18 month time span.

- *Sector 2: Student Travel*—Student travel does not account for a large portion of Princeton's emissions. With its concentrated campus, access to the Dinky, and expanding shuttle system, Princeton already gives many reasons not to own a car. A significant overhaul of student travel policy is not needed. The Task Force recommends that Princeton publicize the ZipCar program more aggressively to develop an alternative for students who drive only infrequently. Further, the Task Force recommends that Princeton create an online ride-board program linked from POINT with incentives for students to ride-share. We also recommend that Princeton attempt to inventory the emissions from student travel over vacations through a voluntary e-mail survey.

- *Sector 3: Food Transport*—Dining Services is already doing many great things to reduce Princeton's food transport related emissions. The only thing preventing the department from doing more is funding restrictions. To overcome this monetary limitation the Task Force recommends that Dining Services prepare a detailed report outlining the local food purchases it would like to make and explicitly quantifying the premium required to make these purchases. Princeton should then approve a new dining services budget which incorporates this premium.
- *Sector 4: Faculty Air Travel*—Princeton should not restrict faculty from flying. Instead, it should provide more video-conferencing facilities so professors have an alternative to flying. It should also provide financial incentives to professors to use these facilities such as making them available at nominal cost. To keep an accurate inventory of faculty air travel, all professors should be asked to register their research/academic flights through Travel Portal, even if they are not booking with this agency. Faculty air travel emissions should be mitigated through offsets.
- *Sector 5: On-Campus Vehicles*—Princeton is already on the right path to greening its campus fleet and so the range of suggestions for improvements in this area are limited. Though many schools have begun using both ethanol and biodiesel on their campuses, biodiesel is the better choice for Princeton. This is primarily due to availability; there are five distributors of biodiesel in New Jersey but none for ethanol. There is also a question of performance; vehicles are around 30% less

fuel efficient using ethanol than gasoline. In contrast, vehicles are only 5-10% less efficient running on biodiesel than diesel. The Task Force recommends that Princeton integrate biodiesel into the campus fleet; and continue buying hybrid, flex-fuel, and electric vehicles.

- *Sector 6: Transportation Demand Management*—Princeton, like many American colleges and universities, is planning substantial growth in the next decade. A bigger campus generally produces more carbon emissions, making it more difficult to meet Executive Order No. 54. If Princeton is to meet Corzine’s targets while simultaneously expanding, the university needs to incorporate sustainability principles into future growth planning. Transportation Demand Management (TDM) seeks to institutionalize techniques to minimize the campus transportation load, thereby withstanding the pressure to grow created by university expansion. For Princeton the motto must be “evolution, not revolution.” To begin establishing a firm alternative transportation network and an institutionalized TDM program, Princeton should create an Office of Transportation Demand Management within the Office of Sustainability which will be involved in all areas of campus planning. This newly created office should oversee all commuter and alternative transportation initiatives and merge them into a comprehensive TDM plan.

## **Conclusion**

The overarching recommendation of the Task Force is the adoption of a dual-prong organizing principle: Princeton should meet the Presidents Climate Commitment through immediate offset purchases and Governor Corzine's Executive Order No. 54 through on-campus emissions reductions. Meeting the Presidents Climate Commitment and going carbon neutral immediately could be achieved through offset purchases costing only \$350,000 annually. Meeting Executive Order No. 54 through on-campus emissions reductions would be more difficult and expensive, but still possible. Known on-campus projects could reduce emissions by more than 50,000 metric tons of CO<sub>2</sub> at a net cost of \$690,000 a year. This is more than half of the 80,000 metric tons of emissions reductions from BAU 2020 demanded by Executive Order No. 54. The Task Force has four main recommendations for how Princeton can reduce on-campus emissions further to enable compliance with Executive Order No. 54. We recommend that:

- The Princeton's Office of Sustainability should be used to institutionalize the commitment to sustainability in six key areas: commitment from top management, administrative chain of command, metrics for success, funding, publicity, and active engagement of students and faculty.
- Princeton should endorse and encourage student grassroots emissions reduction efforts.
- Princeton should bring sustainability into the pre-project stage of new building construction and reconsider LEED certification.
- Princeton should develop a Transportation Demand Management program within the Office of Sustainability.

Pursuing the policies laid out in this paper would allow Princeton to take on a leadership role in the effort to mitigate the effects of climate change at a reasonable cost.

The time to act is now.