

**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

by

Ben Steiner

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

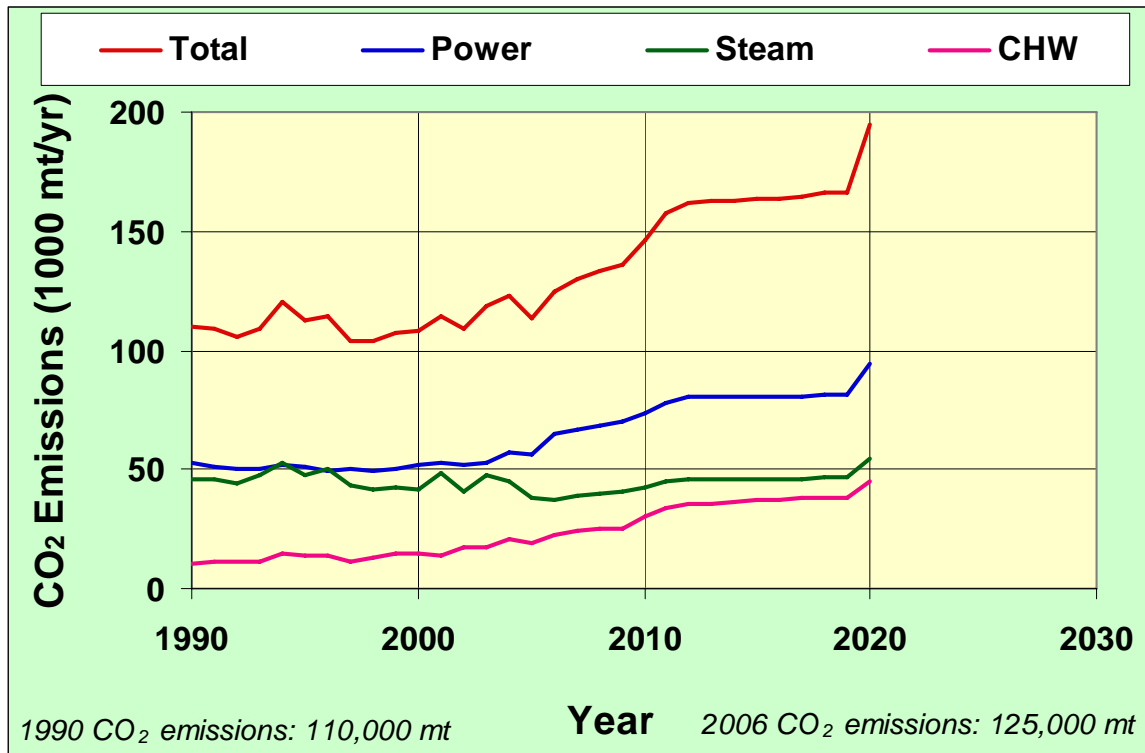
school implement at least two of a list of six other policies: these include establishing LEED Silver or equivalent as the baseline for new construction on campus or pledging to offset emissions from university-related air travel. The PCC also carries a transparency requirement: a signatory school must 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 CO₂ 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 CO₂ Emissions



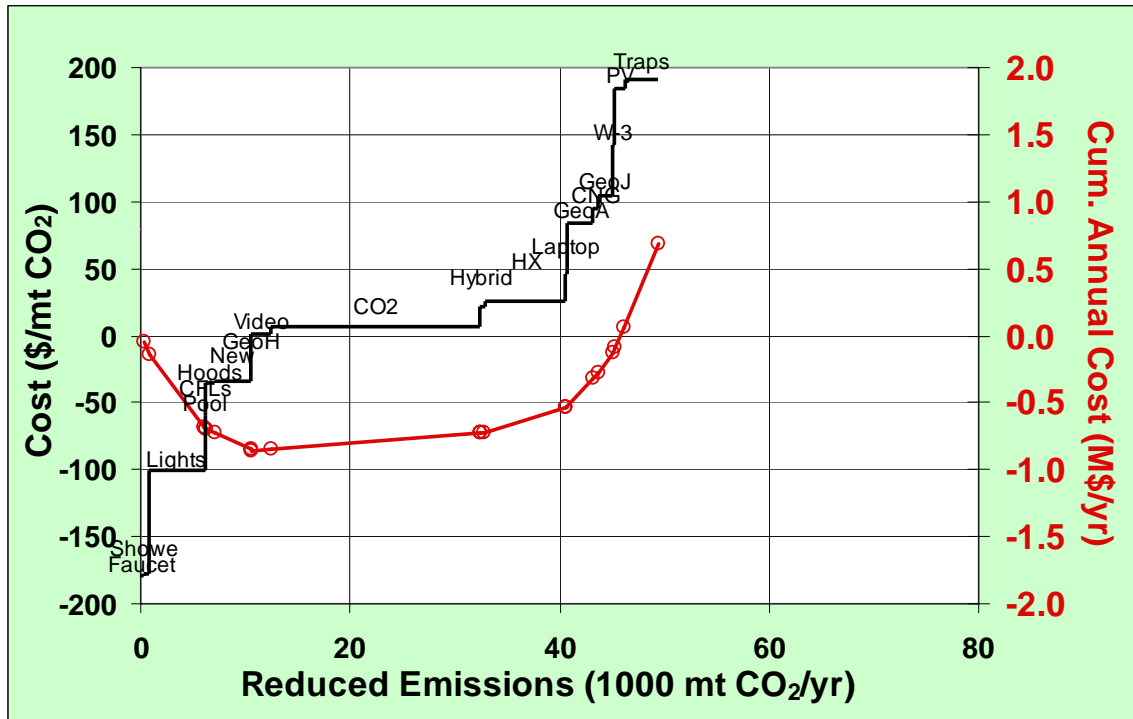
Princeton's emissions have grown significantly since 1990 and they are expected to continue to grow through 2020. Under business as usual (BAU) assumptions, Princeton's 2020 emissions will be 73% greater than those of 1990, hitting 190,000 metric tons of CO₂. Meeting Executive Order No. 54 through on-campus emissions reductions demands reducing CO₂ 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 CO₂ 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 CO₂ 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 CO₂ 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 CO₂ 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 CO₂ 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 CO₂ 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 CO₂ emissions by 50,000 metric tons annually. This is more than half of the 80,000 metric tons of CO₂ 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 CO₂ 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, CO₂ 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.¹ 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

¹ 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 21st 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 CO₂ 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.

**Laying the Groundwork for a Sustainable Princeton:
Organizing Principle Development and Best Practices Policies**
By Miriam Chaum

[0] ABSTRACT

Global climate change has been proven to have anthropogenic causes. The cost of mitigation of this climate change, while significant, is far less than the cost of the potential damages. As one of the world's foremost institutions of research and higher education, it is Princeton University's responsibility to be a leader in campus sustainability, modeling here on campus what we anticipate will be the best course of action for both the United States and the international community. To that end, we recommend that Princeton commit to ambitious reduction goals, including the following. First, we recommend that President Tilghman sign the Presidents Climate Commitment and using legitimate offsets, Princeton should go carbon neutral within the next several years or immediately. Second, we recommend that Princeton commit to the goals outlined by Governor Corzine's Executive Order No. 54 for reductions in emissions on campus. The "best practices" policies from other sustainability-focused institutions can serve as the low-hanging fruit in Princeton's efforts to foster a sustainable spirit on campus. We recommend (1) the establishment of an emissions inventory addressing all scopes of emissions, (2) the implementation of a "Shut the Sash" campaign (behavior modification in use of laboratory fume hoods), (3) the exploration of the potential for a solar energy third-party partnership, (4) the development of a revolving loan fund to fund energy efficiency-increased projects, and (5) a campaign for an environmental student fee to fund renewable energy on campus.

[1] CLIMATE CHANGE AT PRINCETON

To date, Princeton's programs for climate change research 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 and the development of a Carbon Observing System for estimating potential carbon sinks and sources.² The Cooperative Institute for Climate Science/Princeton Carbon Center, which cultivates collaboration between Princeton's researchers and the Geophysical Fluid Dynamics Laboratory, works in four research

² "Carbon Mitigation Initiative: Sixth Year Report," 3.

themes: earth systems/climate research, biogeochemistry, coastal processes, and paleoclimate.³ Work done by CICS in 2006 found a statistically significant relationship between multidecadal oscillations in rainfall in Sahel and hurricane activity.⁴ These programs fall under the auspices of the Princeton Environmental Institute, directed by Steve Pacala, which also awards graduate and undergraduate certificates in Environmental Studies.

However advanced our research facilities and committed our administration to addressing the problem at a global scale, Princeton University itself has no carbon policy. The efforts of student groups to implement individual measures without a comprehensive policy, including the “Pull the Plug” campaign sponsored by Students United for a Responsible Global Environment (SURGE) and Greening Princeton, have had minimal success. Without a university-sanctioned policy, a comprehensive address is impossible. To that end, it is not the responsibility of Princeton to reinvent the wheel. Many other reputable colleges and universities both in the United States and abroad have made ambitious commitments to reducing, and in some cases eliminating, carbon emissions. They have sought their goal by adopting special programs and policies that either directly reduce emissions or do so indirectly by fostering a sustainable spirit on campus. Short of massive retrofits and enormous offset or Renewable Energy Certificate (REC) purchases, many universities have reduced—or made substantive plans to reduce—their emissions using resourceful and creative policies.

³ “Annual Progress Report: Cooperative Institute for Climate Science,” 2.

⁴ *Ibid.*, 10.

These “best practices” represent a significant asset as Princeton makes efforts to develop an effective carbon policy with real potential for student, faculty, and staff involvement and support. It is the purpose of this paper to set out the requirements of several organizing principles and their relative success, to examine a set of these best practices as they’ve been applied at other universities, and to make recommendations as to their applicability here on the Princeton campus.

[2] ESTABLISHING AN ORGANIZING PRINCIPLE

While the student-initiated seminar, ENV-ST01, produced a set of valuable retrofit and building policy recommendations for the Princeton campus (i.e. new fume hoods, new lighting), Princeton’s approach to carbon emissions reductions should be framed by an organizing principle, or overall emissions reduction goal. The implementation plan for this overall goal, which should ultimately be decided upon based on the input of student groups as well as informed faculty and related staff, can be comprised of (1) retrofits, purchases, and building standards like those recommended by ENV-ST01 and (2) the policy plan to reduce emissions to a target level. This organizing principle establishes the degree of commitment that the University is willing to make to reduce its climate impact and the existing options have to be considered ethically before the University can legitimately subscribe to one over another. Moreover, some organizing principles have been highly successful at other universities and these case studies can aid in instituting Princeton’s goal. Sections 2.1 and 2.2 describe our two goals as separate entities, Section 2.3 describes these goals in comparison with other organizing principles, and Section 2.4

outlines the two-part organizing principle that we believe will serve Princeton the best in designing and implementing a carbon plan.

[2.1] GOVERNOR CORZINE’S EXECUTIVE ORDER NO. 54

On 13 February 2007, Governor John Corzine of New Jersey signed an executive order committing the state of New Jersey to an ambitious set of emissions reduction goals: by 2020, the state of New Jersey is to be emitting greenhouse gases (GHGs) at 1990 levels (approximately a 20 percent reduction from current levels) and by 2050, the state is to be emitting 80 percent less GHGs than in 2006.⁵ 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; 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 goals.⁶

[2.2] PRESIDENTS CLIMATE COMMITMENT

After identifying the potential of universities to play a leadership role in reducing emissions and in increasing demand for under-demanded renewable energy, the

⁵ “Governor Corzine Calls for Sweeping Reduction.”

⁶ Ibid.

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 netting zero emissions. To date, 202 colleges and universities are signatories, including such prestigious institutions as the University of California and the University of Pennsylvania.⁷ This number is growing rapidly.

Unlike Governor Corzine's goals, 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 carbon 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.⁸ 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

⁷ "American College and University Presidents Climate Commitment Homepage."

⁸ "The Commitment."

transparency requirement: signatory school must make evidence of their progress relative to their plan available to AASHE, who will review and make them public.⁹

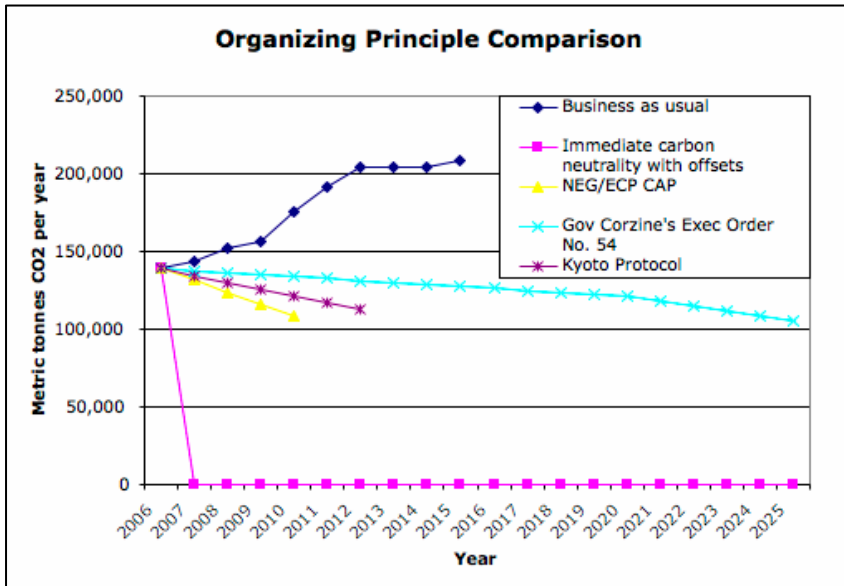


Figure 1: Organizing Principle Comparison

[2.3] PRINCETON'S

EMISSION

REDUCTION GOAL

COMPARISON

Figure 1 compares the real value projections for emissions under each of a variety of potential organizing

principles. The base case values are the weighted emissions growth based on projections of increasing peak electric demand, chilled and heated water demand, and steam demand (see Business as usual).¹⁰ The Kyoto Protocol has been included to provide global context for our campus approach and is based upon a 7 percent reduction below 1990 levels by 2012 (see Kyoto Protocol). The Northeastern Governors/Eastern Canadian Premiers Climate Action Plan (see NEG/ECP CAP) dictates two goals: (1) reduce greenhouse gas levels to 1990 levels by 2010, (2) reduce greenhouse gas emissions to 10 percent below 1990 levels by 2020. Both Yale and Harvard have signed on to goals identical or similar to the CAP goals. Yale has committed to a 15-year strategic plan that,

⁹ Ibid.
¹⁰ Nyquist.

given similarities in size and organization between the institutions, could be used as a template for a similar document for Princeton's campus.¹¹ However, achieving on-campus emissions reductions of the scale of those required by the CAP or Kyoto Protocol targets will take swift and significant action by the Princeton administration. Under the CAP target, we would have to emit almost 62 percent less in 2010 than we would without taking any action (*see* Business as usual). Conversely, this figure highlights the long-term nature of both Governor Corzine's Executive Order No. 54 and immediate carbon neutrality using offsets. By committing to one of these organizing principles, Princeton has the opportunity to devise a long-term plan for reducing emissions on campus and using legitimate offsets to either significantly reduce or eliminate our carbon footprint while we make the financially desirable efficiency increases to reduce our emissions on campus.

[2.4] TWO-PART APPROACH: RECOMMENDATION FOR PRINCETON'S ORGANIZING PRINCIPLE

The above highlighted organizing goals share many benefits and drawbacks in common and it would be reasonable for Princeton to select any of them as long as the accompanying policies addressed Princeton's emissions in an effective way. However, we feel that a special hybrid may best serve the interests of a research institution like Princeton and will provide the best impetus for the development of a comprehensive plan. Having considered the relative requirements of the various organizing principles, this Task Force recommends the following:

¹¹ "Yale's Greenhouse Gas Reduction Strategy."

- President Tilghman signs the *Presidents Climate Commitment* as soon as possible, committing Princeton to carbon neutrality immediately through offset purchases.
- Simultaneously, Princeton commits to *Governor Corzine's Executive Order No. 54* through on-campus emissions reductions.

At face value, signing the PCC makes Princeton a leader in campus sustainability and is the most ambitious objective, as it will eliminate the University's carbon footprint. It is highly visible, easy to publicize, and politically reputable. The PCC sets a clear timeline for policy development, demands reporting transparency, and ensures that comprehensive emissions inventories are taken soon and continuously. But some of the most important benefits of signing the PCC are more broad-based and provide ample support for the decision to sign. By signing the PCC, Princeton will establish itself as a member of the rapidly growing consortium of American universities and colleges committed to campus sustainability. While this may appear to be a symbolic gesture, the opportunity to sit at the round table that the PCC provides can be an enormous resource. First, the PCC facilitates a dialogue between elite universities and many small and community colleges that have implemented highly effective policies. Sustainability issues are not solely an Ivy League concern and best practices sharing between all institutions of higher learning, regardless of rank, can inform policy and projects here at Princeton. Napa Valley College, a community college in Napa, California, has installed a solar array that will fulfill 40 percent of the campus's electricity needs¹²: by signing the PCC, Princeton's sustainability director can more ably share information and garner advice from her

¹² "AASHE Digest 2006: A Review of Campus Sustainability News," 118.

counterpart at Napa Valley College because she will be a legitimate member of the same commitment.¹³ Second, the forum created by the PCC may soon possess the political clout to effect national policy development and change. By signing the commitment, Princeton's representatives will have the status necessary to participate in those processes, whereas committing to climate neutrality without signing the commitment will not.¹⁴

Because Princeton is a research institution, carbon neutrality cannot be achieved on campus entirely (i.e. Princeton cannot increase efficiency and augment green energy enough to cover all campus emissions). Therefore, signing the PCC will necessitate an ethical subscription to the use of off-campus emissions reducers like Renewable Energy Certificates (RECs) or offsets (funding for off-site renewable energy projects). Purchasing RECs, while supporting the infant market for renewables, may not be additional green energy to that which is already on the grid and thus will fail to decrease overall climate impact.¹⁵ By going carbon neutral immediately using offsets, Princeton will eliminate its carbon footprint and establish a pledge to maintain carbon neutrality: the purchase of enough offsets to cover Princeton's emissions from both the cogeneration plant and electricity purchases off the grid ranges from \$764,000 to almost \$1.4 million, depending upon the offsets we purchase and based on estimated emissions.¹⁶

¹³ Weber. Interview.

¹⁴ Ibid.

¹⁵ Jobson et al., 5.

¹⁶ Ibid., 3, 20.

This yearly purchase of offsets will function like a “self-imposed carbon tax”: either Princeton can continue to pay for *both* the electricity itself and the offsets or reduce emissions and pay for neither.¹⁷ This incentive for reductions in energy use on campus will increase as the price of offsets rises, as demand will likely increase more rapidly than will supply. The University of Pennsylvania, for example, has already demonstrated an early dependence on RECs purchasing. Penn signed the PCC on 6 February 2007 and has committed to development of a comprehensive sustainability plan by 2009. In 2003, Penn purchased enough wind power to cover 10 percent of the university’s energy needs and, as of 2006, the university garners one-third of its energy from wind energy.¹⁸ Penn funded the purchase of these RECs with savings from campus programs promoting energy conservation that reduced peak electric demand by 18 percent.¹⁹ Penn’s early dependence on RECs purchases suggests that achieving immediate carbon neutrality using offsets may foster a dependence on offset purchases that the “self-imposed carbon tax” will not be sufficient to dissuade. Moreover, reducing real emissions on campus is inherently valuable, not only for the monetary benefits but for the institution of a sustainable ethic both on campus and in graduating Princetonians as they impact the world. This is why we recommend using Corzine’s goals to guide policy development for reductions on campus.

Corzine’s goals are appealing for their political legitimacy and long-term nature. While the value of Yale and Harvard’s experience and existing policy examples is high, the goals that they have set according to the CAP and the goals that other institutions have set

¹⁷ Buchman.

¹⁸ Hill.

¹⁹ “Penn President Endorses Environmental Sustainability Strategy.”

according to the Kyoto Protocol, for example, demand large emissions reductions too quickly (i.e. within five years or less). And although they did not find enough straight efficiency increasing measures to accomplish the 2020 goal under Corzine’s order, ENV-ST01 found that the university could, at zero cost, reduce emissions by 62 percent by 2016.²⁰ This could be accomplished by a number of energy efficiency increasing projects the savings from which can be used in the purchase of offsets. If the valuable information gathered by ENV-ST01 is used to spur real projects and more innovation in finding potential for emissions reductions on campus, we can reduce our dependence on offsets and possibly exceed Corzine’s goals for reductions. By imbedding Corzine’s goals for on-campus emissions reductions in the PCC’s requirements for carbon neutrality, Princeton can pointedly work to develop an ambitious, achievable, long-term strategy for campus sustainability. The other recommendations of this task force can serve as the first outline for a comprehensive policy plan and the incentive for action under these goals will be high. Shana Weber endorses this hybrid organizing principle

This theory—namely the use of offsets upfront with eventual intention to reduce real emissions on campus—is not without critics. Michael Bates, the Facilities and Energy Manager at California State University, Chico heartily opposes the use of offsets as a first step toward climate neutrality: “By purchasing offsets early on, the students, the faculty, and the staff stop worrying about increasing efficiency. Consider what could be accomplished in reducing on-campus emissions if the money that would have been used on offsets was used on efficiency-increasing projects instead.”²¹ In response to this

²⁰ Kreutz, 4.

²¹ Bates.

argument, we assert that ingenuity on the part of Princeton administrators and facilities managers will be higher under this hybrid organizing principle than they would be under a strictly on-campus reductions timeline because it will be profitable to reduce emissions rather than pay for the energy *and* the offsets. We recommend that the next stage in development of Princeton’s carbon policy take a look at this tradeoff, but we do not find it a principled objection to our organizing principle.

[3] “BEST PRACTICES” POLICY ANALYSES

As Princeton takes its first steps in the development of a carbon plan, a “best practices” approach to policy may ease the transition. Best practices are policies that have been successfully implemented at other universities or organizations and that have potential application at Princeton. The low-hanging fruits of policy, these best practices are cost-neutral or -negative, bureaucratically easy to implement, and foster a sustainable spirit by involving students and faculty and promoting behavior change. Perhaps most importantly, in their application at other universities, these policies have proven themselves effective in the university situation. Sections 3.1, 3.2, 3.3, 3.4, and 3.5 outline five of these best practices.

[3.1] EMISSIONS INVENTORY PROCESS

An emissions inventory is a comprehensive sum of all University-related emissions in a given year. In order to readily respond to the first goal of Corzine’s Executive Order, we must have a complete sum of the emissions in 1990. Princeton has conducted audits since 2000 reviewing the environmental impact of the university’s operations, and

particularly the energy use of individual buildings that are monitored, but it has not undertaken a complete emissions inventory as a guideline for a carbon policy.²²

Clean Air-Cool Planet, an organization that works to initiate programs and policies for the mitigation of climate change, has put together a Campus Climate Action Toolkit, which, in addition to helping formulate policies for reduced emissions, has a built-in Inventory Calculator that has been used, by over 150 universities in ascertaining baseline emissions.²³ The calculator establishes the following categories of emissions:

- **Scope 1:** All stationary energy production on campus (cogeneration steam, cogeneration electric, non-cogeneration), fleet vehicles, agriculture, refrigerants and other chemicals
- **Scope 2:** Electricity purchased from the grid, purchased steam and chilled water
- **Scope 3:** All off-campus transportation (student commuters, faculty/staff commuters, air travel), solid waste²⁴

These three scopes present represent a decision point as Princeton moves toward achieving emissions reductions or carbon neutrality because we have to choose what to include in the inventory and what, of those emissions we include in the inventory, we should be prepared to tackle with our new carbon policy. While the inclusion of Scope 1 and 2 emissions is relatively unchallenged, different universities have taken different stances on the inclusion of Scope 3 emissions. If we augment our monitoring capabilities, a inventory disaggregated by building would allow us to tackle particular problem spots for energy efficiency. Princeton could outfit the major buildings on

²² Bernier et al.

²³ "Climate Action Toolkit."

²⁴ "Campus Carbon Calculator."

campus with comprehensive monitoring systems for less than \$2 million.²⁵ The funding for such a project is a one-time outflow and could possibly be paid for by individual alumni or the money created by a student fee. In turn, the real-time data of campus energy use could be displayed in a central location on campus, raising student awareness and performing as sexy technology with a purpose. And campus policymakers, engineers, and facilities managers would also possess new data, including disaggregated electricity, chilled water, and steam use by building.

Clean Air-Cool Planet says that “GHG emissions from air travel are a very significant source for all institutions, although it may not be an area of emissions easily influenced by greenhouse gas reduction efforts.”²⁶ Tufts University’s emissions inventory includes commuter vehicles²⁷ but their carbon policy does not address air travel because they claim that it is difficult to calculate emissions from air travel.²⁸ Conversely, University of Colorado, Boulder’s emission inventory does not include emissions from commuter vehicles (they do, however, include the minimal carbon equivalent of pipeline leakage of natural gas).²⁹ While collecting data on university-related travel outside the use of fleet vehicles on campus may be difficult, it is a significant contributor to overall campus emissions. In their “Method for Conducting a Greenhouse Gas Emissions Inventory for Colleges and Universities,” the Tufts Climate Initiative concedes that the data most difficult to obtain, including transportation, materials purchasing, and facilities

²⁵ Nyquist.

²⁶ “Climate Action Toolkit Frequently Asked Questions.”

²⁷ “Tuft’s University Greenhouse Gas Inventory,” 3.

²⁸ “What we are not doing!”

²⁹ “Carbon Emissions Inventory for the University of Colorado Boulder Campus.”

renovation, can account for more than 35 percent of a university's carbon footprint.³⁰

Moreover, Shana Weber finds that by excluding commuter vehicles from an emissions inventory and policy response, Princeton would "be missing a huge opportunity for educating the campus population."³¹

ENV-ST01 found that a "high stakes" comprehensive policy address of all transportation-related emissions (including subsidies for high-efficiency vehicles, biodiesel conversion for campus fleet vehicles, and video-conferencing) could reduce campus emissions by almost 1800 metric tonnes of carbon dioxide.³² While data collection may be difficult, we believe that policy for the reduction of transportation-related emissions may not be equally as complicated: with the advent of technologies like video conferencing, faculty and staff air travel has potential for reduction. Steve Pacala, one of Princeton's most outspoken and influential professors on the topic of climate change policy, reported to the University Trustees in March 2007 that he believes augmentation of state-of-the-art videoconferencing facilities could cause a voluntary 50 percent decrease in faculty travel.³³ Whether we are able to establish an accurate inventory of this travel may be unimportant: if we are aware of ways to decrease travel-related emissions, we should do so as a part of our carbon policy, inventory or not. A plethora of policy measures for transportation-related emissions reductions will be outlined in another paper in the report of this task force. The diverse and international nature of Princeton's student body is one of the University's greatest assets: to achieve this end, Princeton can concede that the

³⁰ "Method for Conducting a Greenhouse Gas Emissions Inventory," 12.

³¹ Weber. Interview.

³² Lyon et al., 33.

³³ Weber. Interview.

University's carbon footprint extends around the world as its diversity does. We recommend that Princeton include all Scope 3 emissions in its emissions inventory.

[3.2] “SHUT THE SASH” CAMPAIGN FOR FUME HOOD USE BEHAVIOR CHANGE

The findings of ENV-ST01 showed that the carbon footprint of laboratories on campus is substantial. Of the significant contribution that laboratories make to campus emissions, fume hoods represent a large portion: ENV-ST01 found that “use of fume hoods at Princeton costs on the order of \$990,000 and likely leads to 5,700 metric tonnes of carbon dioxide emissions annually from energy use.”³⁴ Tom Nyquist estimated the energy cost of fume hoods even higher at \$2 million per year.³⁵ While the role that fume hoods play is important to the research of the University, a portion of their energy use is wasted: when researchers fail to close the sash on a Variable Air Volume hood, the hood has to pump more air than when the sash is closed. In Princeton labs, 486 fume hoods are already in place and another 423 will be added when construction of the new chemistry building is completed in 2010.³⁶ Replacement of current fume hoods with new technology that draws a constant amount of air regardless of the position of the hood is an expensive proposition, costing upwards of \$2,700 per hood, depending upon type.³⁷ Behavior of researchers working in labs with fume hoods is a low-hanging fruit for carbon policy at Princeton.

³⁴ Smith et al., 6.

³⁵ Nyquist.

³⁶ Ibid.

³⁷ Ibid.

Having estimated that keeping the sash on a fume hood fully open wastes \$1,500 per hood per year in energy costs, Harvard's Green Campus Initiative ran a "Shut the Sash" campaign in five laboratory buildings on the Longwood campus in 2006.³⁸ Magnets reminding researchers to "shut the sash" were applied to all fume hoods and a campaign of emails, flyers, and posters followed. Participation was ensured and ascertained by a series of regular audits. The results were astounding: the average opening of unused fume hoods fell from 12 inches to two inches over the course of the campaign, saving Harvard more than \$100,000 in energy costs and 544 metric tonnes of carbon dioxide emissions per year.³⁹ As a simple incentive for participation, the Green Campus Initiative threw a party for the lab that decreased its average fume hood opening the most.

This kind of a campaign could be highly effective at Princeton. The project would cost virtually nothing and, if Harvard's results are any indication, the campaign could reduce Princeton's campus emissions by more than 4 percent.⁴⁰ This is a good project for the first timeline (the years between now and 2020, when on-campus emissions will be stabilized at 1990 levels). With a long-term view, ENV-ST01 found that "over the next 30 years Princeton University will be able to reduce its carbon dioxide emissions by 24,180 metric tonnes and save \$895,000 in net present value" by replacing and retrofitting the installed fume hoods with those that have automatic closing sashes.⁴¹ This process is financially viable, appropriate for our emissions reduction goal timeline, and represents a low-hanging fruit of the various policy options available to Princeton.

³⁸ "Shut the Sash Contest at HMS."

³⁹ Ibid.

⁴⁰ Ibid. *and* Smith et al., 6.

⁴¹ Smith et al., 5.

This is not to say that the almost 500 fume hoods to be installed between now and 2010 should not be those with automatic closing sashes, and ENV-ST01 has recommended the best model for those new installations, but this is an interim measure that could be highly profitable.

[3.3] SOLAR ENERGY PARTNERSHIP

While new technology is a highly visible and exciting response to the need for renewable energy sources, it remains cost ineffective and the return on investment in on-campus renewables is longer than investment in efficiency increases. To bridge the gap between emissions-free energy and cost-effectiveness, Baltimore-based SunEdison funds the installation of solar panels on commercial and governmental property and sells the energy produced by the panels back to the institution “at prices equal to or below current retail energy rates”⁴² with yearly escalation for 20 years. In this way, institutions with space available for installations are able to go green, purchasing entirely clean and dependably priced energy at little or no additional cost. In return for this service, SunEdison “receives federal ‘Green Tag’ tax credits for installing solar power equipment that generates renewable energy”⁴³ and they sell the RECs that result from their ownership of the grid, usually to a fourth party.⁴⁴ Several universities in California have partnered with SunEdison in the last year to great success.

California State University, Chico commissioned SunEdison to install two solar arrays on two newly re-roofed buildings in September and October of 2006. Except for the costs of

⁴² “Commerical Solutions.”

⁴³ “Partnership Provides Solar Power for University.”

⁴⁴ Anello.

new roofs on both Yolo Hall and Acker Gym, which projected savings from the project will repay within three years, the \$2.8 million project, consisting of 1,212 3-by-4 solar panels were installed at no cost to the university.⁴⁵ The installation will produce 346 kW,⁴⁶ “[providing] enough power for approximately 70 homes, and [reducing] carbon dioxide emissions equivalent to what is produced by approximately 430 commuter vehicles.”⁴⁷

The cost of the electricity produced by the solar installation is currently being sold back to CSU, Chico at \$0.14 per kWh, one cent more than the electricity they can buy off the grid from Pacific Gas & Electric. This rate increases at 1.25 percent inflation over the 20-year lifetime of the project; at the end of 20 years, CSU, Chico has the option to the buy the panels at their depreciated value or to have SunEdison remove them at no cost to the university.⁴⁸ Over the duration of the project, the average energy cost will be between \$0.17 and \$0.18 per kWh, which will amount to at least \$260,000 but possibly as much as \$400,000 in savings when compared to the likely increase in cost of electricity from PG&E (prices rose by 4 percent in 2006).⁴⁹ Michael Bates, the Facilities and Energy Manager at CSU, Chico, highly recommends the project to Princeton. Dennis Elliot, the Manager of Engineering and Utilities at Cal Poly San Luis Obispo, where a 230 kW solar array was installed in December 2006,⁵⁰ recommends a partnership with SunEdison.⁵¹

⁴⁵ “Partnership Provides Solar Power for University.”

⁴⁶ “Project Profile: California State University (CSU) Chico.”

⁴⁷ “Partnership Provides Solar Power for University.”

⁴⁸ Bates.

⁴⁹ Ibid.

⁵⁰ “Cal Poly to Dedicate Solar Energy System Dec. 7.”

⁵¹ Elliot. E-mail.

ENV-ST01 identified more than 300,000 square feet of roof space conducive to solar installation but concluded that third-party partnerships, like one with SunEdison, wouldn't reduce Princeton's carbon emissions if RECs were being sold by the third-party who owns the solar panels.⁵² We recommend that this option be investigated regardless of those objections, however, because we consider a partnership like this one to be sexy technology at a sexy price. Because of the high cost of visible and high-tech renewable energy on campus, it is unlikely that the administration will be interested in installing solar at all. By partnering with an outfit like SunEdison, we can increase the public attention paid to renewable energy, buttress the infant market, and raise awareness of sustainability among students. In order to ensure that our solar installment achieved real reductions in emissions from energy use on campus, we could purchase from SunEdison or the utility the RECs produced by our installment. Although this appears to represent two payments—one in the form of energy consumption paid to SunEdison and one in the form of a RECs purchase—the overall increase in cost will be small. If we can achieve the kind of cost savings that CSU, Chico has experienced, we could simply pay for the RECs with the savings and remain cost-negative. Moreover, by purchasing the installation at the end of the agreement, Princeton could subsume ownership of the solar panels *and* the resulting RECs. Shana Weber endorses this partnership and accompanying RECs purchase approach because it can “make the additionality issue very transparent and we need to make sure that it is obvious to everyone.”⁵³ While it is not a flawless best practice, we find that it is one of the few cost-effective ways of bringing

⁵² Ravnaas et al., 3.

⁵³ Weber. Interview.

sexy technology to Princeton's campus without an enormous outflow of funds and encourage the investigation into a third-party solar partnership at Princeton.

On 19 April 2007, Public Service Electric and Gas (PSE&G) announced a new initiative meant to spur interest in solar power in the northeastern United States. Participation in the program would function in a way similar to a third-party partnership: PSE&G would loan 40 to 50 percent of the needed funds to a developer who would install the solar array and repay PSE&G in RECs.⁵⁴ While Princeton would still have to purchase the RECs in order to achieve real emissions reductions, this option may be attractive because it does not demand a commitment to purchase the energy over a project lifetime, even if non-green electricity on the grid falls in price significantly.⁵⁵ We recommend that this option be investigated.

[3.4] REVOLVING LOAN FUND FOR EFFICIENCY PROJECTS

The primary hindrance to the development of an effective carbon policy is budgetary. Without a sum of money intended specifically to fund projects that increase energy efficiency, the bureaucratic process necessary to receive funding may prevent many projects from being undertaken. To side-step this bureaucratic issue, several universities have devised special revolving loan funds meant for these projects, using expected savings from efficiency increases to continue funding projects in the future.

⁵⁴“Update: PSE&G Marks Earth Day.”

⁵⁵ Weber. Interview.

The slightly more primitive version of the revolving loan model is exemplified by CU, Boulder's University of Colorado Student Union's Energy Efficiency Fund (EEF). The fund was established in 2004 by legislation of the CU Student Government: funded by a marginal increase in student fees, the fund was to total \$115,000 per year for four years with 35 percent of projected savings in the next year to go towards capital improvements for a minimum of five years.⁵⁶ Efficiency-increasing projects funded by the EEF were to be undertaken in the three student-run buildings on campus, which total 9 percent of the campus energy demand.⁵⁷ Projects are proposed by the building and facilities managers with the aid of a part-time Building Sciences graduate student: each project is modeled according to projected energy use, expected payback, and total savings.⁵⁸ Projects have included solar installations, LEED certification, ceiling insulation, and window replacement.⁵⁹ Having experienced great success with the program over the past three years, Robert Hall, the Energy Manager for CU, Boulder, is hoping the CU Student Government will turn it into a revolving fund, meaning that building and facilities managers can depend upon use of the money past the four-year trial without a decrease in their budget based on reduced energy demand.⁶⁰ Amy Harris, the UCSU Environmental Director, said that turning the EEF into a revolving fund will also reduce student fees, since the fund will require one initial allocation and will then sustain itself using savings from efficiency projects.⁶¹

⁵⁶ "UCSU Energy Efficiency Fund (EEF)."

⁵⁷ Hall.

⁵⁸ Ibid.

⁵⁹ "UCSU Energy Efficiency Fund (EEF)."

⁶⁰ Hall.

⁶¹ Harris.

Harvard's Green Campus Loan Fund (GCLF) is a revolving fund that allocates money to projects with a payback period of five years or less, excluding solar installations.

Founded on the Resource Conservation Incentive Program that operated at Harvard from 1993 to 1998, saving the university almost 4,000 metric tonnes of carbon dioxide emissions annually and \$880,000 in first-year returns on investment, the GCLF is currently at \$12 million. In its first two years of operation, the GCLF was overseen by a full-time staff person, but it was eventually embedded into the work of Harvard's Green Campus Initiative.⁶² Since its inception in 2000, the fund has saved 24,870 metric tonnes of carbon dioxide, averaged a 44 percent return on investment, and is projected to save the university almost \$4 million per year.⁶³ The GCLF has fostered community involvement and cooperation and solidified the legitimacy of the sustainable cause; by involving facilities managers in the project approval process, the incentive for creativity is high.⁶⁴

At first glance, this policy option may appear to be ill suited for the Princeton campus. Both CU, Boulder and Harvard are decentralized campuses, characterized by separate budgets for different departments or buildings groupings on campus, so the incentive for devising and implementing projects is high because savings are owned by the faculty or department that proposes and executes the project. Princeton's campus is centralized and facilities managers cannot claim the savings from their efficiency-increasing projects in their own departmental budgets and facilities managers may therefore not have the same incentive for creativity as they might at Harvard. When asked about this divide, Michael

⁶² "Green Campus Loan Fund: Start-Up Story."

⁶³ "Green Campus Loan Fund: Loan Fund Achievements."

⁶⁴ "Green Campus Loan Fund: Lessons Learned."

Bates said that facilities managers on the CU campus, regardless of department, are the most apt to make suggestions for improvements and the administration at Princeton may be surprised at the proposals that they receive.⁶⁵ Michael Crowley, in charge of Harvard's GCLF, finds that involving facilities and building managers in the proposal selection process may be adequate incentive for action. Moreover, ENV-ST01 laid much of the groundwork for initial projects that could be funded by a revolving loan. By identifying where efficiency increases can be made most easily and cost-effectively, ENV-ST01 produced a list of proposals that could be well served by the money in a loan fund. The recommended new lighting installations, low flow showerheads, faucet aerators, and Accuaire fume hood sashes are all outlined by the ENV-ST01 papers in detail adequate to be approved by a loan fund immediately. Those four projects alone could save the university \$720,700 per year.⁶⁶

Given that we already have the projects in hand, the establishment of a revolving loan fund—using money either allocated from the university, created by student fees (which will be explored in Section 3.5), or given by an alumnus—would ensure the actualization of these projects *and* ensure funding for future projects without requiring a bureaucratic reallocation of money. Shana Weber questions the need for an energy efficiency fund on the grounds that the administration will be willing to pay for projects that have a proven payback period of less than five years.⁶⁷ However, we believe that the establishment of this kind of a fund will not only allow for the pursuit of energy efficiency projects but it will *ensure* that they are undertaken and remove the bureaucratic hurdles to budget

⁶⁵ Bates.

⁶⁶ Kreutz, 3.

⁶⁷ Weber. E-mail.

allocation. If the incentive for creativity exists, the development of a fund particularly for energy efficiency projects will streamline the process and assert Princeton's commitment to reducing its climate footprint. Shana Weber endorses this recommendation for another important reason: if a separate loan fund for energy efficiency projects is not created and proposals for projects go directly to the administration, the sustainability office loses its ability to track savings and project progress in the same way that it can with a fund.⁶⁸ By creating one pool of resources for this specific purpose, we can prove the environmental effectiveness and monetary benefit of climate awareness, enlarging the fund as necessary to follow Harvard's example.

[3.5] STUDENT FEE CREATION TO FUND ENVIRONMENTAL PROJECTS

The overlap of student involvement and fundraising for energy efficiency projects, RECs/offset purchases, and behavior modification campaigns may be increasing or creating student fees to fund environmental projects. By implementing marginal increases in either annual or semester fees, Princeton could establish a loan fund, purchase a windmill and the related green energy, or buy enough offsets to cover the emissions related to the operations of Frist Campus Center. Fee increases have been highly effective in promoting the environmental cause at a number of campuses.

In 2005, a referendum proposed by the Green Energy Campaign at University of North Carolina, Chapel Hill which supported an increase in student fees by \$4 per semester to fund on-campus renewable energy projects passed with 85 percent support.⁶⁹ In the end

⁶⁸ Weber.

⁶⁹ "UNC Green Energy: Power the Future."

of March 2007, almost 70 percent of the student body at the University of Kentucky supported an increase of between \$6 and \$8 increase in fees per semester to fund renewable energy projects on campus.⁷⁰ Even the Ivy League has taken up this method: at the beginning of March 2007, more than 80 percent of the students who voted in Student Assembly elections at Cornell supported a student fee increase of \$3, with a majority voting to make the fee increase optional instead of mandatory.⁷¹ The program of fee increases at University of Colorado, Boulder has been a fundamental part of the sustainability programs put in place at the university. Student fees were increased in 2000, 2005, and again in 2007 to fund the purchase of RECs to cover 100 percent of the emissions from the three student-run buildings on campus. Student fee increases were also used to establish the UCSU Energy Efficiency Fund.⁷²

While the population of these three universities is different than Princeton—the closest in undergraduate enrollment is Cornell, with 13,500 students—the theme is the same. A fee increase of as little as \$10 per semester for Princeton’s almost 5,000 undergraduates could create an almost \$100,000 fund for energy efficiency project or could purchase 10,000 metric tonnes worth of offsets. “Kids like the idea of being environmentally friendly, particularly if the cost of being environmentally friendly ends up on their parents’ bill,” said Robert Hall at CU, Boulder.⁷³ By increasing student fees marginally, we could put funds in place meant specifically for environmental projects. Under the current organization of the Princeton USG, one USG Senator could be put in charge of

⁷⁰ ““Kilowatt Ours’ Director Joins Renewable Energy Panel Discussion.”

⁷¹ Ramachandran.

⁷² Hall.

⁷³ Ibid.

the environmental fund and the Senate could, with the help of the Sustainability Director, select projects from those proposed by building and facilities managers, students, and researchers. Alternatively, the USG could outsource management of the fund to the Sustainability Office entirely. Political momentum for an environmental student fee already exists on Princeton's campus and the referenda will likely appear on the fall election ballot. Robert Biederman, current President of the USG, has said that "[there] seems to be widespread support from both the student body and its elected officials for such a program. [He feels] confident that a school-wide referendum would indicate a majority of students support [an environmental student fee]."⁷⁴ "A referenda of the student body regarding the use of student fees for environmental projects is a good indicator of the campus stance on sustainability and the campaign can actually be a great way to get kids involved, even if [Princeton's] resulting fund isn't as enormous as it is at schools like CU, Boulder."⁷⁵

We concede that the funds raised by the creation of a student sustainability fee could be found elsewhere, perhaps in one fell swoop from a wealthy alumnus. However, we feel that placing such an issue on the ballot would greatly raise campus sustainability awareness and serve as an educational tool. Moreover, the commitment of the student body to environmental concerns could be returned in kind by the administration. Bert Kerstetter, the alumnus who has funded Princeton's Office of Sustainability for its first three years, recommends that the money garnered from student fees be matched or

⁷⁴ Biederman. E-mail.

⁷⁵ Harris.

doubled by the administration.⁷⁶ In this way, the fund would be sizeable and reflect the environmental synergy on campus and a sense of cooperation between students, faculty, staff, and Princeton's highest administrators.

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**The Ethics of Passing the Buck:
The Role of Renewable Energy Certificates and Carbon Offsets in
Creating Environmental Sustainability at Princeton University**

by Molly Rapoport

1. Abstract

As Princeton University develops its environmental sustainability program, it must decide how programs to reduce greenhouse gas emissions and change energy usage will be structured. If Princeton aims to reach carbon neutrality in the coming years, many practical, economic, and ethical considerations must be weighted in developing an efficient and effective plan for creating environmental sustainability on campus. This paper will compare and contrast two off-site purchasing options, Renewable Energy Certificates/Credits (RECs) and offsets, and examine their pros and cons within the context of Princeton's environmental goals. The importance of assuring additionality – the quantified difference between the amount of renewable energy that would have been produced had the REC/offset not been purchased (the business as usual trajectory) and the amount of renewable energy that is produced with the REC/offset purchase – will be stressed. Two University case studies, New York University and Yale University, will be discussed to illustrate the best scheme for REC/offset usage in a university's sustainability efforts. Ultimately, this paper will demonstrate that offsets are a better investment for Princeton than RECs, unless RECs are purchased as part of a multi-university initiative where assuring additionality of the purchases is given top priority. An ethical analysis of both RECs and offsets, however, will demonstrate that off-site purchasing cannot be a long-term solution. As a leader in academics and research, Princeton should set an example for other institutions in the realm of sustainable development. Importantly, building a culture of sustainability on campus and incorporating environmental sustainability into the Princeton education is of utmost importance. Because Princeton graduates will be amongst the next generation of world leaders, the environmental practices they learn at Princeton can have a significant impact upon the future of global sustainability.

2. Introduction

Over the past few years, awareness and concern in America for human-induced global warming has greatly expanded. Noticeable warming temperatures along with the buzz created by Al Gore's documentary "An Inconvenient Truth" have precipitated government environmental policy initiatives, and greater concern from American citizens, corporations and institutions. Global climate destabilization is primarily driven through the combustion of fossil fuels for energy and the resultant greenhouse gas (GHG)

emissions (Pearce, 2006). Carbon dioxide is one of the most abundant and most common gases emitted in energy consumption and has a significant impact on global warming. According to Cool Air–Clean Planet, the average global citizen emits 4.5 tons of carbon dioxide per year and the average US citizen emits 21 tons, while a grown tree can absorb only 3 to 5 tons of carbon dioxide per year (LaCapra, 2007).

Thus, many efforts to curb the emission of GHGs and reduce the resultant global warming effects involve developing sources of renewable energy or “green power.” Common green power sources include wind, solar, and biomass energy that produce electricity with essentially none of the emissions common to fossil fuel plants (Audin, 2004). However, while wind power costs are dropping to a level competitive with coal in some markets, green power sources are often economically impractical, creating little incentive in the marketplace for continued use and development. Despite greater awareness and concern for global warming, Americans are reluctant to overhaul their lives to accommodate the environment and pay substantially higher utility bills to support renewable energy sources (LaCapra, 2007).

Recent efforts, however, are bringing green power into the energy market. Because the benefit of green power is independent of its end location, a market has developed in which environmental benefits from the renewable power are quantified and sold separately from the actual power units (Audin, 2004). Renewable energy outfits are springing up across the country and investors are eager to lay a stake in renewable projects. Additionally, scientific progress in the wind, solar, and biomass energy sectors, among others, has led to viable technologies that strengthen energy portfolios through diversification and reduce dependence on petroleum, making for stronger foreign policy.

When the technologies were first invented, a lack of development made renewable energy production prohibitively expensive. These days, investing in renewables makes economic sense (Currey, 2006).

Progress in renewable energy development, however, cannot be sustained without substantial and continued investment. Renewable Energy Certificates/Credits (RECs) and carbon offsets allow individuals, corporations, and institutions to indirectly reduce their energy use or carbon emissions by financing renewable energy development in places where green power can be used most efficiently and effectively. GHGs have the same climate impact regardless of their physical source, so when reducing emissions on-site is economically inefficient, reducing off-site emissions through purchasing is a viable option. RECs and offsets can be efficient because they take advantage of the knowledge of other renewable energy developers and contribute to large-scale projects (“RECs, Offsets, and Greenpower (ROG),” 2006). In recent years, more Americans are opting for the rising number of options offered by companies to neutralize their “carbon footprints”, the total amount of energy they consume, through RECs and offsets which are an easy first step in developing sustainable attitudes and practices (LaCapra, 2007).

Yet, the selling of RECs and offsets is not without practical and ethical concerns. The ethics of paying for someone else to reduce their emissions or use renewable energy instead of personally using renewables or reducing one’s own emissions is ethically suspect. Such purchasing allows the buyer to continue to voraciously consume non-renewable and climatically detrimental energy reserves. Also, it is difficult to measure and know for certain if a REC/offset is making a quantifiable difference. Verification of off-site GHG reductions must be meticulous to ensure that an institution can justly take

credit for the emission reductions. (“ROG,” 2006).

For institutions such as Princeton University, where efforts to achieve environmental sustainability are in their infancy, RECs and/or offsets can be a viable first step for achieving environmental goals. But as Professor Joshua Pearce of Clarion University of Pennsylvania states: “Because Universities possess access to the most up-to-date knowledge of both environmental problems and technical solutions, they have the responsibility to lead society toward environmentally sustainable policies and practices” (Pearce, 2006). Thus, the economic, ethical, and practical dimensions of REC and carbon offset purchasing must be weighed. Last semester, the class ENV ST01: “Toward an Ethical GHG Emissions Trajectory for Princeton University” provided a cost-benefit analysis of REC versus offset usage for Princeton. This paper will build on their findings and provide an ethical analysis of REC and offset use at Princeton. RECs and offsets will be discussed separately, followed by case studies of REC/offset use at two other American Universities, New York University and Yale University. The ethical concerns of balancing economic and practical/feasibility issues will be discussed. Finally, a series of recommendations for how and to what extent Princeton should use RECs and offsets in their sustainability efforts will be proposed. This paper will suggest that offsets are an ideal first step in building a sustainability culture at Princeton, but their long term use and the ethics of passing the buck of sustainability to off campus outfits must be carefully considered and discussed.

3. Renewable Energy Certificates/Credits (RECs)

This section will define RECs, discuss the key criteria for a good REC, and illuminate the problems associated with REC purchasing. The history and current usage

of RECs will also be discussed and compared to possible applications at Princeton.

3.1 Definitions and Benefits

A REC is a certificate that represents the environmental benefits of 1MWh (Mega Watt hour) of electricity from a renewable energy source that is added to a certain power grid (*A Consumer's Guide*, 2006). RECs are market oriented and aim to achieve targets for renewable electricity growth by increasing the share of renewable energy generation at economic costs below the costs of direct subsidies. Thus, renewable energy prices are driven down by large-scale exposure to market influences. RECs also promote a diverse mix of renewables (Ford, 2007). REC prices range from around \$0.50 to \$10 per MWh (Gillenwater, manuscript), and are relatively cheap when compared with Princeton's average price for standard electricity at \$100 per MWh + \$22,000 per MW demand (Borer, 2007). These low prices reflect the surplus supply of RECs in the market. Sources of energy for RECs include hydro, landfill, photovoltaic, bagasse, and wind power stations ("Renewable," 2004).

The benefits of RECs lie in their association with economic market factors. RECs allow the green power attributes to be sold or traded separately from the physical energy units, allowing a renewable power generator to sell its power competitively elsewhere by covering the cost differential between green power and fossil fuel power. Without this separation, it would be difficult for green power to compete economically with fossil fuel power and all but impossible for renewable energy to flourish in states with limited green markets (Mozumder, 2004). The price of renewable energy is essentially driven down to levels competitive with fossil fuel energy through the subsidization of renewable energy that REC purchasing creates. This system also removes potential locational and physical

bottlenecks, so both suppliers and consumers benefit from the flexibility of the market. REC revenue thus helps develop and expand the renewable energy industry and spurs competitive technology to generate renewable energy, motivating the establishment of a wider spectrum of cost effective technologies that bring further economic benefits. Finally, in places where green power is not yet available, buying RECs can help an institution develop experience with the concepts of sustainability so that it has a better understanding of renewable energy when it does become locally available (Audin, 2004).

3.2 Difficulties and Obstacles

The most difficult obstacle to creating efficient and quality REC purchasing (and offset purchasing, as discussed later) is ensuring additionality. Additionality involves quantifying the difference between the amount of renewable energy that would have been produced had the REC not been purchased (the baseline or business as usual trajectory) and the amount of renewable energy that is produced with the REC. The question of additionality for RECs essentially asks: where is the money used to purchase the REC going? REC certification is crucial in order to assure that the payments go to the proper uses (Chomitz, 2000). Unfortunately, additionality is difficult to demonstrate and is not guaranteed in any REC sale. RECs may be sold for projects that would have been completed anyway, and it is difficult to calculate the energy exchange rate between energy use on-site and renewable energy benefits off-site because a unit of renewable energy “benefit” may not precisely replace a unit of fossil fuel energy (“ROG,” 2006).

Because additionality is not absolutely required in REC purchasing, price instability plagues the REC market. RECs that lack clear additionality will be bought first because they are usually extremely cheap; price instability results because the price is

driven up as fewer cheap RECs are available (Katotsky, 2005). Price instability is also caused by the direct link between the energy price and the REC price; renewable energy prices fluctuate with seasonal variation in the availability of wind supply and solar power, time lags in the development of new green power, and the cost variability of generating renewables in distinct locations due to differences in supply of renewable inputs and existing technologies (Mozumder, 2004).

An absence of additionality requirements and government regulation in the REC market also results in economic difficulties in REC purchasing. Ideally, REC savings should be measured and monitored over time to aid accurate calculations because economically and ethically sound purchasing involves detailed certification (Bertoldi, 2006). However, the standard for REC certification schemes is not always the same in different states, so verification of REC quality is often inconsistent (Mozumder, 2004). Even when standards are clear, it is easy to accidentally double-count REC benefits (Bertoldi, 2006) because REC purchasing does not eliminate an existing MWh or energy, but only replaces fossil fuel energy units with renewable units (Bailey, 2006). Each REC should have a unique time and place of issue to indicate the period over which the renewable energy has been produced, but the intangibility of REC benefits makes visualizing their benefit and developing policy challenging and sometimes subjective.

Perhaps the greatest concern in REC purchasing, and the most ethically charged worry is that there are no local benefits if RECs are bought in distant states (Mozumder, 2004). The benefit of far off intangible technology is less real when RECs are purchased for energy projects thousands of miles away. If concern for creating a local culture of sustainability is considered, building a sense of community and good will around local

sustainability efforts is much more inspiring than purchasing remote credits many states away. While there are global benefits to reducing GHG emissions wherever they occur, a culture of sustainability will bring larger and more consistent reductions in onsite nonrenewable energy use and GHG emissions over time.

3.3 Current Usage and Possible Applications at Princeton

RECs are currently used in the US by individuals and businesses with environmental goals, often included in corporate mission statements. REC purchasing is an easy, simple, and recognized way to achieve this goal and boost a company's environmental image (Audin, 2004). RECs are also an easy way to comply with the Renewable Portfolio Standards (RPS) required by most states that involve flexible market driven policies to ensure the increased production of renewable energy sources. In New Jersey, the RPS requires 25% of new energy units to be renewable (Mozumder, 2004). Each year, New Jersey's Clean Energy program also provides around \$145 million in financial incentives to residential customers, businesses, schools, and municipalities that install energy efficient and renewable energy technologies. New Jersey also has the nation's most active solar REC trading program (Fox, 2006). Thus, RECs are relatively price stable in New Jersey, but most states do not possess such clear regulations.

The practical and economic difficulties associated with RECs combined with their ethical dilemmas, however, make REC purchasing a questionable choice for Princeton. Some of the troubles in REC purchasing can be avoided by only choosing purchases with demonstrated additionality, rigorously assessing purchasing choices, analyzing off-site projects with the same care one would show for on-site projects, and providing extra verification to show that the amount of non-renewable energy used on campus can truly

be considered equal to the amount of renewable energy produced off-site (“ROG,” 2006). Neighboring universities can also work together to be smart about their investments. For example, 22 Pennsylvania colleges and universities are engaged in a partnership committed to supporting wind-generated electricity from Mid-Atlantic wind farms (Pearce, 2006). Communication and cooperation has allowed these universities to make sound investments and bolster an entire region’s wind energy market. Princeton could seek to build a similar system among the Ivy League or New Jersey colleges.

Universities could also organize their investments to support the solar industry. Indeed, universities are ideal candidates to catalyze the systematic mass production of PV cells because they are able to look above simple economics in their purchasing decisions in favor of ethical values. In this way, universities such as Princeton could cooperate with their neighboring schools to support rising technologies and create economic incentives in the market for future investors (Pearce, 2006). However, most universities are not wealthy enough to afford investment in solar energy: indeed, Princeton is unique in its financial capacity and should ultimately take responsibility for more than other institutions with fewer resources.

The ENV ST01 class, however, did not support Princeton purchasing RECs mainly because RECs do not necessarily change the power grid to which they are added (not additional) (“ROG,” 2006). Therefore, this paper will suggest offsets as another off-site purchasing option for Princeton to consider.

4. Offsets

This section will define offsets, discuss the key criteria for a good offset, and illustrate the problems associated with offset purchasing. The history and current usage of

offsets will also be discussed and compared to possible applications at Princeton.

4.1 Definitions and Benefits

Offsets, usually carbon offsets, encompass a broader range of uses than RECs, and are generally defined as credits for financing a part of a project that reduces GHG emissions below baseline emissions or projected business-as-usual emissions in a certain region (“ROG,” 2006). Offset payments may go into activities such as creating renewable energy sources (e.g. wind, biomass) that reduce emissions from energy use, or organically sequestering carbon dioxide to offset emissions (LaCapra, 2007). Carbon offsets range from \$5 to \$25 per ton of carbon dioxide, averaging \$10/ton. Like RECs, the ethics of carbon offset purchasing are built on the notion that global warming is a global problem, so reducing or avoiding GHG emissions in one area can offset the emissions in another region (*A Consumer’s Guide*, 2006). Also like RECs, offset purchasing can stimulate the renewable energy economy.

In contrast to RECs, offsets are defined and contingent upon a guarantee of additionality along with several other important criteria. Offsets purchases should be characterized by demonstrated additionality, precise baseline determination, the ability to quantify the benefits of the offset, permanence, clear known ownership, and meticulous monitoring, verification, and registration (*A Consumer’s Guide*, 2006). Additionality and baseline determination are as important for offsets as they are for RECs; quantifying the additional effects that the offset payment will have on carbon emissions is crucial to both setting the offset price and determining if the offset is producing a measurable environmental effect. Permanence is also important because an offset project should have long lasting effects on atmospheric GHG emissions, as a temporary emission reduction

would not serve to offset continued emissions by the offset buyer. In addition to the obvious necessity for verification and registration, offsets should be able to demonstrate local social and environmental benefits (Chomitz, 2000). While RECs simply add renewable energy units to a particular electricity grid, offsets can have cultural, behavioral, and environmental effects. And unlike RECs, offset cost, timing, and secondary environmental benefits do not affect the technical quality of an offset project (*A Consumer's Guide*, 2006). An emission reduction of a certain size has the same climatic effect regardless of offset price. Conversely, the value of a REC will depend on the type of energy it represents and replaces, as some energy sources release more energy per ton of carbon dioxide than others.

4.2 Difficulties and Obstacles

In many ways, the difficulties in REC purchasing and offset purchasing are quite similar. Additionality and baseline predictions involve quantifying the difference between emissions of an offset project and the hypothetical without-project emissions. Such calculations are surely difficult and involve a certain degree of uncertainty. Unfortunately, both buyers and sellers have incentive to choose predictions of high baseline emissions, which will overstate the overall emission reductions. Determining additionality is most difficult when the buyer is a large commercial entity with good access to financing, the new technology is well understood, and the investment in the new technology yields a direct monetary return to the buyer. Offset projects under these conditions make money for the owner so may be undertaken spontaneously, and may thus not necessarily be additional. Ongoing projects that benefit a larger community such as forest restoration and forest production are much more clearly additional (Chomitz,

2000).

Forest restoration and production projects, however, have their own unique obstacles. Primarily, baseline determination involves isolating and predicting the behavior of a particular land area, which is often impossible as ecosystems constantly fluctuate and change over time. Also, while deforestation patterns are actually quite predictable over time, deforestation rates are not (Bounoua, 2002). Additionally, protection of one plot of forest may simply lead to the diversion of deforestation pressures to a neighboring plot. This so-called “leakage problem” can be reduced by designing internal controls to neutralize leakage or including leakage error in offset calculations (Chomitz, 2000).

The quality and sustainability of forests as carbon sinks is also subject to debate. There is still great uncertainty in the research documenting how well and for how long trees can sequester carbon (Montagnini, 2004). Sequestration ability depends on tree species, density, growth speed, and age, so while estimates suggest a grown tree can sequester between 3 to 15 tons per year, a newly planted tree may sequester only 1/3rd of 1 ton (Bailey, 2006). While the use of tropical forest-based offsets is increasing in popularity, the evidence regarding tropical carbon sinks continues to be sparse. Technically, a climax forest is not sequestering any net carbon dioxide as trees die and decompose while new ones grow, but if the business-as-usual scenario involves deforestation, some nations may believe they deserve credit for *not* cutting down their tropical forests (Pfaff, 2000). Essentially, the benefits of sequestration cannot be assumed.

Offsets that finance forest restoration and conservation, however, represent only

one possible offset purchase. Many offset purchases go towards financing projects that reduce GHG emissions through renewable energy production. However, the transparency and consumer knowledge associated with such purchases is extremely poor. There is also a lack of centralized control in the market, and little information is provided about where the money is spent or what criteria are used to select the reductions that are sold to customers (*A Consumer's Guide*, 2006).

Offset purchases are managed mostly by corporate entities that each invest the offset funds differently; some offsets will be higher quality than others and this fact is rarely considered by buyers. Top offset providers should offer prioritization of offset quality, buyers' ability to transparently evaluate offset quality, information about technical details, and overall education about global warming mitigation. Providers such as Climate Care, Native Energy, and Terra Pass offer such services and are highly ranked for the quality of offset they sell, but because regulation in the market is inconsistent, quality control can only be self regulated (*A Consumer's Guide*, 2006). A prospective buyer must consciously choose to become informed about offset options, which is not a realistic expectation for many consumers. The environmental community also fears that consumers who ease their own conscience by purchasing offsets may be less inclined to turn down the thermostat, car pool, or weatherproof their homes (Deutsch, 2007).

It must also be recognized that offset purchasing is time sensitive. Currently, offsets are extremely cheap, but as soon as a carbon cap law is passed, the price of offsets will increase rapidly. For early adopters, there are many more cost-effective options to explore, but while offsets may be cost effective now, they may not always be so economical. Though not within the scope of this paper, government oversight is

ultimately needed to normalize the offset market. Until this occurs, institutions such as Princeton must be responsible for self-policing.

Finally, offset and REC purchasing share the ethical obstacle of allowing negligence in taking responsibility for one's emissions and energy use (Phillips, 2006). Offset programs may be used by companies in claiming environmental consciousness or by customers in absolving guilt (LaCapra, 2007). These concerns are apparent when current offset uses are analyzed.

4.3 Current Usage and Possible Applications at Princeton

Carbon offsets are currently in wide use by individuals, corporations, and institutions throughout America. AT&T, Bank of America, Dell and Citigroup Inc. offer to donate money towards tree planting on behalf of customers who opt for paperless statements or bills or pay a few extra dollars on their purchases. "Eco-options" are available from expedia.com and Travelocity.com where customers can choose to add several dollars to their bill to offset their travel emissions. Many other companies are making offset certificates available to their customers. Cliff Bar Inc., an organic food company, sells \$2 "cool tags" which each offset about 200 miles of driving at concerts, festivals, and sporting events whose proceeds go to offsetting carbon emissions (LaCapra, 2007). Whole Foods sells analogous wind power cards to their customers, but is also adopting their own green practices including solar roofs, biomass purchasing, carbon credits, compost waste, and cardboard recycling (Deutsch, 2007).

The above-mentioned offsets are primarily managed by parent corporations that each invest the money differently. Climate Care focuses on retail offset ventures that involve small scale renewable energy projects in developing countries, Carbonfund.org

provides solar energy to low-income families in Chicago, DrivingGreen.com converts methane from manure into renewable energy, NativeEnergy funds wind turbine projects in Native American and Alaska Native communities, myclimate constructs solar greenhouses in the Himalayas so that produce does not have to be flown there, CarbonNeutral promotes energy-efficient lighting in Jamaica's tourism sector, particularly in hotels, and TerraPass purchases carbon credits on the Chicago Climate Exchange (LaCapra, 2007). The Chicago Climate Exchange operates a voluntary GHG cap-and-trade program in the US and Europe that is committed to reducing GHG emissions below a certain level (*A Consumer's Guide*, 2006).

Overall, offsets can effectively combine environmental benefits with economic efficiency. When purchasers are informed and aware about the projects they finance, offsets can be a viable option for supporting global sustainability. Despite the difficulties associated with offsets in the global market, the ENV ST01 class highly recommended Princeton's use of offsets instead of RECs ("ROG," 2006). Offsets are a better investment for Princeton because they have assured additionality, more clear objectives, more tangible benefits, and can involve projects undertaken closer to home. If Princeton's objective is to reach carbon neutrality quickly, the goal could be reached with a mere \$300,000 per year in carbon offset purchases, assuming we reap the economic benefits of the cost saving proposals of last semester's class (Kreutz, 2007). Initial large scale offset purchasing is an ideal first step for Princeton. However, Princeton should not build its entire sustainability program around offsets. As this section has shown, the specific value and ethical nature of offset purchasing is not clear-cut and is characterized by the inescapable failure of purchasers to take responsibility for reducing their own emissions.

Case studies of other universities demonstrate the popularity of both REC and offset purchasing, but also illustrate how more creative thinking, varied programs, and campus based initiatives can effectively create a culture of sustainability on campus.

5. Case Studies: Current Uses of RECs and Carbon Offsets in American Universities

This section will compare the sustainability efforts of New York University and Yale University and discuss how they have used RECs and offsets. These case studies illustrate that integrated efforts combining REC/offset use with on campus initiatives is much more effective than exclusive use of RECs/offsets in creating a sustainable culture on campus. Princeton should pay particular attention to Yale's program as it sets an example for how REC/offsets can be used initially to promote sustainability but subsequently phased out as environmental awareness and concern on campus develops and on-campus energy reduction and use of renewables increases.

5.1 New York University (NYU)

In October 2006, NYU Executive Vice President Michael C. Alfano announced the university's commitment to make the NYU community more "green." His announcement led to the creation of the NYU Sustainability Task Force and subsequently the Green Action Plan (Alfano, 2006). The central aspect of NYU's new Green Action Plan has been the purchase of 118,000 kWh of wind power, an amount equal to the power NYU purchases yearly from Con Edison ("Green Action Plan," 2007). NYU's investment is the largest purchase of wind power by any US college or university and is the 11th largest wind purchase in the entire US ("A Review," 2006). The wind purchase, in the form of RECs, has attracted significant media attention and inspired admiration for

NYU's commitment to sustainability. NYU cites the scientific support for wind power that includes gains in economic development, cost stability, resource diversity and conservation, environmental benefits, and public health (Copleman, 2006). However, it is apparent that these purchases may not be as beneficial, in terms of additionality and promoting sustainability on campus, as they may first appear.

While REC purchasing is certainly not the only sustainability work that NYU is undertaking, as they also possess a Cogeneration plant and student conservation activities in addition to employing green building techniques, the wind purchases have certainly been most emphasized and publicized. NYU's investment may certainly lead to positive economic market effects for wind power production, but there is no guarantee that its REC funds are being spent efficiently or that the wind energy units substitute well for energy units used on campus. While, RECs and offsets are certainly a good place to begin university sustainability programs, NYU has taken its investments to the extreme. This policy approach detracts from the activities that do the most to promote sustainability on campus.

For example, one of the programs that has grown out of NYU's Green Action Plan is called the NYU Garden Shop, which is committed to adding an ecological dimension to Washington Square campus garden areas. The Garden Shop is implementing many sustainable gardening practices including: the introduction of native plant species, eliminating chemical fertilizers, integrated pest management (eliminating the need for pesticides), water conservation, reduction of lawns that consume a lot of water, reduced use of fertilizers, pesticides and the fossil fuels burned in mowing, sustainable soil management to maintain organic matter, and eliminating gas powered

maintenance tools. This sort of local carbon offset program is both increasing carbon sequestration and encouraging environmental awareness and thinking on campus. The Garden Shop succeeds in beautifying the campus, offsetting emission with a local initiative, and protecting the environment. This is a very noteworthy local interpretation of carbon offsetting. While the global impact of such a program is small (with regard to net carbon emission offsets), the education value is large, so local initiatives such as the Garden Shop should ideally be expanded and combined with off-site purchasing to simultaneously pursue sustainable education and efficiency at NYU (“NYU Garden Shop,” 2007).

5.2 Yale University

Unlike NYU, sustainability at Yale is not a new concept. In 1987, Yale’s first campus recycling program was initiated, and since then, Yale has developed a Green Action plan and a set of environmental principles, and in 2005, the Office of Sustainability was created (“Yale Office of Sustainability: How we Got Started...,” 2007). Yale’s comprehensive sustainability strategy is designed to integrate university practices, research, curriculum, and student activities to create an environmental culture on campus. As part of its mission, the Office of Sustainability states: “Yale’s scholarly excellence in fields that contribute to sustainability, combined with its ability to put into practice research and discovery connected to it, allow the University to advance the national and international dialogue on an important global issue.” Yale’s acknowledgement of its position as an academic leader has lead to a sustainability program that encompasses three main goals: engaging students, faculty, and staff in gaining understanding of Yale’s current patterns and consequences of behavior, creating

dialogue to explore sustainable characteristics and the means to achieve them, and incorporating sustainability practices into Yale's operational functions and educational framework to both guide university decision making and serve as an example throughout the academic world and beyond. Sustainable ideals are thus being worked into natural resource use, campus operations, and culture at Yale ("Yale Office of Sustainability: Yale Sustainability Strategy," 2007).

Like NYU, Yale has traditionally been a large purchaser of RECs, but has approached its purchasing more as a means of engaging the university community and a first step towards sustainability than as an end in-and-of itself. In 2005, undergraduates at Yale were challenged to reduce energy consumption by 15% over three years, and in the first year, energy consumption was reduced by a shocking 10%. As a result, the University was able to buy 10,000 MWh of RECs equivalent to two thirds of the electricity used by the residential colleges in that year ("A Review," 2006). The RECs were purchased for a mere \$22,500 from the national provider of clean energy, Sterling Plant, and have gone towards subsidizing wind power to replace coal power in the Oklahoma power grid. Julie Newman, director of Yale's Office of Sustainability says that the University will continue to purchase RECs as long as students continue to consume less energy (Siegel, 2006). While Yale has certainly taken advantage of cheap REC purchasing, its purchasing was also used as an educational and motivation tool for students.

Since 2003, Yale has offset 20% of its annual electricity consumption with RECs, but the school is also working to reduce overall energy consumption with, among other projects, installing more efficient light and occupancy sensors ("A Review," 2006).

Yale's School of Forestry and Environmental Studies has purchased \$3500 of wind power RECs aimed to generate more business for the wind industry and set an example for other schools to support renewable energy (Riccitelli, 2003). The School of Forestry and Environmental Studies also neutralized the carbon emission from graduation (including air travel to the event) with RECs and carbon offsets from the Sterling Plant and the Solar Electric Light Fund. However, Yale also used local and organic food as well as biodegradable dishes and utensils and composted waste from the event at Yale's vegetable garden ("A Review," 2006). Essentially, Yale is striking a balance between taking advantage of economical RECs and offsets while simultaneously building and employing local environmental programs. For Yale, the motivation behind every action remains the goal of creating a sustainable culture on campus.

It must be emphasized that Yale does not plan to become dependent on off-site renewable energy sources (Siegel, 2006). Yale is participating in both on campus and off campus projects including a 40kW array of PV at the Yale Divinity School and the use of bio diesel throughout campus. As Yale moves away from the beginning stages of its environmental programs, it is attempting to squeeze the piece of pie that is offsets and RECs smaller and smaller with time. The Office of Sustainability views RECs and offsets as good initial investments, but not long term solutions (Newman, 2007). Students, faculty, and administrators alike feel that supporting renewable energy through renewable credits has been effective in building Yale's involvement in the renewable field, but Yale should not be satisfied with that effort alone and should develop renewable energy projects on campus (Currey, 2006). This forward-looking and environmentally conscious yet economic and practical thinking should serve as a model for Princeton's sustainability

development. Princeton should keep in mind that while off-site purchasing may be a valuable first step, RECs and offsets alone cannot build a sustainable campus culture.

6. The Ethics of Off-site Purchasing: Balancing Practicality, Feasibility, and Morality

This section will discuss the ethical nature of REC and offset purchasing and how moral concerns are weighted against practicality and feasibility issues. Such a discussion illuminates if and to what extent RECs and or offsets should be purchased by Princeton University. Of particular concern is the unique position Princeton occupies as the richest University in the United States per student. Does Princeton have a moral obligation to go beyond what is economically most efficient and set an example for other Universities around the nation and around the globe? This section will argue in favor of such an attitude but will emphasize that economic goals for RECs or offsets in the short term are ethically justifiable.

As Princeton looks to invest in off-site purchases, offsets will prove to be better investments than RECs. Because offsets are additional by definition, their benefits are more certain. While RECs can certainly boost the renewable energy market, RECs are not necessarily additional and are more difficult to quantify than offsets. RECs are extremely cheap and a great way to get an environmental conversation started, but the impact they can have remains unclear (Newman, 2007). Princeton should instead analyze and consider many different offset projects that reduce GHG emissions. Princeton could build a wind farm in a wind-rich region such as North Dakota or Oklahoma or undertake a forest restoration or forest conservation program. Such initiatives could expedite initial emission reductions and sustainable attitudes, and could be publicized on campus to

increase environmental awareness and education. In the long term, however, Princeton should look into on-campus initiatives as well, as Yale's has done, and construct clear goals and specific paths that will eventually lead to a sustainable campus culture.

RECs are particularly troubling because they create a market of intangible goods that is poorly regulated. The market is surely reliable for physical commodities and concrete services, and Americans are becoming increasingly comfortable with marketing intangible goods, a prime example being the Stock Market. However, extensive and nationally cohesive certification and regulation is required to ensure that a market of intangible goods is functioning fairly and efficiently. No such regulation is yet exerted upon the REC market and is necessary before consumer faith in REC benefits can be developed. As mentioned previously, 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.

Economic concerns aside, it is certainly true, scientifically speaking, that a carbon dioxide molecule on one part of the globe has the same effect as a molecule on the opposite side of the globe. Asserting that global warming is a global problem with global solutions, however, ignores cultural and behavioral realities that are region specific. It is the developed, industrial nations, not the poor nations that continue to waste increasingly more energy per capita and pay for off-site emissions programs instead of reducing their own energy consumption. Purchasing offsets and credits sends the message that "renewable energy is not for us," and the poor should use renewable energy while the rich continue to voraciously consume resources. While we should assist developing nations in installing energy efficient technologies, this does not excuse us from adopting

sustainable energy practices as well. Sustainability is about more than sheer numbers and calculations: sustainability is a lifestyle, a consciousness, and a mindset. Mr. Becker of the Sierra Club argues that “People view offsets as papal indulgences that let them make environmentally bad decisions” (Deutsch, 2007). It is not surprising that comparing offsets to papal indulgences is a common practice. Offset consumers can write a check every so often and absolve themselves of the guilt and responsibility that is needed to integrate sustainable practices into everyday life. Ultimately, stopping global warming will require recognition of the problem and widespread devotion to building a better world.

Princeton stands in a very unique and powerful place in this complex cultural web. Americans today are generally open to the idea of contributing to environmental protection, but they want to do it in a small way, and not be charged too heavily for it or be forced to completely change their lifestyles (Richter, 2004). Princeton University, however, is not loosely composed of uninformed and unwilling consumers: we are a benevolent corporate entity and a close community whose shared goals all center on excellence in education and research. Princeton’s informal motto, “Princeton in the nation’s service and in the service of all nations” should carry directly into our sustainability practices. Initial investments in carbon offsets could be extremely beneficial, especially if they were directed towards offsetting business and student travel. Once the sustainability program is on its feet, however, Princeton should begin to invest in other programs, such as solar installments on campus and biofuel use that may be more expensive but will serve to promote environmental awareness on campus. As a leader in research and education, Princeton should set an example for its students and teach them

how to lead sustainable lives after they leave. What students do after college will have a much greater effect on the world than the emission offset by the university, so Princeton has an obligation to make environmental thinking a part of the Princeton education. Building a sustainable culture and teaching sustainable practices is imperative because each year, Princeton cultivates future world leaders, and tomorrow's world will undoubtedly be plagued by environmental concerns.

7. Recommendations

This section will synthesize the arguments and ethical considerations discussed thus far and make recommendations for Princeton's future off-site purchasing.

Purchasing programs can be separated into four separate layers: emission reductions on campus, REC purchasing (additionally not guaranteed), domestic offset programs, and overseas offset programs. 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, though projects that are undertaken close to the University should be favored. As long as additionality and other key criteria for offset quality are met, the university has a degree of freedom in choosing the identity of their particular offset purchases.

1. Princeton should jump start its sustainability program with offset purchasing.
 - A. Offset purchasing is favored over REC purchasing because additionality is obligatory and can be more certainly determined.
 - B. Careful certification, self-policing of offset quality, and balancing of ethical, practical, and economic concerns is necessary.

- C. Possible offset projects include building a wind power plant, investing significantly in a renewable energy plant, or large-scale forest restoration or conservation.
- 2. REC purchasing could be considered under certain, specific conditions:
 - A. Princeton could mimic the Pennsylvania schools initiative and adopt a wind or solar energy sector as part of an Ivy League or New Jersey University partnership.
 - B. Only RECs with sufficiently demonstrated additionality can be considered.
 - 3. As soon as Princeton's sustainability program is established, we should rapidly move away from REC/offset purchasing.
 - A. Offsets are not a long-term solution.
 - B. We should emphasize campus programs that increase awareness and education
 - C. Princeton should use its financial and research resources to lead the charge in the development of novel renewable energy solutions
 - D. Princeton should be willing to occasionally spend more in the pursuit of environmental protection and technological progress. As the wealthiest university in the US per student, we have a particular responsibility to undertake some projects that many other universities may not be able to afford. Such projects may initially be more expensive, but will set a good example among the academic community, and eventually lead to reduced energy use on campus and thus reduced cost in energy consumption. For

example, instead of running our Cogeneration plant by optimizing to reduce net cost, Princeton could choose to run the plant more, at some small economic loss, in order to reduce net campus emissions. On campus emissions are favored over wind power offsets because of the awareness and environmental community building they inspire.

4. Our ultimate goal should be to create a culture of environmental sustainability on campus

A. Princeton should set a goal of integrating sustainable practices into all aspect of university life and operation. Students, faculty, staff, and the community at large should all be aware of environmental issues, and engaged in discovering sustainable solutions. In this way, Princeton could rapidly join the ranks of Yale in promoting environmental thinking throughout the US and the world.

B. Princeton should integrate the teaching of environmental sustainability practices into the Princeton student experience. Princeton students should be taught to become active and thoughtful global citizens and learn sustainable practices and ideals that they will maintain after graduation and throughout life.

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A Six-Pronged Diagnosis of Sustainability Institutionalization in Universities

by James Kuczmariski

Abstract

Offices of Sustainability are becoming increasingly important as institutions of higher learning sign the President's Climate Commitment, which obliges universities to achieve climate neutrality. Attaining this goal necessitates the institutionalization of 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—commitment from top management, administrative chain of command, metrics for success, funding, publicity, and active engagement of students and faculty—must be understood. Only then can these elements be applied properly to individual universities. Princeton University, in particular, has made integral steps in institutionalizing its sustainability efforts but could further progress by signing the President's Climate Commitment; increasing the number of sustainability professionals; changing the reporting structure of the Office of Sustainability; including metrics to evaluate sustainability research and education; expanding considerably funds devoted to environmental 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. Using Princeton's Office of Sustainability to coordinate on-campus carbon emissions reductions is crucial for meeting the statewide carbon stabilization targets set by the New Jersey Governor's Executive Order Number Fifty-four.

1. Introduction

Only recently has climate change entered the collective American consciousness. Twenty years ago it was labeled as a tenuous hypothesis. In 2007, 83% of Americans recognized it as “a serious problem;”⁷⁷ media outlets publicized it as “the greatest challenge in the history of mankind;”⁷⁸ politicians touted it as “part of the next phase of Democratic agenda in Congress;”⁷⁹ and oil companies acknowledged it as worthy of

⁷⁷ Yale Center for Environmental Law and Policy. *Environmental Poll: March 2007*. Available: 6 April 2007. <http://www.yale.edu/envirocenter/environmentalpoll.htm>.

⁷⁸ Leibovich, M. and P. Healy. “Star in New Role, Gore Revisits Old Stage” *The New York Times*. 21 March 2007. p. A1.

⁷⁹ Fialka, J. “Democrats Push Climate Change to the Front Burner.” *The Wall Street Journal*. 18 January 2007. p. A1.

“action to avoid further exacerbation.”⁸⁰ Yet without national policies to curb climate change, state governments and individual institutions have spearheaded efforts to reduce greenhouse gas emissions.

Within the institutional sphere, many colleges and universities have recognized their unique potential to reduce emissions. As non-profit entities with sizable endowments, they possess the financial means necessary to create substantial change. Without shareholders or governmental agencies to report to, they also enjoy the autonomy needed to execute their own emissions reduction initiatives. Moreover, in pursuing such initiatives, they can call on the participation of students and on the expertise of faculty. Given these characteristics, it comes as no surprise that an increasing number of institutions of higher learning have expressed interest in attaining climate neutrality. As of May 2007, over two hundred college presidents had signed the President’s Climate Commitment to eliminate global warming emissions produced on campus.⁸¹

In any organization employing, housing, feeding, teaching, and transporting literally thousands of individuals, altering the many processes that produce carbon emissions is no small task. Reducing carbon emissions considerably requires not merely an additional employee or program, but, rather, a systemic transformation in how the university emits carbon. To that end, Offices of Sustainability have begun to spring up across the nation. These offices have become the forums through which to navigate university administrative structures, centralizing green initiatives and frequently

⁸⁰ British Petroleum. *Climate Change: Overview*. 2007. Available: 3 April 2007. <http://www.bp.com/sectiongenericarticle.do?categoryId=9007616&contentId=7014482>.

⁸¹ American College and Universities President’s Climate Commitment. *Number of Signatories to Date*. 4 May 2007. Available: 4 May 2007. <http://www.presidentsclimatecommitment.org/>.

involving faculty and students. Situated beneath the umbrella goal of campus-wide sustainability, they have served as conduits for reducing university carbon footprints.

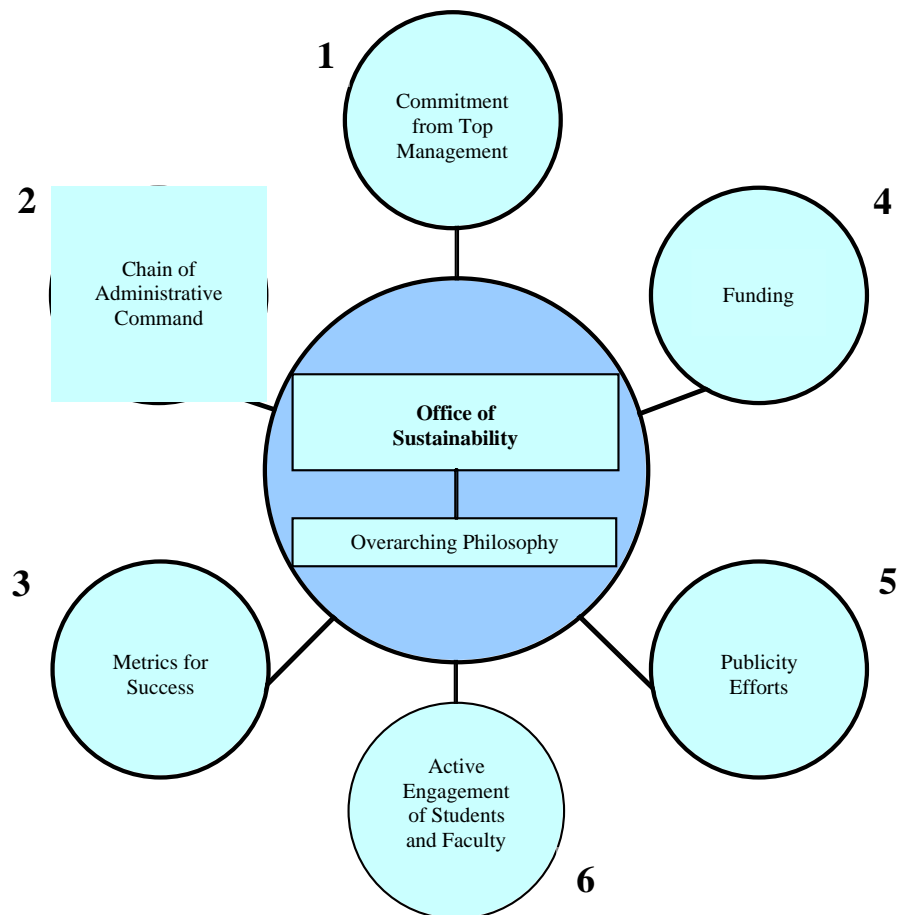
If universities wish to achieve the lofty objective of climate neutrality without relying heavily on offsets, Offices of Sustainability must be well-oiled machines. That the overwhelming majority of Offices have been created in only the past five years, however, makes many universities either wary about embracing their recommendations or unsure about how to organize them for maximum effectiveness. In these situations, information about how other universities have organized their various administrative and operational structures would be extremely useful, especially because the President Climate Commitment allots a mere two months for universities to create the often complex “institutional structures to guide the development and implementation” of greenhouse gas emissions reduction plans.⁸²

Despite its potential utility, a broad study of these structures in Offices of Sustainability across the country has never been completed. This essay will attempt to fill the gap. First, it will identify the five structural elements of an Office of Sustainability as well as a beneficial, yet optional, sixth element. It will then discuss each element, drawing on the expertise of sustainability experts to diagnose what works well within the university context and what does not. Finally, it will apply best practices to Princeton University’s Office of Sustainability, providing recommendations for reforming its institutional structures. Ultimately, the approach taken by this paper is a practical one. It will discuss not only why adoption of certain structures is important but also how particular universities are doing so—and, specifically, how Princeton could follow their lead.

⁸² *Ibid.*

2. The Principal Elements of Campus Sustainability Efforts

Extensive interviews reveal five primary institutional elements of collegiate sustainability efforts: (1) commitment from top management, (2) chain of administrative command, (3) metrics for success, (4) funding, and (5) publicity efforts. A secondary element, (6) active engagement of students and faculty, plays a crucial role in efforts to engrain sustainability into university culture but is less necessary if raw, environmental



impact reduction is the central goal (Figure 1).

Figure 1: The Elements—Depending on the philosophy of the Office of Sustainability, either five or six tenets comprise the administrative and structural organization of university sustainability efforts. The optional sixth element is featured at the bottom of the figure.

The nature of each element is derived from the overarching philosophy of the Office of Sustainability. According to its most common definition, sustainability is development that “meets the needs of the present without compromising the ability of future generations to meet their own needs.”⁸³ Historically, Offices of Sustainability at individual institutions have embodied this definition with one of a broad spectrum of philosophies, ranging from merely saving money by reducing energy inefficiencies to incorporating consummately all aspects of sustainability into campus procedures, building design, curriculum and culture.

The philosophy fundamentally reflects what the university is trying to accomplish. The University of New Hampshire, for instance, puts forth a philosophy with sustainability defined not only as “integrating knowledge in all its forms into cultural institutions to establish patterns of living that sustain us now and generations into the future”⁸⁴ but also as incorporating “what we value: love, beauty, relationships, meaning, identity, and human and ecological health.”⁸⁵ With such a penetrating definition, sustainability pervades all aspects of the University’s daily operations, and the Office of Sustainability is a centerpiece—physically, fiscally, and ideologically—of campus. Near the opposite end of the spectrum is Harvard, whose philosophy is to support sustainability projects that turn an eventual profit. Each philosophy is certainly worthy of merit—indeed, each represents effective efforts to reduce a university’s negative impact on the environment—but the differences between them influence entirely how the Office of Sustainability is institutionalized. At the University of New

⁸³ EPA. “About Waste Minimization.” *Waste Minimization*. 6 June 2006. Available: 9 April 2007. <http://www.epa.gov/epaoswer/hazwaste/minimize/about.htm>.

⁸⁴ Kelly, Tom. “What Is Sustainability?” *NH Forum: Office of Sustainability Programs, University of New Hampshire*. April 2003. Available: 7 April 2007. <http://www.sustainableunh.unh.edu>.

⁸⁵ UNH Office of Sustainability. What Is Sustainability? 2006. Available: 7 April 2007. <http://www.sustainableunh.unh.edu/whatissustainability.html>.

Hampshire, the Office has core staff who coordinate both grassroots and top-down sustainability initiatives by students, faculty, and administrators to revise the college's education, culture, food, and society to incorporate more heavily the tenets of sustainability. At Harvard, the Office, known there as the Harvard Green Campus Initiative, has a professional staff of sixteen engineers, architects, scientists and educators who work under the guise of a profitable business, chiseled and honed to decrease university expenditures with energy efficiency improvements and to maximize returns on energy-saving investments.

Accordingly, defining precisely an Office of Sustainability's philosophy—and, thus, its primary purpose and goals—will dictate to what degree each of the six elements plays a role within the institution. Do top administrative officials actively support or passively condone campus sustainability efforts? Do Office staff report to the Facilities Department or the Provost Office—or both? Is the budget funded annually by an administrative body or endowed permanently by a general sustainability fund? Are quantitative metrics or qualitative indicators used to evaluate achievement? Are successful initiatives celebrated publicly or carried out behind closed doors? Do students and faculty play roles as participants or as observers? If the end-goal of sustainability efforts ranges from picking off low-hanging fruit to reducing considerably a campus's environmental impact, only the five primary elements of institutional organization and structure need apply; if the end-goal is to generate transformational change in how *all* members of the university approach sustainability, the sixth element—active engagement of students and faculty—also applies.

2.1 Element One: Commitment from Top Management

If sustainability is to be taken seriously, the President and Board of Trustees must dictate its precise role within the university.⁸⁶ Without endorsement by top management, sustainability is seen as “an optional extra, a luxury that is tolerated;”⁸⁷ 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. Moreover, public backing by top management helps either rationalize extra expenditures for sustainable products or institutionalize the risk inherent in decisions with sustainability implications, assuring members of the university community that such decisions are supported by the university’s executives. For administrative staff in facilities, this support is crucial; it allows them to recognize that cost is not the sole driver in decision-making and that environmental impact can “be a tie-breaker between two purchasing options.”⁸⁸

In its earliest stages, the commitment is a general statement indicating a sweeping desire “to be more sustainable” or “to become climate neutral.” Such a statement is known as an environmental policy statement, “a public declaration of university commitment to environmental protection.”⁸⁹ In terms of climate change, this statement might take the form of the President’s Climate Commitment. Historically, some universities have signed the President’s Climate Commitment in order to dive in and join the climate change mitigation bandwagon, using it to galvanize initial action towards achieving climate neutrality; others have forgone signing until having determined how climate neutrality could be achieved. Either way, the initial environmental policy

⁸⁶ Indeed, according to Sarah Creighton of Tufts University, “Top-level commitment is as important for universities as it is for corporations. University staff, faculty, and students often look to the university administration to articulate and follow through on commitments to environmental stewardship.”ⁱ

ⁱ: Creighton, Sarah. *The Greening of the Ivory Tower*. Cambridge: MIT Press, 1998.

⁸⁷ Downey, P. “Sustainability Takes Time.” *International Journal of Sustainability* 5.1 (2004). p. 85.

⁸⁸ Nyquist, Tom. Director of Engineering. Princeton University. Personal Interview. 22 March 2007.

⁸⁹ *Ibid.*

statement that indicated intent must eventually be expanded to include 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. The statement is most effectively drafted by a committee composed of students, faculty, and administration. By incorporating these three parties, the committee brings all relevant stakeholders to the table, ensuring that the statement includes end-goals based on multiple points of view.⁹⁰

Even after the statement has been drafted, top management has not finished its job. It needs to embody the commitment. According to Sarah Creighton of Tufts University, “Once an administrator states that he or she is committed to environmental stewardship, everyone else tends to measure any actions against that standard. A failure by top-level administrators to assume personal action can stymie more comprehensive efforts and discourage participation.”⁹¹ A letter issued by the president’s office printed on single-sided paper, for instance, sends the message that top management itself is not fully committed to the implementation of sustainability goals outlined in the environmental policy statement.⁹² Holding top management accountable for following through with sustainability goals might require upper-level officials to present progress

⁹⁰ Creighton, Sarah. 1998. *Op. cit.* At some universities, each committee member begins by drafting the university statement individually; personal statements are then used as starting points from which to pool common ideas and to debate disparate ones. At Tufts University, “the process for developing the statement was nearly as important as the statement itself. In 1991, about twenty-five staff, faculty, deans, and students from the university were appointed to a policy committee by the president’s council of vice presidents and deans.” The committee crafted a policy statement that held weight because representative members of all constituencies within the university had designed it. Moreover, the statement helped institutionalize a commitment to environmental stewardship by incorporating university power-players from the outset.¹

¹: *Ibid.*

⁹¹ *Ibid.*

⁹² *Ibid.* Such a message is perhaps best exemplified by Colorado College, where the president named sustainability one of six key visions for the college but then failed to create an Office of Sustainability to carry out the vision; with only a sustainability committee, Colorado College’s sustainability efforts have merely a level-two administrative structure.¹

¹: Drossman, Howard. Professor of Environmental Science and Chemistry. Colorado College. Personal Interview. 29 March 2007.

reports to the president or Board of Directors on a yearly basis.⁹³

As more and more presidents sign the President's Climate Commitment, top management will feel increasing pressure either to follow suit or at least to formulate a stance of sustainability issues. Adding to this outside pressure, students, faculty and alumni within each university can often serve as impetuses for declarations of support for sustainability. Given that students are the *de facto* clients of a university, student backing can be an especially effective tool to encourage the administration to adopt official green policies.⁹⁴ Such backing can take several forms, including a written petition or an online pledge that voices concern.⁹⁵ As sources of future donations to the university, concerned alumni can also be effective at voicing concern about insufficient sustainability policies. Alumni sometimes form a coalition, using their aggregate power to compel their Alma Mater to change its policies. At Dartmouth College, seventy-five distinguished alumni recently urged the president to sign the President's Climate Commitment.⁹⁶ In addition, individual professors can single-handedly attempt to change university policy. At Colorado College, Professor of Environmental Science and Chemistry Howard Drossman put his job on the line by holding such a firm stance on sustainability issues; he

⁹³ At Sheffield Hallam University in the United Kingdom, for example, the vice chancellor submits "a formal, annual report on sustainability to the board of governors."ⁱ

ⁱ: Downey, Peter. *Op. cit.* p. 83.

⁹⁴ Camill, Phil. Associate Professor of Biology. Carleton College. Personal Interview. 29 March 2007.

⁹⁵ Members of the Oberlin College community "collected signatures from 1200 students and used them to lobby the president and other upper level administrators."ⁱ At Harvard University, over 4,000 members of the academic "community signed an online pledge committing themselves to a range of environmentally preferred practices, including recycling, energy conservation, public transportation, environmental procurement and more."ⁱⁱ

ⁱ: Engstrom, Nathan. Environmental Sustainability Coordinator. Oberlin College. Personal Interview. 27 March 2007.

ⁱⁱ: Although pledges are usually signed as part of implementing university-wide sustainability efforts, rather than to

prompt them, they easily could be used in this way.

⁹⁶ Walton, Judy. Director of Strategic Initiatives. Association for the Advancement of Sustainability in Higher Education (AASHE). Personal Interview. 4 April 2007.

threatened to leave unless the college president initiated sustainability efforts.⁹⁷ The president acceded.

2.2 Element Two: Chain of Administrative Command

Because many universities began their sustainability initiatives with varying motivations and without substantial input from established programs, the administrative chain of command varies considerably among institutions. Although most programs include sustainability councils comprised of faculty, students, and administrative staff, only particular institutions have Offices of Sustainability with staff who report to officials with institutional power within the university. A five-level scale was developed 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.

2.2.1 Level One

At this level, minimal, if any, commitment is given to sustainability efforts. Although a sustainability coordinator may exist on paper, he reports to no one on a regular basis. Student groups may advocate sustainability and faculty may teach courses that touch on elements of global or local sustainability, but such efforts exist independently of any person working to centralize existing sustainability initiatives or to create new ones. At George Washington University (Figure 2),⁹⁸ sustainability efforts exist at this rudimentary stage.

⁹⁷ Drossman, Howard. *Op. cit.*

⁹⁸ Starik, Mark. Department Chair of School of Business. George Washington University. Personal Interview. 30 March 2007.

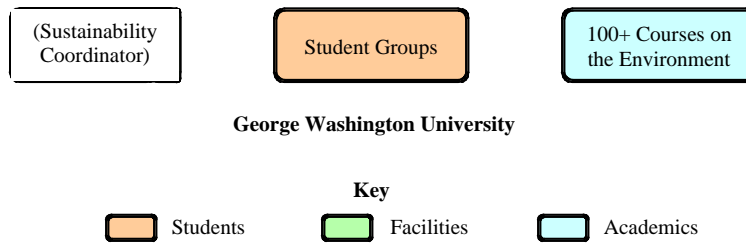


Figure 2: Level One Structure—Because George Washington University’s Sustainability Director exists only in title, he is placed in parentheses; the primarily blue coloring of his box represents the fact that he serves an academic role and engages in few, if any, efforts to coordinate sustainability efforts with facilities.

2.2.2 Level Two

At this level, a formal sustainability committee exists for one or more of the following purposes: to generate sustainability project ideas, to serve as an advisory council to university officials, or to implement green initiatives. Although Sustainability Councils vary in both title and membership composition, they are typically comprised of faculty from various departments, students from campus environmental groups, and administration from the facilities department. At Colorado, Williams, and Lewis and Clark Colleges, sustainability efforts exist at this secondary stage of institutional authority (Figure 2).⁹⁹

⁹⁹ Drossman, Howard. *Op. cit.*; Vu, John. Student. Williams College. Personal Interview. 28 March 2007.; Mullins, Kat. Student. Lewis and Clark College. Personal Interview. 2 April 2007.; Sestric, Michael. Campus Planning Chair. Lewis and Clark College. Personal Interview. 27 March 2007.

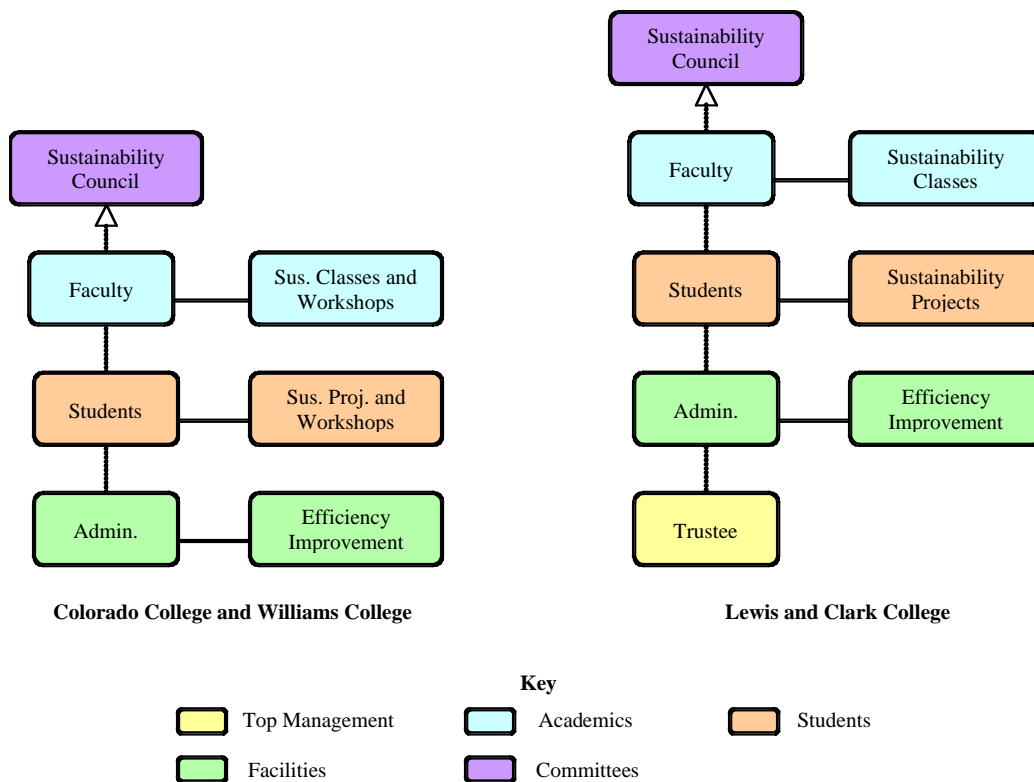


Figure 3: Level Two Structure—Sustainability Councils typically have staple memberships of students, faculty, and facilities staff. Colorado College’s Council also has a trustee who can relay information to the Board of Trustees, although he was unable to convince to Board to sign the Talloires Declaration, a ten-point action plan for incorporating sustainability into the university.

In the absence of an Office of Sustainability, most committees lack the structural support necessary to influence how a university approaches sustainability. In the worst cases, committees have no regular communication with university officials not already sitting on the committee.¹⁰⁰ According to Michael Sestric, a Campus Planning employee who sits on Lewis and Clark College’s Sustainability Council, his committee has “no power whatsoever” and offers sustainability information and advice simply to “anyone

¹⁰⁰ Mullins, Kat. *Op. cit.*

who will listen.”¹⁰¹ Although the council was “structured under the provost office, it has no formal reporting mechanisms to it.”¹⁰² Even if reporting mechanisms existed, however, members belong to the committee out of the kindness of their hearts and have little time to implement sustainability initiatives. Moreover, the committee meets only once a month—and sometimes with members unable to attend.¹⁰³

Because they have either little power to make a difference or members without sufficient time to follow through with sustainability goals, most committees have members confused about “what their real mission is.”¹⁰⁴ Lewis and Clark’s committee is “not a student group, not a department; it doesn’t have any real mold and, therefore, doesn’t have a set place to fit in.” As a result, there is a striking disconnect among the administrative bodies that created it, the council members who serve it, and the academic community that sees few implemented initiatives as a result of it. Given that weak follow-up is cited by almost 50% of university environmental programs surveyed in 2003 as a primary reason why green initiatives fail,¹⁰⁵ these committees, *per se*, can be anathema to attempts at sustainability.

2.2.3 Level Three

At this level, a paradigm shift occurs in the way a university approaches sustainability; it makes a concerted effort to incorporate formally sustainability into its operations. According to David Carpenter of Australian National University, such

¹⁰¹ Sestric, Michael. *Op. cit.*

¹⁰² *Ibid.*

¹⁰³ *Ibid.*

¹⁰⁴ *Ibid.*

¹⁰⁵ Sammalisto, Kaisu. and Karin Arvidson. “Environmental Management in Swedish Higher Education.” *International Journal of Sustainability in Higher Education* 6.1 (2005). p. 23.

incorporation isolates a green management niche within the vast university bureaucracy. Doing so not only enhances the scope of sustainability initiatives but also encourages broader participation:

By establishing a simple environmental management infrastructure, university employees and students know with whom the responsibility for environmental programs rests, what the role of each group is, what programs are out there, and who to contact about environmental issues: this fosters interest and involvement. Universities are large, complex bureaucratic institutions and it is typical for people to feel confused about management issues. Clearly articulating the environmental infrastructure of an institution simplifies the issues and promotes the natural tendencies of individuals to be good citizens.¹⁰⁶

With at least one staff member devoted entirely to addressing green initiatives, they can be attributed to an identifiable face on campus and, just as importantly, are pulled away from the already substantial workloads of sustainability committee members. The committee, in turn, transitions from its dual implementation and advisory role to solely a consultative one; it becomes a pivotal hub for idea generation, project problem troubleshooting, and incorporating high-profile faculty and administrators in decision-making processes.¹⁰⁷

Located within the facilities department, level-three sustainability coordinators typically have excellent communication with campus engineers and facilities upper

¹⁰⁶ Carpenter, David. "Mainstreaming Environmental Management." *International Journal of Sustainability in Higher Education* 3.1 (2002), p. 33.

¹⁰⁷ Based on personal observations of Princeton's Sustainability Meeting, 5 April 2007.

management.¹⁰⁸ Oftentimes, regular meetings among them allow for synchronization of efforts and, at the very least, for keeping one another apprised of future goals. Moreover, through facilities, the coordinator has a direct line of communication to university power-players, notably the president (Figure 4).¹⁰⁹

Although at this stage sustainability has been formally institutionalized, a problem remains. The majority of his or her efforts are devoted to implementation, rather than on facilitating growth of new programs and building relationships as the figurehead of sustainability.¹¹⁰ He or she can rely only moderately on the part-time interns for project implementation.¹¹¹ As a result, the sustainability coordinator's would-be role of facilitator transforms into that of a recycling wonk or energy hound. The problem is exacerbated at certain colleges, such as Dickinson, where the coordinator has only a one-year appointment; stability is crucial for generating innovative, long-term projects.¹¹²

¹⁰⁸ Weber, Shana. Sustainability Manager. Princeton University. Personal Interview. 4 April 2007.

¹⁰⁹ Wise, Chris. Environmental Management Coordinator. Washington and Lee University. Personal Interview. 30 March 2007.

¹¹⁰ At many colleges, students also fill the role of project coordinators in particular campus dormitories.ⁱ

ⁱ: Teichert, Kurt. Adjunct Lecturer in Environmental Studies and Resource Efficiency Manager. Brown University. Personal Interview. 4 April 2007.

¹¹¹ Leith Sharp, Director of the Harvard Green Campus Initiative at Harvard University, discusses the nature of this problem:

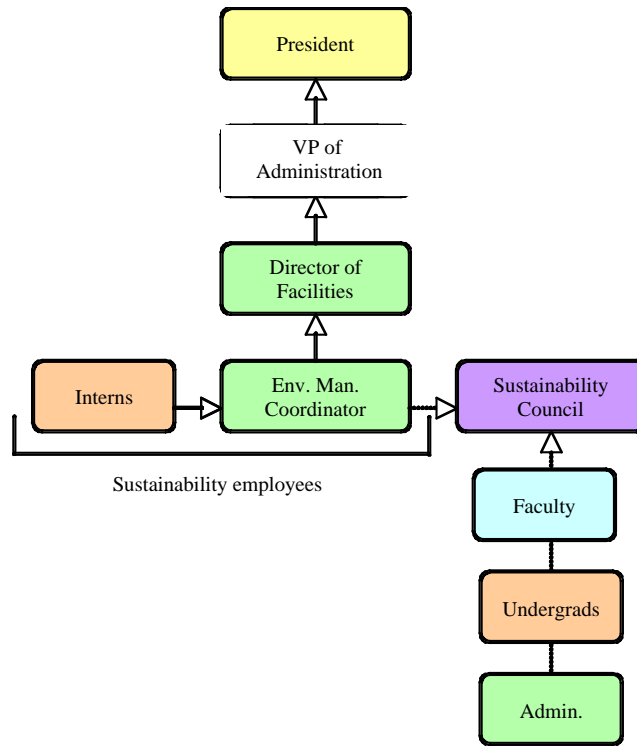
Too often, campus sustainability practitioners become project managers and implementation staff for a small cluster of particular green campus activities, perhaps the campus recycling program, a carpooling program, a green building review service, etc., leaving them very few hours for doing the heavy lifting in creating new business opportunities around the campus. Campus sustainability practitioners need to keep the majority of their hours free of project implementation work, focusing their attentions instead on doing the business development, partnership building, fundraising, work plan development, recruitment, staff training, and management and organization building of a green campus...that makes its living by improving campus design and performance.ⁱ

ⁱ: Sharp, L. *Campus Sustainability Practitioners: Challenges for a New Profession*. Date unavailable. Available: 8

April 2007. http://www.aashe.org/resources/pdf/challenges_for_a_new_profession.pdf.

¹¹² Each year at Dickinson College, the sustainability coordinator spends the first few months acclimating to the job, re-making connections with permanent facilities staff, and slowly getting comfortable with the institutional processes necessary to create change. Yet right when he or she has built strong relationships and facilitated green projects, his or her term is up—and a new person replaces him or her, restarting the learning curve at zero and forcing the neophyte to begin implementing previous projects, rather than generating innovative, long-term ones.ⁱ

ⁱ: Walker, Becky. Sustainability Specialist. Dickinson College. Personal Interview. 30 March 2007.



Washington and Lee University

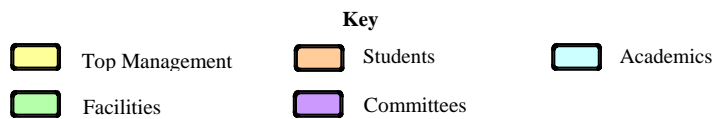


Figure 4: Level Three Structure—At Washington and Lee University, the Environmental Management Coordinator has: direct channels of communication to high-level officials, the helping hands of interns, and the advice of a sustainability council. The environmental coordinator at Washington and Lee does not work within an Office of Sustainability, but level-three operations at other universities frequently situate the coordinator as such.

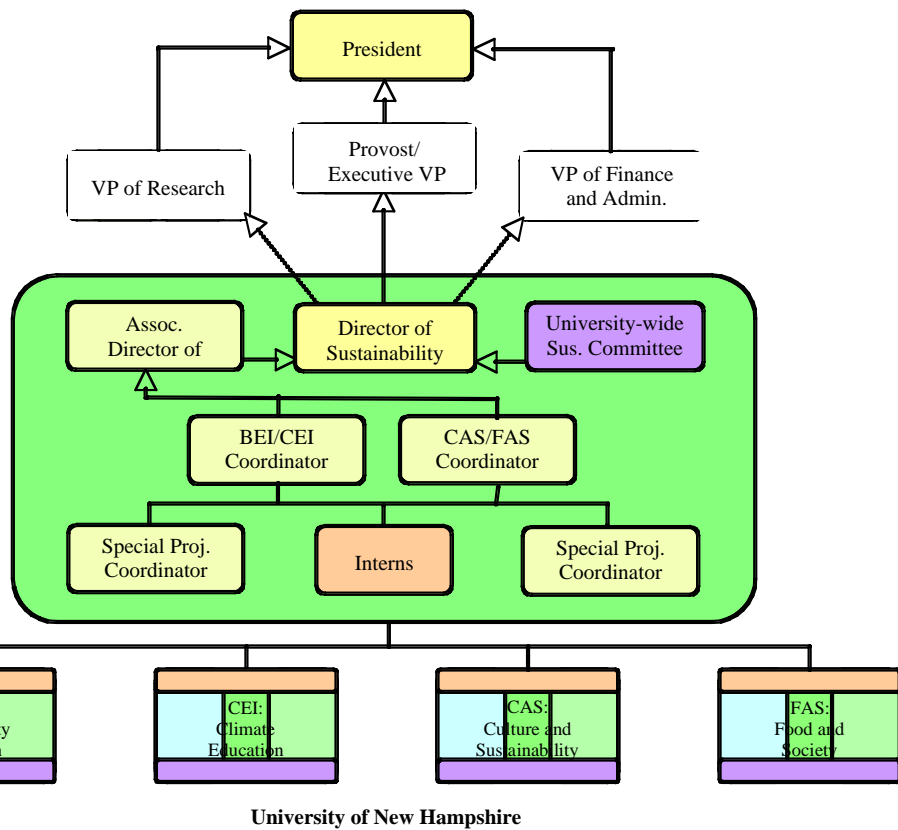
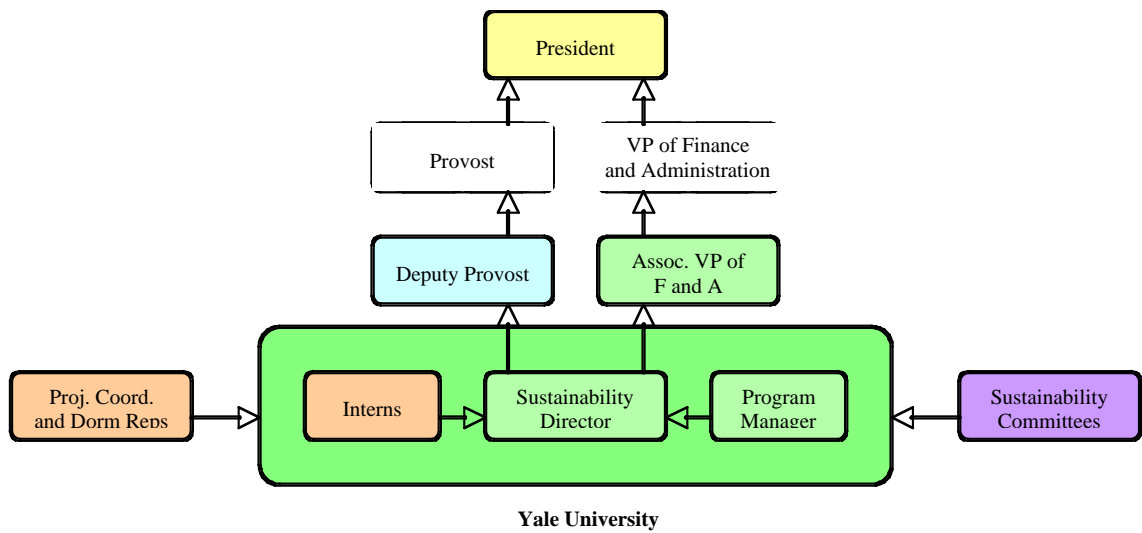
2.2.4 Level Four

At this level, sustainability professionals report not only to facilities management but also to academic officials. The sustainability coordinator often works with both the Deputy Provost and the Associate VP of Finance and Administration, meeting regularly

with each person individually and also arranging conferences for the three of them.¹¹³ There seems to be the worry that “having two masters” might be confusing or diffusive of efforts, but communication with both sides of a university—operational and educational—allows sustainability coordinators to “better institutionalize the risk” inherent in their jobs.¹¹⁴ After all, the sheer newness of Offices of

¹¹³ At Yale University, relationships between the three administrators are so strong that “they work more or less as a team,” with the two higher-level officials proposing green initiatives to the coordinator.ⁱ

¹¹⁴ *Ibid.*ⁱ: Newman, Julie. Director of Sustainability. Yale University. Personal Interview. 23 March 2007.



- Top Management
- Assistants
- Academics
- Committees
- Students

Figure 5: Level Four Structure—Yale University and the University of New Hampshire have

sustainability directors who work closely with both Facilities and Academics.¹¹⁵ While UNH's approach is to integrate sustainability into *all* aspects of the college, Yale's approach is less systemic, yet also quite penetrating. Despite their common administrative structures, the University of New Hampshire devotes more core staff to project implementation than does Yale. Yale's sustainability director has expressed a desire for more permanent staff, however, reiterating the need to reduce the director's implementation-focused workload.¹¹⁶ Oberlin College, where the VP of the College sits on the primary Sustainability Committee, has similar reporting structure to that of Yale.¹¹⁷

Sustainability can lead easily to risk-averse operations, focused only on money-saving projects or ones without campus-wide impact; having regular, face-to-face contact with higher powers lets coordinators choose more wisely among certain initiatives and feel more confident about following through with them.¹¹⁸

With a substantial number of interns and often a core staff able to focus on project implementation, level-four sustainability coordinators have more time to engage “strategic oversight and connection to wider campus sustainability effort, financial and administrative growth,”¹¹⁹ “organizing meetings, building ideas based on new input, writing proposals, ensuring that stakeholders are satisfied and supportive, drafting budgets, generating solutions to problems that emerge,”¹²⁰ and writing articles. Similar to level-three coordinators, level-four coordinators also manage multiple projects with a series of committees, each compartmentalized to address specific topics yet guided and

¹¹⁵ The structure of this diagram was vetted by Tom Kelly, Director of Sustainability at University of New Hampshire, via email on 1 May 2007.

¹¹⁶ Newman, Julie. *Op. cit.* Specifically, Newman cited sustainable procurement as well as sustainable design positions as possible future additions.

¹¹⁷ Engstrom, Nathan. *Op. cit.*

¹¹⁸ *Ibid.* To this end, communication with the academic side of the university is especially important. A university is an academic institution through-and-through; if communicating only with facilities, sustainability directors receive input from merely a small part of what make the university function. Academic officials work more closely with the collegiate processes that constitute the principal purpose of the university and, therefore, can provide invaluable advice and reassurance, especially on large-scale projects that affect the entire community.¹

¹: Walton, J. *Op. cit.*

¹¹⁹ Harvard Green Campus Initiative. *The Campus Green Team Resource*. 2007. Available: 30 March 2007.

<http://www.greencampus.harvard.edu/greenteams>.

¹²⁰ Harvard Green Campus Initiative. 2007. *Op. cit.*

streamlined by a general sustainability committee. Both Yale University and the University of New Hampshire have level-four structures, although each takes a slightly different form (Figure 5);¹²¹ as discussed previously, such a difference stems from their overarching philosophies.

2.2.5 Level Five

At this highest level, a sustainability professional reports directly to the university president. Arizona State University is the only university in the country to have reached this level.¹²² Its Office of Sustainability (OS) is the on-campus, facilities-based extension of the academic Global Institute of Sustainability (GIS), which coordinates “interdisciplinary research on environmental, economic, and social sustainability. The Executive Director of Sustainability Initiatives, the mastermind for the growth all sustainability programs, is special advisor to the president (Figure 6).¹²³

¹²¹ Newman, J. *Op. cit.*; and Kelly, Tom. Director of the Office of Sustainability. University of New Hampshire. 29 March 2007. The University of New Hampshire’s diagram was fact-checked by Tom Kelly via email on 1 May 2007.

¹²² Global Institute of Sustainability. *Global Institute of Sustainability: Arizona State University*. 24 October 2006. Available: 22 April 2007. <http://sustainability.asu.edu/gios/>.

¹²³ Buizer, James. Executive Director of Sustainability Initiatives. Arizona State University. Personal Interview. 8 April 2007. The structure of this diagram was “fact-checked” with on 24 April 2007.

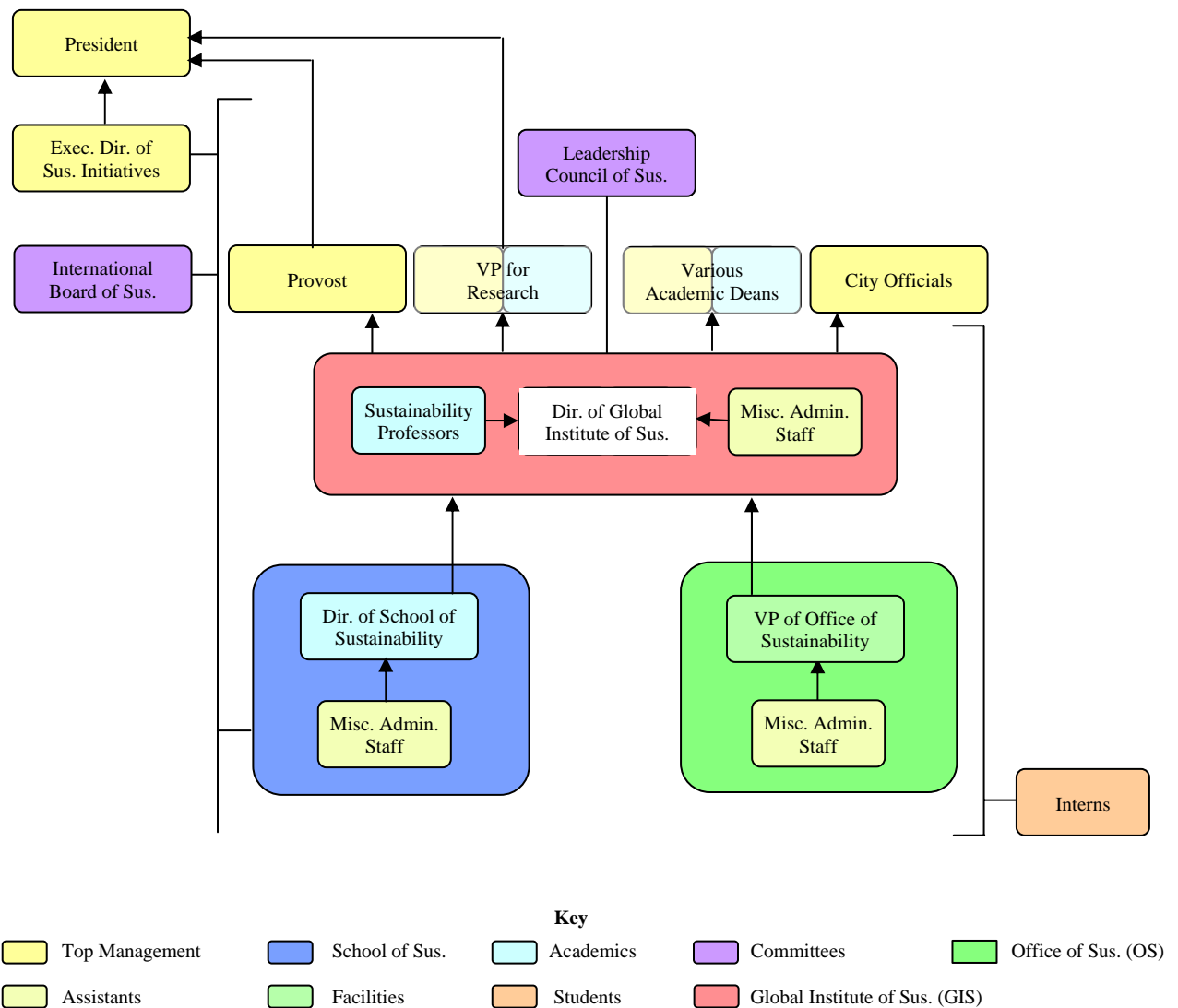


Figure 6: Level Five Structure—Sustainability is a central tenet of Arizona State University. The VP of OS reports to the Director of GIS, who reports to the provost and VP of research as well as develops science- and policy-based research projects with academic deans and city officials from Phoenix. Regular meetings take place among the Director of Sustainability Initiatives, the Director of GIS, and the VP for Research. All directors have staff to carry out project implementation, and student interns are involved at all levels of the administrative structure. In addition, the Leadership Council of Sustainability, consisting of high-level university officials, meets to discuss dean-level problems, such as how to appoint joint hires

and to promote further faculty involvement. At an even more macro-level, the high-profile International Board of Trustees meets to strategize Arizona State's growth as a global leader in the sustainability arena.¹²⁴

2.2.6 Other

Several green programs deviate from traditional administrative structures. Sustainability professionals in the Environmental Center at the University of Colorado, for instance, report both to administrative officials and to student government, which provides the bulk of their funding. The Center has an “organic, cooperative relationship” with facilities, but there exist no formal channels of communication between the two groups (Figure 7).¹²⁵

¹²⁴ *Ibid.*

¹²⁵ Newport, Dave. Director of Environmental Center. University of Colorado at Boulder. Personal Interview. 30 March 2007.

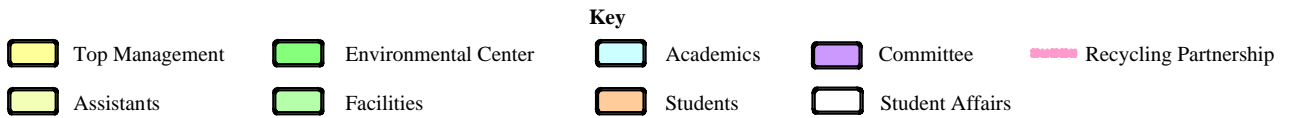
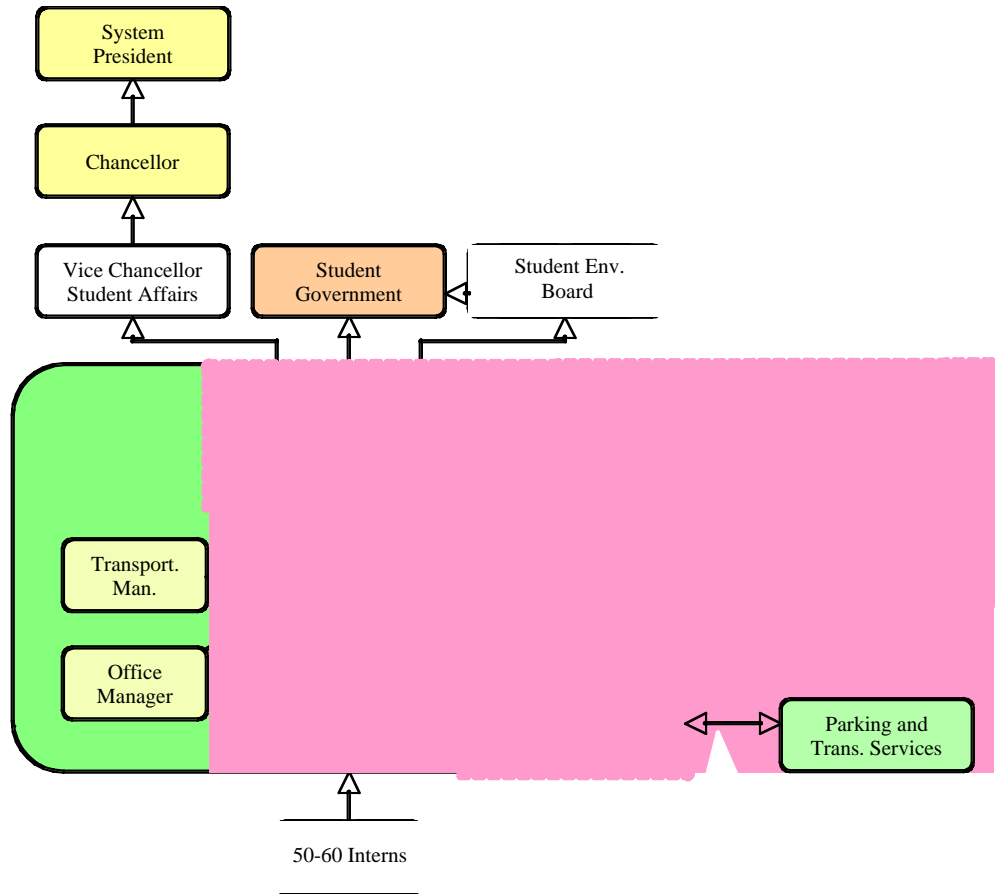


Figure 7: Other Structure—The Director of the Environmental Center at the University of Colorado in Boulder reports principally to students. Reflecting this student focus, it provides a hands-on learning experience to its 50-60 interns, educating them how an organization centered on sustainability functions—hence, the orange/blue coloring of Interns in the Figure. The System President is the head of all three University of Colorado universities.¹²⁶

2.3 Element Three: Metrics for Success

¹²⁶ The content of this Figure was fact-checked with Dave Newport by email on 22 April 2007 and by phone on 27 April 2007.

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. Without the use of metrics to break down large problems into smaller ones, sustainability professionals can often get lost in their sheer scope.¹²⁷ After all, macro-scale projects organized into micro-scale initiatives are more manageable, “finishable,” and have tangible results.¹²⁸ Such results convey to sources of funding that money was well spent and to university top management that their commitment to change was met with action.

Compiling an initial inventory of factors contributing to a campus environmental footprint, including total greenhouse gas emissions, establishes a baseline from which to derive metrics. The nature of the inventory will dictate which metrics are available. If the inventory includes CO₂ emissions produced by faculty commuters, for instance, then metrics can be developed to assess CO₂ reductions made by encouraging them to buy hybrid cars or to take public transportation.¹²⁹

Some sustainability professionals warn against focusing only on metrics. Tom Kelly of the University of New Hampshire argues that doing so can leave gaps in sustainability efforts at the program level, where issue-specific metrics often do not apply. “Really rigorous metrics can be too reductionist,” Kelly says.¹³⁰ To remedy the problem, many Offices of Sustainability also use indicators, which allow professionals to “pragmatically assess gaps in efforts” on a larger scale.¹³¹ In the end, the use of a combination of metrics and indicators may provide the best solution; specific goals, such as CO₂ emissions reductions can be tracked with metrics, while programmatic success

¹²⁷ Newman, Julie. *Op. cit.*

¹²⁸ *Ibid.*

¹²⁹ Creighton, Sarah. Project Manager of Tufts Climate Initiative. Tufts University. Personal Interview. 30 March 2007.

¹³⁰ Newport, Dave. *Op. cit.*

¹³¹ *Ibid.*

(e.g. the extent to which students embrace a sustainable ethos) can be judged with indicators.¹³²

2.4 Element Four: Funding

Funding for Offices of Sustainability is often scarce. Because sustainability initiatives have arisen so recently, university budgets have frequently included them as petty add-ons, rather than as significant, capital-worthy expenses. The lack of funding often results in Office of Sustainability budgets devoted almost entirely to staffing costs and with little discretionary income for outreach, travel, books, printing, or environmental awards—many of the elements that allow for creativity and greater impact.¹³³

Establishing an endowment for an Office of Sustainability is one way to combat funding granted annually for person- and project-specific purposes only. An endowment gives the Office of Sustainability “vital stability” that stems from not chasing dollars, not needing to compromise the Office’s mission in order to raise dollars, and having the autonomy to carry out its mission.¹³⁴

In creating an endowment, an Office of Sustainability can appeal for funding from different departments within the university: Facilities, Dining Services, Transportation Services, etc.¹³⁵ It also can bypass initially the administration and appeal directly to students or alumni. The Office may wish to create an agreement in which each dollar

¹³² *Ibid.*

¹³³ Newman, Julie. *Op. cit.* For instance, at Yale University’s Office of Sustainability, about 70% of the budget is devoted to staff;ⁱ at Harvard University’s Green Campus Initiative, about 90% of the budget “goes to support 19 student interns who work a total of ninety hours per week and a HGCI Coordinator who works twenty-five hours per week.”ⁱⁱ

ⁱ: *Ibid.*

ⁱⁱ: Harvard Green Campus Initiative. 2007. *Op. cit.*

¹³⁴ Kelly, Tom. *Op. cit.* Kelly’s annual budget of \$400,000-\$450,000 comes from a sustainability endowment of \$12 million.

¹³⁵ Harvard Green Campus Initiative. 2007. *Op. cit.*

donated by students or alumni is matched by a comparable (or even larger) donation from the university; in this sense, the university supports sustainability initiatives only to the extent to which alumni and students care about them—a fitting accord for an institution that serves these very people.¹³⁶ Monetary support from students is most often attained by a student referendum, through which students indicate initial support for an “opt-out” sustainability fee that appears on their tuition bills;¹³⁷ the opt-out option allows dissenting students the option not to participate.¹³⁸ Alumni support can come either from appealing to specific, environmentally-minded individuals for donations or from creating a sustainability endowment fund to which any alumni can donate—or both.¹³⁹

In addition, a revolving loan fund can be established to finance cost-saving, environmentally-beneficial projects that require capital investment. At Harvard University, the “Green Campus Loan Fund provides interest-free capital for high performance campus design, maintenance and occupant behavior projects” with a payback period of ten years or less.¹⁴⁰ If the Office of Sustainability spearheads the development of the revolving loan fund, it may be able to request a portion of savings accrued from post-positive projects in order to fund other green initiatives.¹⁴¹ Doing so would provide yet another source of funding.

¹³⁶ Newport, Dave. *Op. cit.*

¹³⁷ Harvard Green Campus Initiative. 2007. *Op. cit.* Moreover, the opt-out option bypasses potential moral problem of increasing student tuition. Even at state institutions, where students might attend solely because of decreased tuition costs. The opt-out option provides no required financial burden.¹

¹: Wise, Chris. *Op. cit.*

¹³⁸ For a 2004 referendum at Harvard University, 82% of students polled supported a \$10 term bill fee to fund renewable energy on campus.¹

¹: Hiatt, Alexandra. “Students Vote on Greener Harvard.” *The Crimson*. 6 December 2006. Available: 4 April 2007.

<http://www.thecrimson.com/article.aspx?ref=516203>.

¹³⁹ Kelly, Tom. *Op. cit.*

¹⁴⁰ Harvard Green Campus Initiative. *HGCI Newsletter*. Spring 2006. Available: 4 April 2007.

<http://www.greencampus.harvard.edu/newsletter/>.

¹⁴¹ Creighton, Sarah. 1998. *Op. cit.*

2.5 Element Five: Publicity Efforts

Publicizing campus sustainability efforts is important for five reasons. First, it adds legitimacy to an Office of Sustainability; public relations help signify its role as an established university entity.¹⁴² Second, it can help build a broader support base by encouraging voluntary involvement from students and faculty.¹⁴³ Third, it generates awareness about the Office of Sustainability that might result in additional funding.¹⁴⁴ Fourth, it promotes accountability of sustainability professionals.¹⁴⁵ Finally, it becomes an avenue through which to showcase a university-wide commitment to sustainability.¹⁴⁶

Multiple strategies can be used to publicize sustainability efforts. An Office of Sustainability website can be the centerpiece of such efforts, serving as a billboard for forthcoming initiatives, a database for past successes, and a window into the Office itself. In addition, a monthly or quarterly sustainability newsletter written by the Office of Sustainability and sent to all students, faculty, and administrators furthers sustainability exposure.¹⁴⁷ Permission for sustainability professionals to send periodic, university-wide emails also allows for direct communication between the Office of Sustainability and the university community. Finally, issuing press releases to local media outlets might expose the Office to the broader community. A combination of all strategies is no doubt the best approach.

¹⁴² Harvard Green Campus Initiative. 2007. *Op. cit.* Although most are run by facilities, the revolving loan fund at Macalester College is initiated and implemented entirely by students. Monies in this fund were contributed by Student Government, the Environmental Studies Department, and the College Discretionary Fund.ⁱ

ⁱ: Colehour, Alese. Student. Macalester College. Personal Interview. 30 March 2007.

¹⁴³ *Ibid.*

¹⁴⁴ *Ibid.*

¹⁴⁵ Carpenter, David. *Op. cit.* p. 32.

¹⁴⁶ *Ibid.* p. 32.

¹⁴⁷ Byrne, Jack. Campus Sustainability Coordinator. Middlebury College. Personal Interviews. 17 April 2007 and 10 May 2007.

2.6 Optional Element Six: Active Engagement of Students and Faculty

The active engagement of students and faculty in sustainability efforts is important for any university working to change systemically the way each member of the community views his or her environmental footprint. To this end, the Office of Sustainability must work to transcend “the fundamental cultures of separation” that exist among faculty, administration staff and students.¹⁴⁸ Put simply, sustainability must be incorporated into classrooms and dormrooms.

Encouraging faculty to devote time to non-academic endeavors is often foolhardy.¹⁴⁹ A handful of faculty may choose to sit on the sustainability committee that serves an advisory role to the Office of Sustainability, but most will be unable or unwilling to devote time to such efforts.¹⁵⁰ Encouraging faculty to incorporate sustainability into their individual academic endeavors shows more promise, although some sustainability coordinators have described this issue as “a can of worms.”¹⁵¹ The trick is to provide them with the tools and incentives to do so.¹⁵² Emory University’s Piedmont Project demonstrates how this can be accomplished. In 2001, Emory Professor Peggy Bartlett and several environmentally-minded colleagues drafted a proposal for a two-day sustainability workshop for faculty that would begin just after graduation. The plan was for faculty to discuss “how environmental issues connect to their fields [of study].”¹⁵³ In addition, “many small breakout group discussions would allow [for]...participants to get to know each other, broaden their thinking about both content

¹⁴⁸ Sharp, Leith. Green Campuses: The Road from Little Victories to Systemic Transformation. *International Journal of Sustainability in Higher Education* 3.2 (2002). p. 137.

¹⁴⁹ Bartlett, Peggy and Geoffrey Chase, ed. *Sustainability on Campus: Stories and Strategies for Change*. Cambridge: MIT Press, 2004. p. 82.

¹⁵⁰ Harvard Green Campus Initiative. 2007. *Op. cit.*

¹⁵¹ Weber, Shana. Sustainability Manager. Princeton University. Personal Interview. 15 March 2007.

¹⁵² According to Phil Camill, *Op. cit.*, “Professors don’t have hostility toward having sustainability in the curriculum, but rather a lack of ‘know-how.’”

¹⁵³ *Ibid.* p. 82

and teaching methods, and reflect together about what are [their] ideal educational outcomes.”¹⁵⁴ The workshop was a huge success for three reasons. First, the timing made it easy for faculty to participate. Second, several faculty members had been behind it from the outset, and their enthusiasm encouraged broader participation. Finally, a \$1,000 stipend was provided to faculty who, post-workshop, submitted revised syllabi that included some aspect of sustainability; this provided them with an incentive to follow through with the goal of the workshop.

Students often need less encouragement to get involved in sustainability initiatives than do faculty, but the Office of Sustainability can take measures to increase their participation as well. Partnering with student government, which can serve as both a channel to all students and a source of workers to spearhead particular sustainability initiatives, is an important first measure.¹⁵⁵ Another measure is to organize inter-dorm competitions to reduce energy consumption. If energy meters are installed in each dorm, progress can be determined by measuring actual energy reductions over a given time period; progress can also be determined by the percentage of students in each dorm who sign an online pledge to reduce energy usage.¹⁵⁶ An additional measure is to send letters home to freshman encouraging them to buy purchase green products.¹⁵⁷ Finally, the Office of Sustainability can create high-profile sustainability awards conferred to students

¹⁵⁴ *Ibid.* p. 82.

¹⁵⁵ Harvard Green Campus Initiative. 2007. *Op. cit.*

¹⁵⁶ Although the second scenario is less desirable, some universities have observed a decrease in the *overall* university energy consumption during such a competition; in other words, they are effective. Smith College observed such a decrease. Todd Holland. Energy Manager. In both scenarios, the competitions are especially effective if sustainability professionals offer rewards, such as a pizza party or even a designated number of offsets, to the winning dorm.ⁱ

ⁱ: Holland, Todd. Energy Manager. Smith College; Mt. Holyoke College; Amherst College. Personal Interview. 29

March 2007.

¹⁵⁷ *Ibid.*

who make the greatest contributions to on-campus sustainability efforts.¹⁵⁸

3. Recommendations for Princeton University

Princeton's Office of Sustainability was created in December 2006,¹⁵⁹ only three months before New Jersey Governor Jon Corzine signed Executive Order Number Fifty-four, which set targets to stabilize New Jersey's greenhouse gas emissions at 20% below current levels by 2020 and at 80% below current levels by 2050. The demands of this Executive Order, the recent upsurge in public support for sustainability issues, and the prospect of signing the President's Climate Commitment all render the time ripe to further the institutionalization of sustainability at Princeton.¹⁶⁰ To this end, the six elements of campus sustainability efforts will now be applied.

3.1 Commitment from Top Management

Current Status: Princeton's President has already expressed interest in mitigating the university's environmental impact: "Princeton should grow in a manner which is sensitive to geography, sensitive to energy and resource consumption and works to sustain strong community relations," she said.¹⁶¹ A more explicit commitment to sustainability, however, is needed galvanize the broader university community; to direct "the intellectual talents of the institution on the sustainability challenge;"¹⁶² and to allow the Office of Sustainability to pursue more effectively collaborative partnerships that can help "Princeton University realize its sustainability goals."¹⁶³

¹⁵⁸ Fallica, Joe. Student. Middlebury College. Personal Interview. 17 March 2007.

¹⁵⁹ Stevens, Ruth. "Sustainability Moving Ahead at Princeton." *News@Princeton*. 8 February 2007. Available: 25 April 2007. <http://www.princeton.edu/main/news/archive/S17/08/73Q05/index.xml?section=science>.

¹⁶⁰ Weber, Shana. Sustainability Manager. Princeton University. Personal Emails. 2 May 2007 and 3 May 2007.

¹⁶¹ Weber, Shana. *Presentation on Princeton's Office of Sustainability*. Delivered on: 9 March 2007.

¹⁶² Weber, Shana. *Op. cit.* 2 May 2007 and 3 May 2007.

¹⁶³ *Ibid.*

Recommendation: The President should sign the President’s Climate Commitment. Given that universities account for three to five percent of total U.S. greenhouse gas emissions, Princeton has the opportunity to join an effort that can make significant reductions; help shape public opinion; set an example for other sectors of society; and possibly “affect the market for ecologically-friendly energy, construction, products and services.”¹⁶⁴ In encouraging top management to sign the President’s Climate Commitment, students may wish to organize a referendum voicing support. With the Office of Sustainability providing an advisory role, a student-run environmental group, such as Greening Princeton, may wish to spearhead this effort.¹⁶⁵ In addition, top management should make clear any desire for the expansion of university research and curricula that focus on local or regional sustainability issues. Voicing such a desire would help motivate academic departments to recruit related faculty.

3.2 Chain of Administrative Command

Current Status: Princeton’s Office of Sustainability has a level-three administrative structure: part-time student interns and a part-time Associate Sustainability Manager report the full-time Sustainability Manager, who reports to facilities management and is advised by the Princeton Sustainability Committee.¹⁶⁶

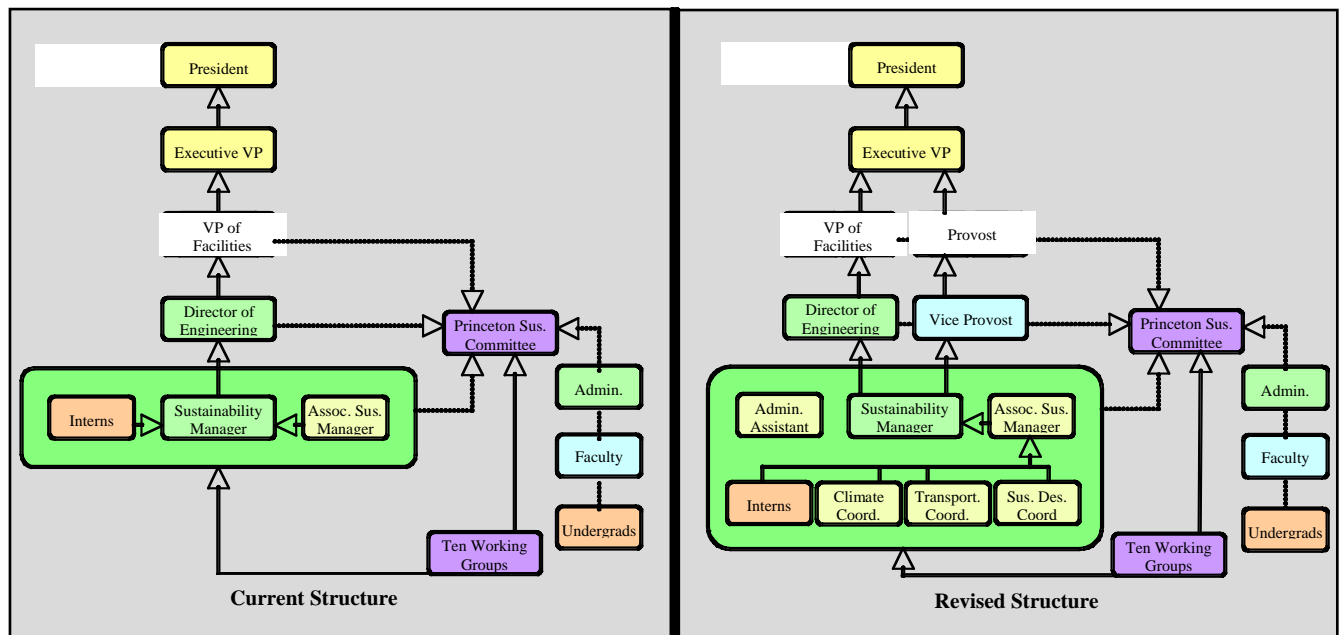
Recommendation: The Office should transition to a level-four administrative structure (Figure 8). This entails both (1) increasing the number of core staff within the Office of Sustainability and (2) creating formal reporting mechanisms to the academic side of the university, not just the facilities side. In terms of (1), the Associate Sustainability

¹⁶⁴ These insights were provided by: Walton, Judy. Personal Email. 10 April 2007.

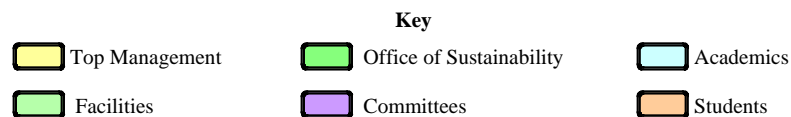
¹⁶⁵ Weber, Shana. Op. cit. 3 May 2007.

¹⁶⁶ *Ibid.*

Manager should become a full-time position; a Sustainable Design Coordinator, a Transportation Coordinator, a Climate Change Coordinator, and an administrative assistant should be added as full-time employees;¹⁶⁷ and the number of student interns should be increased. In order to facilitate communication and cross-pollination of ideas after (2) has been implemented, meetings among the Sustainability Manager and representatives from facilities and



Level Three → Level Four



academics offices should take place regularly.

3.3 Metrics for Success

¹⁶⁷ These positions were named by the Sustainability Manager as those that would be most helpful to her. Weber, Shana. *Op cit.* 4 April 2007.

Current Status: Princeton's Sustainability Committee, comprised of students, faculty and administrative staff, has formed working groups to complete by the end of 2007 a baseline sustainability report in ten areas, including university-wide energy usage and CO₂ emissions.¹⁶⁸ The Office of Sustainability will measure the success of the CO₂ inventory using a set of metrics and indicators already in place.¹⁶⁹ Progress at the program level of the Office of Sustainability is determined by the number of collaborative relationships with academic programs, the frequency of requests for guest lectures by the Sustainability Manager, the size of its professional staff and budget, the extent of its recognition on campus, and the level of student involvement.¹⁷⁰ Both short-term and long-term goals are also used to organize sustainability efforts.

Recommendation: The Office of Sustainability may wish to include a set of metrics developed by Yale University to evaluate the extent of sustainability education and research.¹⁷¹ If efforts to further incorporate sustainability into the university's academic side are intensified, the following metrics may prove especially useful:

Metrics to Assess Extent of Sustainability Education

- Number of students participating in sustainability curriculum
- Number of courses addressing sustainability

Metrics to Assess Extent of Sustainability Research

¹⁶⁸ The others are purchasing, transportation, dining services, solid waste, building management, sustainable building guidelines, grounds management, potable water, and education.¹

¹: Weber, Shana. *Op. cit.* 4 April 2007.

¹⁶⁹ These include: "how the institution utilized the inventory information to inform its goals and strategies; the extent to which it identified the most significant sources of emissions, and provided a benchmark to track progress into the future; [creating] mechanisms for updating the inventory as things change and new sources are included; [using the] inventorying process to help inform the collective efforts of peer institutions; [and] how well informed the campus community is about that inventory."¹

¹:Weber, Shana. *Op. cit.* 3 May 2007.

¹⁷⁰ *Ibid.* On campus surveys can be used to determine the extent to which the Office of Sustainability is recognized on campus.

¹⁷¹ Yale Office of Sustainability. *Sustainability Metrics*. 2007. Available: 6 May 2007. <http://www.yale.edu/sustainability/>.

- Total number of research awards
- Number of research collaboration projects
- Amount of sustainability research funding

3.4 Funding

Current Status: The current budget includes the salaries of sustainability employees and an annual operating budget of \$25,000 for the next three years.¹⁷²

Recommendation: The budget should be expanded in order to hire more staff and allow for more extensive outreach, travel and publicity. The establishment of an endowment for the Office of Sustainability would provide the autonomy necessary to carry out its mission without spending time chasing dollars. To this end, the Office may want (1) to appeal to environmentally-conscious alumni for donations; (2) to pursue an “opt-out” sustainability fee in tuition bills; and (3) to devise an agreement for the university to match any funds raised. Finally, a revolving loan fund should be created to finance sustainability projects that require capital investment; a portion of savings made from these projects could be used to fund other sustainability initiatives.

3.5 Publicity Efforts

Current Status: The Office of Sustainability is almost ready to launch its website and has completed two major publicity efforts: Earth Day 2007 and the creation of the Student Environmental Communication Network (SECN). Earth Day, a two-week, high-profile effort to draw attention to pressing environmental issues, highlight green activism and

¹⁷² Weber, Shana. *Op. cit.* 3 May 2007. These funds were donated by a generous alumnus.

call for increased governmental action to protect natural resources, ended recently. The SECN “is a project to train active students in producing sustainability stories for the national media, primarily radio.”¹⁷³ In addition, the Sustainability Manager networks and engages with an array of sustainability professionals and institutions.¹⁷⁴

Recommendation: To augment publicity, the Office may wish (1) to compose a monthly or quarterly newsletter to be sent to all members of the university community (2) to send university-wide emails with updates on sustainability initiatives and (3) to publish regular columns “in the Princeton Alumni Weekly (PAW) and other university publications.”¹⁷⁵

If the Office of Sustainability expanded its core staff, the Sustainability Manager could allocate many of her current duties to other employees and spend more time on publicity efforts.

3.6 Active Engagement of Students and Faculty

Current Status: The Office of Sustainability has begun coordinating sustainability initiatives with student-run environmental groups and with the Undergraduate Student Government.¹⁷⁶ It also organized the “Pull the Plug” campaign to reduce energy usage in student dormitories. Although a few faculty serve on the Princeton Sustainability Committee (Figure 8), the overwhelming majority is uninvolved with on-campus sustainability efforts. Despite this lack of broad involvement, Princeton is home to world-renown faculty who research global sustainability issues as well as to the Princeton Environmental Institute (PEI) and PEI-related programs, such as the Geophysical Fluid

¹⁷³ *Ibid.*

¹⁷⁴ These include, but are not limited to, the following: sustainability professionals at other universities, the Northeast Campus Sustainability Consortium (NECSC), the Association for the Advancement of Sustainability in Higher Education (AASHE), and community leaders and groups.¹

¹: *Ibid.*

¹⁷⁵ *Ibid.* This recommendation was offered by Shana Weber.

¹⁷⁶ *Ibid.*

Dynamics Laboratory, that affiliate faculty with environmental interests.

Recommendation: The Office of Sustainability should make the conscious effort to put as many students and faculty on its radar screen as possible.¹⁷⁷ To further engage students, it should continue working with student-run groups but also (1) send letters home to freshmen explaining the Office of Sustainability’s mission and detailing how to get involved with sustainability efforts; and (2) confer high-profile sustainability achievement awards. To engage faculty, it should organize a Princeton “Piedmont Project”—named the Sustainable Princeton Project—in which faculty would participate in a post-graduation workshop that teaches them how to incorporate sustainability into their individual courses. When planning this workshop, the Office of Sustainability may want to work with the McGraw Center for Teaching and Learning that helps plan faculty edification programs.¹⁷⁸ Tenured PEI professors, especially those currently researching global sustainability issues, should be approached to sign-up initially; other faculty will likely follow if colleagues have expressed interest. A \$1,000 stipend should also be awarded to any faculty who incorporate some aspect of sustainability into their syllabi. In addition, if more staff are hired to help run the Office of Sustainability, the Sustainability Manager herself may wish to offer a course on a sustainability-related topic.¹⁷⁹ Finally, the creation of a faculty position with a joint appointment in an academic department (e.g. Geosciences, Woodrow Wilson School) and the Office of Sustainability might further integrate Princeton’s academic community with on-campus sustainability efforts. The faculty member could be housed within his or her relevant

¹⁷⁷ Newman, Julie. *Op. cit.*

¹⁷⁸ The McGraw Center. *Programs and Workshops*. Spring 2007. Available: 25 April 2007. <http://web.princeton.edu/sites/mcgraw/>. Thanks to Denise Mauzerall for providing this idea.

¹⁷⁹ Specifically, the Sustainability Manager “served as a faculty member and as director for campus and community programs at Santa Clara University’s Environmental Studies Institute from 2002 to 2005.”ⁱ

ⁱ: Stevens, Ruth. *Op. cit.*

academic department but have a research focus in local or regional sustainability issues that reflects the Office of Sustainability's mission.¹⁸⁰

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¹⁸⁰ Weber, Shana. *Op. cit.* 3 May 2007. Weber helped conceive of this recommendation.

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**Green from the Bottom Up:
Recommendations for Princeton University's Endorsement of Student Grassroots
Initiatives to Reduce Campus Energy Use**

By Jonah A. Wagner

Abstract

Student grassroots sustainability initiatives have so far played a relatively insignificant role in Princeton's administrative efforts to increase campus energy efficiency. By endorsing student-run energy awareness and peer education 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, CO₂ emissions reduction, and positive national media attention. The establishment of an environmentally savvy, or "green" culture on Princeton's campus will not only improve the University's energy efficiency and public image, but it will imbue graduating students with a sense of their own commitment to adopting sustainable lifestyles as they go on to become the leaders of tomorrow. This proposal illustrates the important role of the Princeton administration in fostering a green culture on Princeton's campus by generating and supporting student environmental activism in the area of responsible energy use and development. The following recommendations for Princeton University are designed to facilitate this process:

- Increase funding for the Princeton Office of Sustainability and broaden its scope to include the provision of direct, unsolicited assistance to student sustainability initiatives, and the creation of incentives for energy conscious lifestyle changes among the student population.
- Install energy monitors with real-time data feeds in student dormitories.
- Create options for sustainable living on campus by rezoning and retrofitting old dormitories with energy efficient appliances and living products, and/or by constructing new sustainable student housing.
- Construct a carbon neutral or zero-emission environmental campus center, both as a model for sustainable development and as a hub for campus environmental activity and discourse.
- Establish a Revolving Loan Fund to provide up front capital for student sustainable design projects.

1. Introduction

There are few today who would deny the existence of global warming or the threat that it poses. As twelve of the past thirteen years were the warmest on record, as current CO₂ levels are the highest in over 600,000 years, and as sea levels continue to rise,¹⁸¹ there can be little doubt that this generation of graduating students is facing a world with a new set of daily priorities – we will call those the pressures of sustainable living. Energy conservation begins with individual lifestyle change. Princeton, as an institution of higher learning, has an obligation not only to be an model of campus energy efficiency, but to equip its student body with the proper knowledge and tools to adopt sustainable lifestyles as they go on to become the leaders of tomorrow.

There is significant potential for student grassroots initiatives that promote campus sustainability¹⁸² to reduce University energy consumption, and Princeton’s administration has a positive role to play in their facilitation. The direct impacts of student activism on campus energy expenditures may in some cases be difficult to quantify. Still, the importance of generating and supporting student-run initiatives is not to be understated. Student-run sustainability efforts have the advantages of being low-cost, result-oriented, widespread, and potentially very high profile¹⁸³. Individuals in student organizations are usually highly motivated to organize and execute events as they have only four years on average to do so before they graduate. However, as student

¹⁸¹ Weber, S. “Lecture on the Princeton Office of Sustainability.” *Office of Sustainability, Princeton University*. Class Lecture. April 13, 2007.

¹⁸² The term “sustainability” when used in this paper will refer solely to the improvement of campus energy use (electricity and heating) in order to reduce greenhouse gas (GHG) emissions, as this is the focus of this task force.

¹⁸³ Siddique, A. *Frist Filibuster & the Princeton Progressive Review*. Personal Interview. March 30, 2007: The Frist Filibuster, a student-led initiative, began as a simple protest but within a week had gained national media attention.

leadership comes and goes, it oftens lead to gaps in project continuity.¹⁸⁴ The University (i.e. the non-student, administrative decision making body), with an absolute advantage in resources, power, and long term perspective, is in a unique position to galvanize and support such student involvement as part of a coherent strategy for the future of Princeton's energy use.

It is the recommendation of this task force that President Tilghman sign onto the American College and University President's Climate Commitment (ACUPCC) as soon as possible, and commit Princeton to carbon neutrality immediately through the purchase of offsets. At the same time, Princeton would commit to Governor Corzine's Executive Order No. 54 through on-campus emissions reductions only. University support for student-run sustainability initiatives has been limited so far by the absence of a unified plan for maximizing Princeton's energy efficiency over the near and far future. In conjunction with these recommendations, the University's endorsement of student sustainability groups and activities on campus has the potential to establish Princeton as a model of energy conservation and a leader in the Ivy League.

This paper will illustrate the important role of the Princeton administration in creating and fostering an environmentally savvy, or "green" culture on Princeton's campus by generating and promoting student environmental activism in the area of sustainable living and development. It is divided into five sections, including the Introduction: Section 2 covers past and present grassroots initiatives at Princeton, Section 3 describes Princeton's goals in terms of promoting student sustainability initiatives, Section 4 gives an overview of best practice grassroots initiatives at other schools, and

¹⁸⁴ Teichert, K. *Resource Efficiency Manager, Brown University*. Telephone Interview. April 6, 2007.

Section 5 provides a list of policy recommendations for improving University endorsement of a green campus culture.

2. Past and Present Grassroots Initiatives at Princeton

2.1 Student Group Initiatives

A number student environmental groups¹⁸⁵ on Princeton's campus have been involved over the past several years in pushing both the student body and the administration towards energy efficient strategies:

2.1.1 Greening Princeton

Greening Princeton is a small, student-led group that coordinates a broad spectrum of sustainability efforts – from energy and green building, to dining and waste – working mainly as a research or consulting organization for managers of campus Dining Services, Facilities, various academic departments, and the provost's office. Their focus has begun to shift, however, to organizing events targeting the broader student population.¹⁸⁶ They have been involved with numerous campus-wide sustainability initiatives, including the creation of Princeton's Eco-Reps program,¹⁸⁷ the University's decision to switch to 100% recycled paper, the Pull-the-Plug Campaign, the replacement

¹⁸⁵ Groups not listed below include the Princeton Environmental Action group (PEA) and Water Watch, both of which deal indirectly with energy conservation issues.

¹⁸⁶ Satterfield, B. *Greening Princeton, Princeton University*. Telephone Interview. April 6, 2007.

¹⁸⁷ The Eco-Reps program will be discussed in further detail in Section 2.2.1.

Eating Club incandescent light bulbs with Compact Fluorescent Light bulbs (CFLs), and the annual Earth Day celebration – a series of lectures, film screenings, rallies, and other events to increase campus environmental awareness.¹⁸⁸ Most of their funding comes from the Princeton Environmental Institute (PEI), Dining Services, and the newly established Princeton Office of Sustainability.¹⁸⁹ Yet according to Greening Princeton co-president Kelsey Stallings, there are numerous events that are avoided because of funding deficiencies, such as encouraging the participation of well-known lecturers at campus sustainability events.¹⁹⁰ Still, Greening Princeton has had a hand in nearly every sustainability initiative on Princeton's campus to date.¹⁹¹

2.1.2 Students United for a Responsible Global Environment (SURGE)

SURGE is a national network of student sustainability organizations based in North Carolina¹⁹² that arrived at Princeton this year. SURGE members, consisting of both graduate and undergraduate students, focus their efforts entirely on reducing campus green house gas (GHG) emissions through campus activism in efforts to make Princeton a leader in carbon emissions reductions. They helped co-sponsor with Greening Princeton both the Pull-the-Plug Campaign and the Earth Day celebration, though their main focus is on the creation of a Green Alumni fund through which alumni funds could be

¹⁸⁸ Stallings, K. *Greening Princeton, Princeton University*. Telephone Interview. April 9, 2007.

¹⁸⁹ The Princeton Office of Sustainability will be discussed in further detail in Section 2.2.2.

¹⁹⁰ Stallings, K. April 9, 2007.

¹⁹¹ Weber, S. *Office of Sustainability, Princeton University*. Personal Interview. May 3, 2007.

¹⁹² <http://www.surgenetwork.org/>

channeled into student “green campus initiatives” – initiatives designed to improve campus sustainability.¹⁹³

2.1.3 Princeton Sustainability Committee (PSC) & the Princeton Environmental Network (PEN)

PSC is a committee of university faculty, staff and students dedicated to sustainability, while PEN is a hub for representatives from various student environmental groups on campus to share information about their activities and plan joint initiatives. These networks facilitate communication between groups and individuals focused on campus sustainability in order to create partnerships and avoid the overlapping of projects.¹⁹⁴ PEN was reorganized this year by the Office of Sustainability in order to create a more unified student voice on campus sustainability issues; Pull-the-Plug was PEN’s first major achievement as student representatives from many different student groups worked together to carry out the initiative.¹⁹⁵

2.2 Recent Positive Institutional Shifts

Two considerable changes in Princeton’s administrative sustainability efforts took place recently – the establishment of an Office of Sustainability run by Princeton’s first Sustainability Manager, and the development of a campus-wide Eco-Reps program:

¹⁹³ Princeton SURGE. “Princeton SURGE Homepage.” *SURGE, Princeton University*, 2007: <<http://www.princeton.edu/~surgers/index.html>>

¹⁹⁴ Markatos, D. *Princeton SURGE, Princeton University*. Task Force Communications. April 29, 2007.

¹⁹⁵ Weber, S. May 3, 2007.

2.2.1 Princeton Office of Sustainability

The Princeton Office of Sustainability, run by Shana Weber, was established in 2006 by a \$75,000 grant from a generous Princeton Alumnus¹⁹⁶ to cover its operating budget for three years. The Office of Sustainability has since reformed the PEN network, and set about producing a baseline sustainability report of all of Princeton University that is scheduled to be completed at the end of this academic year. The Office makes extensive use of student interns in the absence of funding for full-time staff members and its effectiveness is limited considerably by budgetary constraints.¹⁹⁷

2.2.2 Princeton Eco-Reps program

The Princeton Eco-Reps program was started in 2004 and is funded and run by Facilities. It is composed of a team of 20-30 students employees, the majority of which are also Residential College Advisors (RCAs) in underclassmen housing. Eco-Reps focus predominantly on recycling and waste management issues, though they were involved to a certain degree in the Pull-the-Pull Campaign over Intercession this year. They receive almost no publicity through the University or otherwise.¹⁹⁸

3. Princeton's Grassroots Sustainability Objectives

¹⁹⁶ The donation came from Princeton alumnus Bert G. Kerstetter.

¹⁹⁷ Weber, S. May 3, 2007.

¹⁹⁸ Thompson, M. *Eco-Reps, Princeton University*. Telephone Interview. April 24, 2007.

This section describes Princeton's immediate objectives in supporting and harnessing student sustainability activism. As student energy awareness is in large part peer educated, the University should focus on its ability to create durable and lasting incentive and/or institutional structures to facilitate the following goals:

- Increase the publicity and visibility of global, local, and campus environmental issues.
- Foster a green culture on campus.
- Become a leader in the Ivy League in campus energy conservation and GHG emissions reduction.

Creating a dynamic and vibrant green culture on Princeton's campus is both a gradual and lasting positive step towards achieving carbon neutrality, not only for the University, but also for those students who pass through it. Whether or not Princeton graduates pursue careers in the field of environmental sustainability, if the Princeton experience can imbue them with a sense of environmental consciousness, it is likely that they will be more inclined to live or advocate sustainable living regardless of the career path they choose. A campus with a visible and widespread green culture will educate the student body about the environment, increase energy awareness for campus environmental issues, and lead to direct University emissions reductions as students work for change

individually. Energy conservation efforts should begin to emerge organically from the bottom up as guided by administrative support of student grassroots initiatives.

In order to encourage such a green campus culture, methods of individual lifestyle change must be both well-publicized and made convenient to the student body. Section 4 provides a number of examples from other schools of effective administrative endorsement of grassroots sustainability efforts.

4. Effective Student-Run Initiatives at Other Schools

Positive examples of administrative endorsement of student sustainability activism exist at numerous universities and colleges across North America. Many schools have already tested and implemented scaled up versions of projects that Princeton's student environmental groups are only just now beginning to undertake. Even certain schools in the Ivy League have established well-integrated systems of environmental sustainability to increase student body participation in green campus initiatives. The following are a series of "Best Practice," or highly effective examples of university-supported student initiatives at other schools that have been grouped together by function:

4.1 Best Practice Student-Run Initiatives at other Colleges & Universities¹⁹⁹

4.1.1 Peer-to-peer outreach and sustainability pledges

¹⁹⁹ These initiatives are listed in Appendix A.

Peer-to-peer communication is a rapid and effective way of disseminating information about energy use and the consequences of Global Warming. Many schools, including Princeton, have adopted Eco-Rep programs to take advantage of this. Eco-Reps are students employed by the university to educate and encourage students about living sustainably. At Princeton, the main focus of the Eco-Rep program is to persuade students to recycle,²⁰⁰ with almost no emphasis on other forms of energy conservation. Other schools have taken their student-run energy awareness initiatives in a broader and more effective direction.

The Dorm Energy Conservation Challenge is a month-long dorm energy-reduction competition that was run for the first time this year by the Campus Climate Challenge group at Pomona College. Dorms competed to have both the highest percentage of students who have signed sustainability pledges²⁰¹ as well as the highest percentage reduction in energy use compared to that of the previous month.²⁰² Campus dorm energy use was reduced by a total of 8% in November of 2006, significantly lowering student CO₂ emissions and saving the college an estimated \$2,500.²⁰³ The Harvard annual Eco-Cup competition is similar – dorms compete for sustainability pledges and the administration buys renewable energy to offset each winning dorm's remaining GHG emissions. In 2007, over 7000 students, faculty and staff signed on to the Harvard Sustainability Pledge as a result. There are examples of inter-collegiate energy conservation competitions as well: the Million Monitor Pledge Drive is a competition

²⁰⁰ Thompson, M. *Eco-Reps, Princeton University*. Telephone Interview. April 24, 2007.

²⁰¹ Sustainability pledges are pledges signed by students, faculty, and/or staff who want to live more sustainably and are willing to commit to making the necessary lifestyle changes to do so.

²⁰² Cardenas, G. "Students Conserve Energy in Quest for Green Cup." *The Student Life, Pomona College*, Vol 118 (7), 2006:

<<http://www.tsl.pomona.edu/index.php?article=1939>>

²⁰³ Hunnicutt, T. "Walker Narrowly Wins Campus Climate Challenge Contest." *The Student Life, Pomona College*, Vol 118 (12), 2007:

<<http://www.tsl.pomona.edu/index.php?article=2124>>

between Smith, Amherst and Mt. Holyoke to amass the greatest number of student pledges promising to put their computers to sleep instead of on screen saver. Student who fulfill their pledges potentially save an estimated \$8.50-\$51.00 (depending on the model) per year. Smith won the 2007 competition with 1887 total pledges, or nearly 75% of the student body.²⁰⁴

4.1.2 Dorm energy monitoring

The installation of monitors in campus dorms makes possible to a certain degree the measurement of the impacts of student grassroots and/or administrative initiatives on student energy use. Energy monitoring systems are a fundamental part of creating energy reduction incentives through school-wide competitions (as detailed in Section 4.1.1) and they are used in many colleges across the country. Brown University monitors the electricity output of all of its buildings and is in the process of installing monitors that gather data on thermal expenditures as well,²⁰⁵ Harvard University measures dorm output of electricity, heat, trash, and recycling.²⁰⁶ Oberlin College, however, sets the national standard in terms of best practice dorm energy monitoring.

Oberlin has recently adapted its dorm energy monitors to export a real-time data feed of its dorm energy use to a public access website.²⁰⁷ The program was installed in 18 dorms on campus over the 2004-2005 academic year. During a two week dorm energy conservation competition in 2005, students saved 68,300 kWh and \$5,107 in electricity

²⁰⁴ Smith College. "Million Monitor Pledge Drive." *Information Technology Services & Clean Energy for Smith*, 2006: <<http://www.smith.edu/its/estar/>>

²⁰⁵ Teichert, K. *Resource Efficiency Manager, Brown University*. Telephone Interview. April 6, 2007.

²⁰⁶ Greeney, S. *Environmental Action Committee, Harvard University*. Telephone Interview. April 9, 2007.

²⁰⁷ www.oberlin.edu/dormenergy/

costs and reduced campus GHG emissions by 148,000 lbs of CO₂ and 1,360 lbs of SO₂.²⁰⁸ Many dorms reduced their energy consumption by over 50%, and nearly every dorm reduced its energy consumption to some degree. This example points to the potential for energy awareness in the student body to have a significant impact on how it is consumed.

4.1.3 Green campus housing

Providing sustainable living options for energy conscious students on campus both allows motivated students to live sustainable lifestyles, and creates a model for sustainable living on campus to which other students might look for information and guidance. Cornell University's Eco House Dorm Residency is the best example in the Ivy League of such a program. Environmentally interested students apply to live in the Eco House dorm and work together to engage the community on environmental subjects. Students in the dorm are invited to participate in numerous lectures, programs and projects dedicated to improving environmental and sustainability awareness.²⁰⁹ The dorm also boasts a huge compost outside for student food and material waste.²¹⁰

Even more compelling is example of the Chico Sustainability House, the nation's first sustainable student residence, created by California State University in 2006 by retrofitting an old campus dorm with energy-saving appliances and living products.²¹¹

²⁰⁸ Petersen, J. E., Shunturov, V., Janda, K., Platt, G., & Weinberger, K. "Dormitory residents reduce electricity consumption when exposed to real-time visual feedback and incentives." *Lewis Center for Environmental Studies, Oberlin College*, Vol. 8 (1), 2007: p. 16.

²⁰⁹ Cornell University Staff. "Summer Newsletter Eco House." *Facilities*, 2006.

²¹⁰ McEachern, K. *KyotoNow, Cornell University*. Telephone Interview. April 4, 2007.

²¹¹ CSU Staff. "Campus Announcements: April 14, 2006." *California State University, Chico*, 2006: <<http://www.csuchico.edu/pa/campusannounce/archives/2006/04/14/>>

Students living in the dorm are able to reduce their carbon footprints significantly. At Duke, there is a smaller energy awareness project called the Duke Sustainable Living Team, a team of committed students that use social marketing strategies to raise student body energy awareness.²¹² The combination of CSU's and Duke's examples could be a highly effective model for a sustainable student residence at Princeton, in which students would both live sustainably and actively seek out their peers to do the same. Sustainable student housing allows committed environmentalists to lead by example, setting the tone and foundation for a green culture on campus.

4.1.4 Green campus center

Creating a campus center for environmental studies and activities is an important, perhaps even essential part of fostering a green culture on campus. Many schools, like the University of New Hampshire and the University of Colorado at Boulder, that place a very strong emphasis on student sustainability awareness, also have on-campus centers for environmental research and design. UNH's Environmental Technology Building is the center of environmental initiative and activism on campus,²¹³ while CU Boulder's Environmental Center is now the largest student-run environmental center in the country.²¹⁴ Both schools actively promote student energy conservation initiatives and

²¹² Duke University Webmaster. "New Program Changing Environmental Culture on Campus." *Environmental Sustainability at Duke, News and Events*, 2006:

<<http://www.duke.edu/sustainability/2006-03-20ssl.html>>

²¹³ Sundberg, D. Senator Gregg and NOAA Celebrate Opening of UNH Environmental Technology Building." *UNH News*, 2006:

<<http://ciceet.unh.edu/news/dedication.html>>: The Env Technology Building is home to a number of environmental groups including the UNH Environmental Research Group, Recycled Materials Resource Center, Pollution Prevention Program, and many others.

²¹⁴ CU Boulder Staff. "CU Boulder Environmental Center Homepage." *University of Colorado at Boulder*, 2007:

<<http://ecenter.colorado.edu/index.html>>

both have created centralized forums for such projects to evolve. Though both Harvard and Brown have campus environmental centers, they are focused more on their respective Environmental Studies major; they have little outward connection to campus sustainability.

Yet a green campus center can be more than just a hub for student and/or administrative environmental activism, it can be a model sustainable development and living on campus. The Florida State University Sustainable Energy Science and Engineering Center (SESEC) has recently begun construction on a zero-emission building on campus as a prototype for sustainable development. The building will run entirely on solar power and excess energy generated will be used to produce hydrogen (which burns cleaner than natural gas) on which the building's appliances will run.²¹⁵ A combination of FSU's zero-emission building project and CU Boulder's Environmental Center into one green campus center would truly set a national standard for sustainable development.

4.1.5 Green revolving loan fund

The principle behind a green revolving loan fund is that although sustainable design projects often cost more up front than do business-as-usual models, over time these green projects tend to save considerably more money in energy conservation than the initial cost differential. Harvard's Green Campus Loan Fund (GCLF) is probably the best example of an effective green revolving loan fund in the nation. With a budget of

²¹⁵ Kramer, J. "Cutting-edge energy-efficient building going up at FSU." *FSU News*, 2007: <<http://www.fsu.edu/news/2007/02/27/efficient.building/>>

\$12 million, the GCLF provides capital for design projects that promise to reduce University environmental impacts and have a payback time period of 5 years or less. The departments who benefit from the energy savings repay the initial cost of the project with the money they saved at no interest. This fund currently saves over \$5 million annually at Harvard and has reduced more than 60 million pounds of annual greenhouse gas emissions since its inception in 2000.²¹⁶ Though the GCLF is primarily focused on green building and sustainable design projects,²¹⁷ this type of institutional structure could easily be adapted at Princeton to support student group initiatives and events geared towards improving campus environmental awareness.

4.2 Sustainable Student Initiatives in the Ivy League

The recent signing of the Ivy League Climate Neutrality Resolution²¹⁸ by student representatives from every Ivy League school suggests that students in such elite institutions are becoming actively devoted to facing the challenges of global warming. Many Ivy League schools have committed significant resources to the improvement campus energy efficiency through student grassroots sustainability projects. In Appendix B, there is a chart of Ivy League grassroots and administrative sustainability initiatives. Although Section 4.1 provides a number of effective examples of best practice administrative sustainability measures in the Ivy League, there are certainly areas in which Princeton can establish itself as a leader, including one in particular. After

²¹⁶ Crowley, M. "Green Campus Loan Fund." *Harvard Green Campus Initiatives*, 2006:

<<http://www.greencampus.harvard.edu/gclf/>>

²¹⁷ Crowley, M. "Lecture on Harvard's Greening Campus Initiative." *Green Campus Initiatives, Harvard University*. Class Lecture. February 27, 2007.

²¹⁸ A pledge among student representatives in the Ivy League to work within their respective administrations towards carbon neutrality.

interviewing student group leaders and knowledgeable faculty at every Ivy League school except Columbia²¹⁹, I found that there were almost no examples of unsolicited administrative assistance or guidance given directly to grassroots sustainability organizations and initiatives. Student groups at those schools could apply for funding from the university or request an audience with certain members of the faculty, but in nearly²²⁰ every case there was a disconnect between the administration and the student body. This significant trend across all of the Ivy League could easily be rectified at Princeton, as I demonstrate in Section 5.1 of my Policy Recommendations.

5. Policy Recommendations

This section outlines the following five policy recommendations for promoting student grassroots sustainability efforts and fostering a green culture on campus:

- Increase funding for the Princeton Office of Sustainability and broaden its scope to include the provision of direct, unsolicited assistance to student sustainability initiatives, and the creation of incentives for energy conscious lifestyle changes among the student population.
- Install energy monitors with real-time data feeds in student dormitories.

²¹⁹ I was unable to get in touch with a student group leader from Columbia, but I have little doubt that the situation there would be any different; Columbia appears to be on the lower end of the Ivy sustainability list.

²²⁰ I am reluctant to make entirely conclusive statements about the status of student environmental groups after only one or two interviews, but the trend was striking nonetheless.

- Create options for sustainable living on campus by rezoning and retrofitting old dormitories with energy efficient appliances and living products, and/or by constructing new sustainable student housing.
- Construct a carbon neutral or zero-emission environmental campus center, both as a model for sustainable development and as a hub for campus environmental activity and discourse.
- Establish a Revolving Loan Fund to provide up front capital for student sustainable design projects.

5.1 Increase funding for the Princeton Office of Sustainability and broaden its scope to include the provision of direct, unsolicited assistance to student sustainability initiatives, and the creation of incentives for energy conscious lifestyle changes among the student population.

Princeton is in a position to establish itself as a leader in the Ivy League in campus energy conservation and awareness simply by providing direct, unsolicited assistance to student sustainability groups on campus. As described in Section 4.2, there are few if any examples in the Ivy League of other administrations playing significant roles in shaping or guiding student energy awareness projects and campaigns. Instead of student groups alone bearing the majority of the responsibility for improving campus energy use awareness, the Princeton administration should engage the student body by

working directly with these groups. The Princeton Office of Sustainable is the correct institution through which to facilitate student grassroots activism, and it is currently too understaffed and under-funded to fully engage the student body as such.

There is on ongoing movement across North American university and college campuses towards environmental responsibility. In order to tap into this energy at Princeton, the administration needs to hire a full professional staff for the Office of Sustainability who can carry projects forward and work with the broader student body.²²¹ The Office could help to remedy the disconnect between university sustainability initiatives like the STEP lectures, and those of student grassroots sustainability organizations. The Office could also advise student groups on possible projects and initiatives that might complement administrative sustainability efforts and advance University energy conservation goals. Although the reestablishment of PEN is certainly a step in the right direction, there are countless other initiatives waiting to be undertaken by a fully-funded and fully-staffed Princeton Office of Sustainability. The following is a list of some initiatives that, if supported, would catapult Princeton to the forefront of the university campus sustainability movement:

5.1.1 Publicize, expand, and restructure Princeton's new Eco-REP program.

Princeton's Eco-Reps receive almost no publicity on campus, making their initiatives like RecycleMania significantly less effective.²²² To remedy this, one student Eco-Rep should be hired for every dorm on campus and every year, events and

²²¹ Weber, S. May 3, 2007: Princeton should hire, at minimum, full-time Office of Sustainability employees to be in charge of building design and construction, transportation, and communications, respectively.

²²² Weber, S. May 3, 2007.

competitions between dorms and individual students should be coordinated to promote campus environmental awareness.

5.1.2 Use student groups to distribute CFLs or Turn Me Off light switch stickers to student residences.

As was shown in the study done by last semester's ENV- ST01 class,²²³ inefficient lighting is currently the biggest area of potential energy savings on Princeton's campus. Conserving student lighting energy use is a very effective of saving money and reducing GHG emissions.

5.1.3 Create a sustainability pledge for students to sign on their arrival to Princeton including information about sustainable living.

This pledge could be modeled off of any of the examples provided in Section 4.1.1, and would be distributed with matriculation forms for students accepted into Princeton. An example of such a pledge is included in Appendix C.

5.1.4 Help to format and organize the websites of student sustainability groups.

The current status of Princeton student environmental group websites is not impressive. Restructuring those websites and providing links to them (perhaps through

²²³ Brennan, T. & Sweney, W. "Lighting and Appliances." *Princeton University ENV ST01 Report*, 2006.

the Office of Sustainability website) would be a good way of increasing publicity for student environmental initiatives.

5.1.5 Engage non-sustainability oriented groups and disciplines in campus sustainability initiatives.

The sustainability movement has spanned many different student groups on campus that might potentially contribute to improving campus energy use awareness. For instance, campus religious groups have recently been emphasizing environmental responsibility; the Arts and Music community also has the potential to produce a significant following. The administration is in a great position to encourage these groups to work together towards the energy conservation goals of the University as a whole.²²⁴

5.1.6 Support the creation of green student magazine on campus and/or create a sustainability news column in Princeton Alumni weekly.

A weekly or monthly sustainability news report could help to engage a broader student and alumni interest in green initiatives both on campus and nationally.

5.1.7 Collect suggestions from the student body itself through a weekly/monthly discussion forum.

²²⁴ Weber, S. May 3, 2007.

Allow students to give their own creative input into the details of Princeton's campus energy use reform. Since students live on campus, they can be a great source of field research and innovation in terms of school energy use.²²⁵

5.2 Install energy monitors with real-time data feeds in student dormitories.

The purpose of installing energy monitors with real-time data feeds in student dormitories is two-fold:

5.2.1 Establish a baseline of campus energy usage from which to gauge the impacts of University energy conservation initiatives.

Currently, Bloomberg and Scully are the only dorms on campus with energy monitors; 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 monitors in campus dormitories simply to track the efficiency of lighting and heating in each building.²²⁶ However, it is important that Princeton not delay in installing these monitors in order to take advantage of energy savings and to reduce GHG emissions.

²²⁵ Mauzerall, D. Associate Professor of Public and International Affairs, Woodrow Wilson School, Princeton University. Task Force Communications. April 12.

²²⁶ Weber, S. May 3, 2007.

5.2.2 *Increase collective student body energy awareness.*

Oberlin realized a remarkable decrease dorm energy usage after the introduction of its real-time energy monitoring system.²²⁷ 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.²²⁸ And more importantly, campus energy awareness would increase significantly as a result.

5.3 Create options for sustainable living on campus by rezoning and retrofitting old dormitories with energy efficient appliances and living products, and/or by constructing new sustainable student housing.

Providing students with sustainable living options guarantees the University significant energy savings and CO₂ emissions reductions from those students, as well as possibilities for substantial energy and GHG 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 21st century. The creation of the Princeton sustainable housing program would be akin to that of Substance Free, except that there would be an application process for it. Students in sustainable housing would also have the option of

²²⁷ See Section 4.1.2.

²²⁸ 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).

working for the University in the same manner as Duke's Sustainable Living Team (see Section 4.1.3) – going to public events and making a statement to increase student body energy awareness. The University could choose to either renovate existing student housing 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.

5.4 Construct a carbon neutral or zero-emission green campus center, both as a model for sustainable development and as a hub for campus environmental activity and discourse.

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. It 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-emission. The center would promote energy awareness within the University, as well as immediately establishing Princeton as one of the nation's leading universities in sustainable development.

5.5 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, GHG emissions reductions, and positive press. The fund would function according to the same principles as Harvard's GCLF (see Section 4.1.5), 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 threefold: #1 –It is visible apart from the University as a target for solicited alumni or other donations (as proposed by SURGE, Section 2.1.2). #2 – It is visible apart from the University to the student body, increasing sustainability awareness and providing an impetus for creative student proposals for campus sustainability projects and initiatives. And #3 – 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.

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Appendix A.

Table of best practice student-run initiatives at other colleges and universities:

<i>Sustainability Initiative</i>	<i>Project Description</i>	<i>University/College</i>	<i>Student Group or Institution</i>
Peer-to-Peer Outreach	<u>Dorm Energy Conservation Challenge</u> : Month-long dorm energy-reduction competition; Prizes, Green Cup, purchase of RECs	Pomona College	Campus Climate Challenge
	<u>Million Monitor Pledge Drive</u> : Students pledge to put their computers to sleep instead of on screen saver - 1887 students signed on.	Smith College	Information Technology Services & Clean Energy for Smith
	<u>Rewire Project</u> : A personal sustainability pledge providing students with tools to reduce their own energy footprint; reduced electricity consumption 5-10% in the buildings being monitored during 2005-2006 school year.	University of Toronto	University of Toronto Sustainability Office
	<u>Generating Residential Environmental Education Now Program (GREEN)</u> : Similar to Eco-	NC State	IRC, OWRR, Office of Energy Management

	REP program, but coordinates community service projects as well; in every dorm.		(OEM), and University Housing
	<u>Eco-Olympics</u> : Every November, ~700 students participate in compost games, eco-tours, presentations and other activities.	UC Davis	Recycling Center
Dorm Energy Monitoring	<u>Campus Resource Monitoring System</u> : Provides real-time info about energy use on website; used in 18 dorms and 8 houses.	Oberlin College	
Green Campus Housing	<u>Students for Sustainable Living</u> : A team of committed students working 3-5 hours per week to raise campus awareness of sustainability issues and promote a green culture on campus.	Duke University	
	<u>Chico Sustainability House</u> : The nation's first sustainable student residence; uses 'Energy Star' products and operates very efficiently.	California State University	Alliance to Save Energy's (ASE) Green Campus Program
	<u>Eco-House Dorm Residency</u> : A campus dormitory for students interested in living sustainably and promoting sustainability on campus.	Cornell University	

Green Campus Center	<u>Off-Grid Zero Emissions Building (OGZEB)</u> : Construction of a completely solar powered building with hydrogen appliances designed to achieve LEED platinum certification for energy efficiency.	Florida State University	Sustainable Energy Science and Engineering Center (SESEC).
	<u>CU Boulder Environmental Center</u> : The largest student-run environmental center in the country, with 7 full time staff members supporting the work of a student board, volunteers and employees.	University of Colorado, Boulder	
	<u>Environmental Technology Building</u> : Research facility promoting the development of green technologies and engineering projects; houses the Environmental Research Group.	University of New Hampshire	
	<u>Sustainability Center</u> : Student run, with several positions for faculty and staff.	University of Idaho	
	<u>Student Env Center</u> : 6 paid student coordinators and 1 full-time staff person.	UC Santa Cruz	

Green Revolving Loan Fund	<u>Green Campus Loan Fund:</u> A revolving loan fund that provides capital for campus projects designed to reduce University environmental impacts and have a payback period of <5 years.	Harvard University	Harvard Green Campus Initiative.
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Appendix B.

Table of sustainable student and administrative initiatives in the Ivy League:

<i>University/ College</i>	<i>Campus Env. Groups</i>	<i>Student Sustainability Initiatives</i>	<i>University Sustainability Awareness Initiatives</i>	<i>Office of Sustainability</i>
Brown	emPOWER; Brown Environmental Action Network (BEAN)	Earth Week; "Cold Turkey" Program	Eco-Reps; Electricity monitors; Center for Environmental Studies	1 full-time, plus interns.
Columbia	Students for Environmental and Economic Justice; Green Umbrella	Earth Week, Campus Sustainability Day	Eco-Reps; Sustainability Advisory Council	Office of Environmental Stewardship
Cornell	KyotoNOW; Feel the Heat; Cornell Sustainability Hub	Earth Week	Eco-House*; Signed Univ. Presidents Climate Commitment; Sustainability content in courses	Environmental Compliance Office (ECO)
Dartmouth	Sustainable Dartmouth, Env Conservation Org; Green Magazine	Step-It-Up; Sustainable Move-Out; CFL Initiative	LEED building programs; Sustainability content in courses; Eco-REPs	1 full-time, plus interns.

Harvard	EAC; Sustainable Allston; Green Campus Initiative	CFL switch; Earth Week; Greener Harvard; "Cold Turkey" Program	Eco-REPs; Eco-Cup*; Monitor building trash, recycling, heat, energy; Green Campus Loan Fund*	Fully-time staff
Penn	PEG; Vision 20-20	Civic house greening proposal	Large purchase of wind power.	None.
Princeton	Greening Pton, SURGE; PEA; Env network	CFL switch; Pull-the-Plug; Earth Week	Eco-Reps	1 full-time, one part-time, plus interns.
Yale	Yale Student Env Coalition; YSAC	Petition for GHGs reduction; Earth Week; Sustainability Dance; Green Graduates	Eco-Reps	1 full-time, a few part-time.

Appendix C.

*Harvard's Campus Sustainability Pledge*²²⁹:

"I pledge to support Harvard University's efforts to reduce its environmental impacts and implement Campus-wide Sustainability Principles."

"I will make my contribution by pledging to do at least five of the most applicable actions listed below."

- Make sure that my computer is set to go into sleep mode.
- Turn my thermostat down in winter and up in summer.
- Turn off computers, lights, and other equipment when not in use.
- Buy or request ENERGYSTAR equipment for my office.
- Buy paper with recycled content (at least 30%).
- Use compact fluorescent bulbs in task lights.
- Recycle all plastic, glass, aluminum containers.
- Think twice before I print something, and recycle all mixed paper that I do have to use.
- Double-side all copies that I make (and ask others to do the same).
- At least once a week, take the T, walk or bike to work or school instead of driving.
- Bring in a reusable coffee cup and water glass so I can stop using paper ones.
- Unplug my cell phone, camera, etc. chargers when the equipment is not charging (these chargers continue to draw electricity if left plugged into the wall).
- Buy renewable energy certificates (RECS) to offset my own personal energy use.

²²⁹ Harvard Green Campus Initiative (HGCI). "Harvard Campus Sustainability Pledge." *HGCI & President and Fellows of Harvard College*, 2005.

- Green the events or meetings that I hold by using less paper, offering recycling, using reusable dishes, and serving locally produced foods.
- Buy ENERGYSTAR appliances such as refrigerators, lights, computers, printers, etc.
- Wash my clothes in warm or cold water (not hot water).
- Use green cleaning products that are less toxic and not made out of petroleum products.
- Turn down the heat in my room when I am planning to be out of the room all day or away for a holiday break.
- Take shorter showers.
- Turn off the water while brushing my teeth, washing my face, etc.
- Shut my fume hood sash every time I leave the hood.
- Ask vendors for energy efficient equipment when purchasing new lab equipment (or contact the Green Campus Initiative for assistances).
- When applicable, turn off equipment at night and over the weekend (talk to your lab manager first).
- Only run full loads for glass washers and autoclaves.
- Donate used lab equipment to the International Health and Science Network.
- Reduce the amount of hazardous waste generated by my lab.
- Use appropriate temperature and time settings that are needed to sterilize the materials I am using.
- Recycle all rigid plastics in my lab that are plastic #1-7 (especially pipette tip holders).
- Tell others about this sustainability pledge.
- Join the Green Campus Network.

**Green Buildings, Energy Demand, and Infrastructure on Princeton University
Campus:
Enabling Efficient Growth**
by Aaron Buchman

Abstract

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 and especially energy efficiency. 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.

Introduction: Basis for Inquiry

Simply put, Princeton University needs energy to operate. Given current technology, energy generation generally requires burning fuels which emit carbon dioxide. This has been found to be very likely the main human contribution to global warming, as this year's Intergovernmental Panel on Climate Change (IPCC) report indicated.²³⁰ As an ethical, responsible institution with the power to change its impact, Princeton University should reduce its contribution to global warming by reducing its demand for energy. Yet Princeton's size is increasing, so without changes to its efficiency, its impact will grow rather than shrink. If Princeton University is to fulfill its

²³⁰ Alley et al., p.3

potential to lead, it must both continue to increase its activity and commence reductions in its energy needs.

Three realities inform this paper's reasoning and determine its recommendations. First, the price Princeton University pays for energy is currently below the societal and environmental optimum, but this cost will increase in the near future to incorporate these external costs, either as a result of market forces on the price of fuel, a nationwide carbon tax, a self-imposed obligation to offset carbon emissions with carbon reducing programs elsewhere, or a combination of the three. Second, Princeton University must and will continue to expand its campus in accordance with its academic mission. Third, and mediating between the first two, Princeton University does not plan to and will not dramatically increase its district energy facilities.

Facilities and Infrastructure: Extrapolations from the Premise

In 2006, Princeton University is estimated to have released nearly 140,000 tons of carbon dioxide.²³¹ Without a change in policy, campus floor space will increase by perhaps 15 percent over the next ten years, but carbon output may increase by as much as 70 percent.²³² This carbon footprint is based almost entirely on one primary measurable source of carbon on Princeton University campus. Instead of individual building furnaces and building or room air conditioners, the University's Facilities Plant centralizes electrical power, heating and cooling supply for nearly all the buildings on campus. The

²³¹ Nyquist, "Development of Policy Initiatives..."

²³² Ibid.

plant, which is run with a great deal of care for efficiency and cleanliness, is the recent recipient of an Energy Star award from the US Environmental Protection Agency.²³³

While Princeton supplies itself with clean energy, this tells only part of the story. If the public utility grid is selling power for less than the cost of operating the on-campus generator, the university's plant management will switch to purchasing electricity and scale back or shut down the cogeneration plant. At the present, the University could at most times provide itself with all the power it needs. Unfortunately, this choice is not permanently open. This has become concerning over only a few years. In 2000, Princeton University purchased 12.8 billion Watt-hours (GWh) of electricity from the grid, and sold 2.2 GWh back to the grid, demanding a net of only 10.6 GWh, while producing more than 100 GWh locally.²³⁴ By 2006, Princeton University purchased 79.8 GWh from the grid, producing only 57.8 GWh locally.²³⁵

The University's academic campus is growing rapidly, while the facilities plant is growing slowly, if at all. As the square footage of campus space to be heated, cooled, and lighted increases, the facilities plant will be less able to meet all of our needs directly and less able to insulate itself from price and demand fluctuations on the grid. This will eventually necessitate some purchases of electricity from the grid at all times, whether cost effective or not. This is a concern because at times when grid price is high, marginal power on the grid is added by the least efficient backup power plants. Resorting to the grid at these times incurs higher prices, and compels the inefficient use of non-renewable fuel. While the route is circuitous, the resulting state of affairs is a profligate emission of

²³³ Benner, "U. Power Plant Wins Award for Efficiency"

²³⁴ Borer, "Campus Energy Production..."

²³⁵ Nyquist, "Development of Policy Initiatives..."

greenhouse gases, and responsibility for it lies with the University. The proposed offset system necessitates an accurate sense of the impact of Princeton's purchases.

Unfortunately, the exact operating regimen of grid-supplying power plants is not publicized, so Princeton cannot predict with any accuracy the cleanliness or efficiency of its grid purchases. Assuming that the grid's annual average applies is a bad compromise. The University is not purchasing average electricity; its purchases are nearly always elective. It is therefore responsible for the marginal component of grid supply, the power plant which just barely breaks even at the current price point. Since base power levels are provided by the cheapest, and therefore most efficient plants, the ones Princeton compels to be activated are likely to be among the worst utilizers of fuel, and far less efficient than Princeton's own cogeneration plant.²³⁶ Unfortunately, this information is not available, even to bulk purchasers that monitor the grid closely. Princeton remains largely unable to assess its single largest environmental impact, but it likely is much worse than previously estimated.

Three options exist that would address this problem. Most simply, the University could push for carbon emissions data collection and dissemination by the utility operators. If Princeton could judge how much carbon it would cause to be produced at any given instant, it could weigh the increase carbon emissions against decreased cost compared to running the cleaner but more expensive on-campus plant. Princeton University is unfortunately not a powerful enough influence, as a lobby or as a consumer to overcome power companies' leering about revealing their operations. The cost of a carbon tax will be incorporated into market prices, but this will not aid Princeton in

²³⁶ Borer, "Campus Energy Production..."

determining its offset obligation. Alternatively, the University could expand its facilities plant to match anticipated growth in demand, replacing all grid purchases with emissions-measurable local generation. While increasing local supply may eventually become necessary, doing so sooner incurs penalties of foregone technological improvements. If this option is delayed through alternatives, the plant eventually installed can reflect innovations not yet perfected or even yet conceived.

The final option comes from the other side of the equation, demand. Limiting demand for power would allow the University to purchase less electricity and emit less carbon. While behavior-based conservation offers an inexpensive source of reductions, much of the campus demand for energy is built in, simply required by the current setup of Princeton University's buildings. This is a continuing challenge, because buildings designed today with contemporary energy prices in mind will be in use for as much as a century or more, so constructing them to optimize today's cost structure may result in unnecessary costs in the future. Conversely, expending extra thought today may obviate great expenditures in the future, perhaps even without additional initial cost. Thus adopting green building standards for both renovations and new construction is an essential step toward moderating Princeton's energy demand.

Recommendations: Designing Green Buildings in the Princeton University Context

Recommendation 1: Incorporate Expectations of Cost Increases

Fuel costs have been on a rising trend. Global demand is outpacing global supply, and the shortfall is increasing. American electrical generating costs have risen over and

above the cost of fuel, as demand outstrips a slow-growing supply. Most recently, Consolidated Edison of New York announced plans to increase rates by 17% next year, followed by increases of 3.2 and 3.7 percent in each of the next two years.²³⁷ Simply incorporating an expectation of increased energy prices will make more improvements affordable, resulting in more efficient buildings.

It also appears that a carbon tax will be imposed within the next two years. The northeastern states, led by New York, have agreed to a carbon credit cap-and-trade system, called the Regional Greenhouse Gas Initiative (RGGI).²³⁸ Starting in 2009, the ten participating states will split amongst themselves a fixed quota of carbon emissions credits. Each state will then auction the credits to power plants of at least 25 megawatt capacity. While this exempts Princeton University's 15-megawatt cogeneration plant, it will radically restructure the cost of energy purchases. Princeton should especially watch for the 2015 cycle, where the cap on credits will begin to be reduced. RGGI projects that by 2021, energy prices will be 10% higher than they would be without the system, and that real price increases will begin in 2015, after the cap begins to shrink.²³⁹ If the first six years do not see rising energy costs, the subsequent years certainly will.

At the same time that Princeton University will face increasing cost on the energy market, it will begin to impose on itself the cost of offsetting carbon emissions. Offsets vary in cost today, but as easier and less expensive projects are completed, the overall price of offsets will increase. Five of the most used categories of offsets are incorporated in the Regional Greenhouse Gas Initiative. A power plant can fund these offsets to reduce

²³⁷ Chan, "Con Edison Seeks to Increase Electric Rates..."

²³⁸ Fairfield, "When Carbon Is Currency"

²³⁹ RGGI Electricity Sector Modeling Results, p.8

their obligation to purchase credits. This will cause demand and prices for offsets to increase. If offsets are a self-imposed tax, they are a tax with an automatically increasing rate. RGGI projects the cost of credits eventually settling in price at \$6.50 per ton of carbon dioxide (in 2003 dollars); offsets can be safely assumed to remain less expensive than credits.²⁴⁰ This will make increasingly ambitious projects affordable in fewer years, as the University seeks alternatives to the cost of offsets.

If the minimum plant size is reduced to cover Princeton's cogeneration plant, this will only increase the incentive to develop green buildings on campus. The RGGI rules allow green building construction as an offset.²⁴¹ Additionality is not a concern, because the savings of avoided credit purchases would result in separate calculations, with identifiable resulting increases in building efficiency.

I thus recommend that Princeton University make long-term projections for energy costs, and use these projections to inform decisions about energy efficiency and infrastructure projects. Doing so is the best way to ensure Princeton University's long term financial interests while reducing greenhouse gas emissions.

Recommendation 2: Energy Self-Sufficiency

Princeton University's exemption from the Regional Greenhouse Gas Initiative is a windfall for the University. Being free of a mandate to purchase credits will substantially reduce the cost of running Princeton's cogeneration plant relative to purchasing electricity from credit-burdened plants. At low-demand times, when mostly nuclear and hydroelectric plants are operating, the University may still find it cost

²⁴⁰ RGGI Electricity Sector Modeling Results, p.10

²⁴¹ RGGI Model Rule, p.132

effective to purchase energy, but at peak times the University will feel a real constraint to save power. Depending on rules under the cap and trade system, Princeton may actually have a financial incentive to sell power back to the grid at a profit. Since it is both more efficient than the grid average and exempt from the tax, Princeton's cogeneration plant might become among the least expensive generators in the region.

As mentioned above, the use of grid power poses an epistemological challenge to a University carbon neutrality commitment. Without accurate assessments of the grid's instant marginal carbon output, Princeton cannot account for its carbon footprint and purchase the proper offsets to compensate. More accurate carbon emissions data will be available under the new Initiative, because measurement will be necessary for enforcement. This will likely not help the University, however, because at any moment the grid supply's composition will still remain unknown.

Fortunately, there is an alternative to "going off the grid" completely, made possible by the price advantage Princeton can expect. Princeton can go "grid neutral," returning as much power to the grid as it withdraws. If Princeton draws power at low demand times and returns it at high demand times (as the present facilities would enable), it can assume conservatively that the marginal power demanded and marginal power obviated were of the same carbon intensity. This would allow the University to use the grid as a storage battery, as it currently does with thermal storage. From an accounting perspective, this acts as an energy savings account, banking power when Princeton has a surplus and draining it when running a deficit is desirable. Instead of calculating grid efficiency, Princeton can simply measure its own emissions and offset those.

The relative costs of operating local power generation and grid purchases remains to be determined, but the change is certain to be in favor of local operation. Princeton should continue to balance its energy supply with cost for the time being, but once it adopts a carbon offset commitment, I recommend that Princeton University adopt a grid-neutral policy. It is convenient, financially beneficial, and ethically compatible with offsets.

Recommendation 3: Incorporate Sustainability in the Pre-Staging of Projects

Princeton University's Design Standards encapsulate the process by which buildings are designed. In this system, energy efficiency and environmental sustainability are treated as building details, rather than as part of the building's purpose. While the technical drawbacks of this method are discussed below, simply by reducing sustainability to this footing the University reduces its opportunities.

Project selection and prioritization is an important process, and one in which sustainability and energy are not considered. At some level, the University must decide which academic needs require new buildings or renovations. Without a central control, this process is driven by a combination of individual or group initiative within the University and donor availability to underwrite projects. This has the disadvantage of disconnecting campus growth from academic need and practicality for the University's infrastructure. Projects get built too soon and fill slowly, using power to heat, cool and light underused rooms, while other projects that could replace inefficient or inconvenient older buildings go uncompleted.

I recommend twofold solution to this problem. First, Princeton University should formalize and publicize the process by which it identifies and initiates projects. Within this process, demonstrated academic need and potential for sustainable design should be among the main criteria. Second, Princeton should green its capital donation process. If alumni or other donors wish to contribute to a specific program or initiate a building project, these projects should not automatically be accepted. While the University's capital budget is flexible, its operating budget is constrained, especially for facilities. Princeton should not simply reject projects as undesired, but can redirect donors from white elephants toward projects that would better serve the University's mission.

Recommendation 4: Incorporate Sustainability in Setting General Goals for All Projects

Princeton has hired its architects for high-style design, and has given them goals for sustainability as a concern that comes second both in priority and chronology to excellence of architecture. This has produced aesthetically and functionally successful buildings, but it is undeniable that these designs have sacrificed both efficiency and cost. To require more stringent efficiency standards raises concerns that architects will be constrained, that to build very energy efficient structures is to build exceedingly plain ones. Fortunately is possible to produce pleasing, accommodating designs that fulfill all of Princeton's standards for quality while also achieving greater energy savings.

The Princeton University Design Standards specify that a Sustainability Charrette be held in the Pre-Schematic Design phase of a project.²⁴² This meeting brings together the building's occupant, the University's Project Manager, and the design team of

²⁴² PUDS 1.2, p.3

architects and engineers. Here they establish sustainability goals that are deemed attainable on the specific project, including a level of energy efficiency. By this point, the architect has been selected, and he or she will have a detailed aesthetic vision in place, a site selected, and funding largely secured.

This hinders sustainability, because fundamental features that strongly influence efficiency have already been determined. A building must fit the site if one has already been picked, and the configuration is set in the architect's mind. These limit flexibility to improve orientation and massing. These features can account for as much as a 40% variation in heating and cooling load, because north-south aligned buildings absorb more heat.²⁴³

Rather than the current project-specific goals, which are developed in an exploratory manner, Princeton University could adopt a guiding principle for determining goals, and then commit to achieving them. I propose that Princeton adopt two guiding principles. First, Princeton should determine the maximum passive efficiency a building can achieve. This would include site selection, building configuration and alignment, which have essentially no cost but which can determine a large part of a building's energy demand. Second, Princeton should determine how much energy can be saved through measures that also reduce costs. This process would involve studying the physical demands of a potential new building, and determining the maximum efficiency that could be affordably achieved. The resulting energy efficiency target will be ambitious but attainable. It is the maximum that can be attained without sacrificing cost.

²⁴³ Gratia and De Herde, p.610

This has the additional advantage of being a flexible standard. A building with laboratories and high-energy computers will never be as efficient as a simple office, but any structure can reach its own passive and profitable optimum.

If this ideally cost and energy efficient building were to be constructed, it would be exceedingly plain. Passive efficiency is best achieved with monolithic forms and an unbalanced window arrangement to avoid solar heating. Rather than require sacrifices, Princeton should simply mandate an equivalent level of energy efficiency. Using a standard, the design team can be allowed to attain that level by any means. If an architect prefers to have high ceilings that increase heating and cooling costs, or a heat-trapping glass façade, he or she should be permitted to include those features. The energy inefficiency can simply be made up elsewhere in the design with cost-positive features. Instead of standard insulated glass, the designer might specify expensive but highly insulated glass, to reduce the solar load. If a design cannot meet energy efficiency goals, on-site renewable energy generation might be integrated, through a photovoltaic roof, or micro-wind turbines along the eaves.

I recommend that Princeton University establish efficiency standards that come entirely prior to the project. Project goals will follow from these standards, but specific design elements will not, enabling the most cost efficient combination of design flexibility and ensured energy efficiency.

Recommendation 5: Adjust the LCCS System for Transparency, Predictability, and Results

As part of its Sustainable Design Guidelines, Princeton University has committed to using Lifecycle Cost Comparison Studies (LCCS) to make determinations about projects. Lifecycle costs include purchasing, operating and disposal expenses of every item in a project. Where energy efficiency is concerned, lifecycle costs generally weigh a higher initial price against lower operating expense.

In LCCS, the design team hired by Princeton will examine several alternatives for one aspect of the project. For example, better insulated windows will cost more, but save money over time. This stream of savings over time has been discounted, because Princeton has opportunity costs. If it spent that money elsewhere, or invested it, the University would gain revenue. This passed up opportunity is especially high for Princeton, because the Princeton Investment Company (Princo) has a very high rate of return. In 2006, Princo returned 19.5 percent on the University endowment.²⁴⁴

By using this or any similar discount for opportunity cost, nothing appears to be affordable. Savings as few as five years away are not affordable, because investing instead will double the money in that time, and any savings late in the project's life are essentially worthless. This approach is clearly not the one Princeton has used, but it demonstrates in an exaggerated manner the pitfalls of misapplying accounting principles to energy savings.

Using a discount rate at all is not a clear necessity. Princeton University indeed has an opportunity cost for operating expenses, since those moneys could be returned to the endowment. Capital funds used for building projects however are largely the result of

²⁴⁴ Liemer, "University to Up Budget Funding..."

project-specific donations. It cannot be safely asserted that these donations would have funneled into the endowment had a project not been initiated.

The LCCS process itself has flaws that reduce its utility. The Sustainability Guidelines specify conducting at least six comparison studies, with at least one studying building envelope design and one studying building energy systems.²⁴⁵ The other four must be divided among six other categories, ranging from the electrical system to the interior design. No more than three studies can be in any one area.

This overlooks the importance of siting and massing, one of the eight categories and the single most influential component of building energy use. Indeed, this scheme seems to encourage frivolous studies rather than those with the most potential savings. Most interior furnishings and building materials have been researched by third parties, and their impact on building energy is well established. While sustainability director Shana Weber confirms that studies are not conducted to replicate this information, the Sustainability Guidelines do not mention the availability or use of third party studies.

LCCS also foregoes the benefit that could be gained from use of modeling instead of comparison. Comparing three discrete options out of a continuum does not guarantee the optimum choice, while computer modeling can.²⁴⁶

I recommend that the LCCS rules be revised in three ways. First, these rules should require a lifecycle cost study of massing and siting along with the two specific studies already mandated. Second, the rules should specifically encourage use of third-party data to expedite or replace the more minor analyses. Third, the rules should specifically encourage the use of modeling to augment discrete comparisons where

²⁴⁵ PUDS 1.2, p.6

²⁴⁶ Wang, Rivard, and Zmeureanu, p.5

options are continuous. The combination of these modifications will make the intent and method of the process clearer to design teams, enabling better design choices to result.

Recommendation 6: Seek Outside Certification of Projects Through LEED

While the University has developed its own standards for efficiency and sustainability as an outgrowth of its design standards for contractors, third-party institutions have been developing guidelines specifically for “green” buildings. Among these the most famous are the LEED standards. Leadership in Energy and Environmental Design (LEED) was first created by the US Green Building Council in 1999, and has since become the most widely recognized means of acknowledging an institution for its commitment to energy efficiency. The standards take the form of a checklist; a project can be assessed easily for most items, only a few require calculations or detailed inspection. Tallying the number of criteria met yields a point value. Different ranges are assigned names, ranging from merely “Certified,” through “Silver,” “Gold” and “Platinum.” The list of qualifying buildings is publicized by the Green Building Council, and the certification nomenclature is intuitive for the public, even if they are not familiar with the criteria behind the ratings.

Unfortunately, Princeton University has had difficulty obtaining LEED recognition. The initial LEED standards were focused on individual building projects, especially commercial construction of offices. Princeton’s centralized facilities confounded the original criteria, which presupposed that every building would have its own heating and cooling equipment. As Princeton Vice President for Facilities Michael McKay has noted, “LEED criteria, however, do not adequately respond to both the

advantages and challenges of a college campus setting.”²⁴⁷ If ordinary projects were built with the efficiency of Princeton’s facilities plant, they would receive at least six extra LEED points. Princeton Sustainability Director Shana Weber has noted that eight points is the difference between not even obtaining the lowest “LEED Certified” award and obtaining the “LEED Silver” rating.

Happily, the US Green Building Council has been receptive to this criticism from many institutions with district power systems. In October of 2005, they released an adapted set of LEED criteria specially suited to campuses with district power systems. Under these criteria, Princeton can harness the credit for its excellent facilities plant. With these criteria, a new building designed to satisfy existing Princeton University standards and announced intended policies would almost certainly qualify for “LEED Silver” rating and would definitely qualify for “Certified” status (see Appendix I).

Some experts object to LEED certification, because it fails to sufficiently differentiate the weights of different aspects of sustainability. For example, making a building’s operation five percent more energy efficient might save more energy than recycling a half of the building waste, but they both earn one LEED point. Indeed, if LEED is used to direct building design, it will result in the cheapest and easiest criteria being satisfied, not necessarily the most sustainable building. This should not be a hindrance to Princeton University’s intended use of LEED. Princeton would continue to use its own design criteria, and submit for LEED certification after the fact. Point-seeking would not be the design process, but Princeton should continually review the LEED criteria for alterations or updated evidence that make newly desirable some points

²⁴⁷ Stevens, “University Steps Up Sustainability Efforts.”

Princeton does not currently seek. As the study of building health improves, some more expensive features LEED accredits may be found to have benefits besides energy efficiency that make them worth including.

The cost of certification is another reason to be hesitant about LEED status. Fortunately, this concern should be a minor one. Certification costs for buildings under 50,000 square feet are flat at \$2,250 for non-member institutions, with a rate of 45 cents per square foot applying on buildings between 50,000 and half a million square feet.²⁴⁸ Considering that University projects routinely measure their final costs in the hundreds of dollars per square foot, this is a trivial component of cost. This minor burden can even be converted into an opportunity for donor recruitment. Alumni groups such as the graduating classes could easily raise a contribution in this range. Donating the certification costs of a building could be commemorated with plaques in visible locations in the building, in the same way that minor gifts have resulted in dedicated entryways to buildings.

In exchange for this cost nominal cost, Princeton University will get four benefits. These are derived directly from the certification of buildings to LEED standards, not from the physical improvements that could be accomplished with or without certification. Even if Princeton does not alter its designs to suit LEED, the present practice is opaque to public scrutiny, and more publicity would give a more accurate impression of the University's commitment.

First, concerned outsiders will know that Princeton is committed to building very efficient and sustainable buildings. This constituent pool includes prospective students,

²⁴⁸ USGBC

faculty, and donors. Top-caliber students and scholars will become increasingly environmentally-conscious as climate science confirms the danger of global warming. While this is a small factor in an average student's choice of school, there will be some who look specifically for a University that takes up leadership on energy sustainability. This category will include some very talented, passionate young leaders, exactly the types Princeton University seeks. Faculty in certain fields, especially the biological science, will be similarly receptive to an institution that takes efforts to align itself with the recommendations of their discipline. To have these groups consider Princeton as a first choice among our peer institutions is an ideal to be pursued through many routes, and providing high-profile physical evidence of Princeton University's institutional commitment is one method.

Second, if attracting students and scholars were not enough, building green will encourage the University's donors. Existing donors with lingering qualms about the waste of resources will have those concerns allayed if Princeton commits to building green. Potential but inactive donors may also be encouraged to commence or resume donations thanks to the positive publicity. And a small but growing group of environmentally-conscious alumni will be spurred to give significant gifts in furtherance of a Princeton commitment to only building green.

Third, LEED standards can be a learning tool for architects who are not experts in green building design. This is especially true of the established and world-renowned ones Princeton prides itself on attracting. Princeton University having an internal design mechanism without a well-recognized adjunct like LEED reduces the pool of experienced colleagues to whom an architect can turn for assistance. Only a few dozen firms have

worked on Princeton University campus under the current sustainability guidelines, but thousands of architects now focus their practices exclusively on green buildings designed to qualify for LEED. LEED can help talented but unfamiliar architects get up to speed before they get into the details of a project. This might result in a smoother design process, with less need to go back and ensure sustainability goals have been met, and might very well result in the design of more efficient buildings.

Lastly, Princeton University can confirm its own assessment of its buildings if it seeks LEED certification. The designers and project team may be confident that a building will be highly efficient and sustainable, but only an impartial outside opinion can confirm this with transparency and accountability.

Reflecting all of these benefits, I recommend that Princeton University seek LEED certification for future projects, but that it make designs without a focus on the LEED criteria.

Conclusion

It would be easy to say that concerns over carbon emissions detract from our institution's primary goals of education and research. Princeton is in a race to be the best University it can be, and expense or concern over this issue might be seen by some as an inconvenience or a distraction. But energy sustainability is not something Princeton must seek at the expense of the University's research and teaching missions. It is in fact a part of our mission as a steward of the public interest and a training ground for future leaders. This will become increasingly clear in coming years, as leadership by example becomes expected of universities throughout the United States. Through the recommendations

above, Princeton University can take on that leadership role in combating global climate change, improve its operations, and further its mission to be “in the nation’s service and the service of all nations.”

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Appendix I: LEED Qualification Under Attainable University Policy

Items in bold are credits that existing University practice, policy or conditions demand for new projects. Also included are projects that have not been mandated but are consistent with university policy, or which have been demonstrated to be cost negative. The largest uncertainty remains in the “Low Emitting Materials” criteria. Princeton seeks to avoid using emissive materials, but compliance with the LEED criteria is unclear. Without those four points, 29 Credits are mandated already, and several more could be obtained with practical benefit at low cost. This is equivalent to LEED “Certified” status, which requires between 26 and 32 points.

Sustainable Sites 14 Possible Points

Prereq 1 Construction Activity Pollution Prevention Required

Credit 1 Site Selection 1

This is a compliance credit, for defining the project limits in a manner that allows assessment.

Credit 2 Development Density & Community Connectivity 1

Princeton’s Campus is sufficiently dense that any project will qualify.

Credit 3 Brownfield Redevelopment 1

Credit 4.1 Alternative Transportation, Public Transportation Access 1

All of Princeton’s campus is sufficiently served by public transportation.

Credit 4.2 Alternative Transportation, Bicycle Storage & Changing Rooms 1

Compliance with this credit is easy and fits with existing University initiatives for bicycling.

Credit 4.3 Alternative Transportation, Low Emitting & Fuel Efficient Vehicles 1

Credit 4.4 Alternative Transportation, Parking Capacity 1

Princeton University does not construct parking capacity as part of individual projects.

Credit 5.1 Site Development, Protect or Restore Habitat 1

Credit 5.2 Site Development, Maximize Open Space 1

Credit 6.1 Stormwater Design, Quantity Control 1

Princeton University has stated an intent to control storm water volume.

Credit 6.2 Stormwater Design, Quality Control 1

Also one of Princeton’s stated sustainability values.

Credit 7.1 Heat Island Effect, Non-Roof 1

Campus planning reduces heat islands by having more vegetation than black surface.

Credit 7.2 Heat Island Effect, Roof 1

Princeton University design guidelines specify high albedo or green roofs.

Credit 8 Light Pollution Reduction 1

Lighting guidelines should satisfy this requirement on any project large enough to potentially create light pollution.

Water Efficiency 5 Possible Points

Credit 1.1 Water Efficient Landscaping, Reduce by 50% 1

Reduced irrigation is University policy.

Credit 1.2 Water Efficient Landscaping, No Potable Use or No Irrigation 1

Credit 2 Innovative Wastewater Technologies 1

Credit 3.1 Water Use Reduction, 20% Reduction 1

Credit 3.2 Water Use Reduction, 30% Reduction 1

These reductions were found to be cost negative by ENV ST01.

Energy & Atmosphere 17 Possible Points

Prereq 1 Fundamental Commissioning of the Building Energy

Systems Required

Prereq 2 Minimum Energy Performance Required

Prereq 3 Fundamental Refrigerant Management Required

Credit 1 Optimize Energy Performance 1–10

The efficiency of the Facilities Plant and standard University hardware garners 6 points.

Credit 2 On-Site Renewable Energy 1–3

Credit 3 Enhanced Commissioning 1

This is a compliance credit, given for projects that are inspected according to more stringent rules.

Credit 4 Enhanced Refrigerant Management 1

Princeton Buildings do not use refrigerants, and the facilities plant qualifies for refrigerant management credit.

Credit 5 Measurement & Verification 1

This is a compliance credit, meant to ensure short-term defects are corrected.

Credit 6 Green Power 1

Materials & Resources 13 Possible Points

Prereq 1 Storage & Collection of Recyclables Required

Credit 1.1 Building Reuse, Maintain 75% of Existing Walls, Floors & Roof 1

Credit 1.2 Building Reuse, Maintain 95% of Existing Walls, Floors & Roof 1

Credit 1.3 Building Reuse, Maintain 50% of Interior Non-Structural Elements 1

Credit 2.1 Construction Waste Management, Divert 50% from Disposal 1

Construction on campus averages close to this level of diversion.

Credit 2.2 Construction Waste Management, Divert 75% from Disposal 1

Credit 3.1 Materials Reuse, 5% 1

Credit 3.2 Materials Reuse, 10% 1

Credit 4.1 Recycled Content, 10% (post-consumer + 1/2 pre-consumer) 1

Credit 4.2 Recycled Content, 20% (post-consumer + 1/2 pre-consumer) 1

Credit 5.1 Regional Materials, 10% Extracted, Processed & Manufactured Regionally 1

Brick and stone used by Princeton are regional.

Credit 5.2 Regional Materials, 20% Extracted, Processed & Manufactured Regionally 1

Credit 6 Rapidly Renewable Materials 1

Princeton has previously used rapidly renewable materials in building interiors.

Credit 7 Certified Wood 1

Princeton has previously used certified wood for flooring.

Indoor Environmental Quality 15 Possible Points

Prereq 1 Minimum IAQ Performance Required

Prereq 2 Environmental Tobacco Smoke (ETS) Control Required

Credit 1 Outdoor Air Delivery Monitoring 1

ENV ST01 found that compliance would be cost-negative.

Credit 2 Increased Ventilation 1

Credit 3.1 Construction IAQ Management Plan, During Construction 1

Credit 3.2 Construction IAQ Management Plan, Before Occupancy 1

Credit 4.1 Low-Emitting Materials, Adhesives & Sealants 1

Credit 4.2 Low-Emitting Materials, Paints & Coatings 1

Credit 4.3 Low-Emitting Materials, Carpet Systems 1

Credit 4.4 Low-Emitting Materials, Composite Wood & Agrifiber Products 1

Credit 5 Indoor Chemical & Pollutant Source Control 1

Credit 6.1 Controllability of Systems, Lighting 1

Plans to include on-demand lighting are in place.

Credit 6.2 Controllability of Systems, Thermal Comfort 1

New buildings and renovations contain occupant controlled thermostats.

Credit 7.1 Thermal Comfort, Design 1

Credit 7.2 Thermal Comfort, Verification 1

Credit 8.1 Daylight & Views, Daylight 75% of Spaces 1

Credit 8.2 Daylight & Views, Views for 90% of Spaces 1

Innovation & Design Process 5 Possible Points

Credit 1.1 Innovation in Design 1

Credit 1.2 Innovation in Design 1

Credit 1.3 Innovation in Design 1

Credit 1.4 Innovation in Design 1

Credit 2 LEED Accredited Professional 1

Campus Transportation
By Connor Cobean

1. Introduction

This report extends the scope of Princeton's environmental duties beyond the most conventional factors by focusing on all aspects of university transportation. Specifically, the study focuses on six areas of transportation: employee commuter travel, student travel, food transport, faculty air travel, on-campus vehicles, and transportation demand management.

There are three main reasons for the necessity of addressing these sectors when considering Princeton's sustainable future:

1. **Direct carbon reductions.** Princeton's current carbon emissions inventory assesses transportation as comprising approximately 13% of the total.²⁴⁹ This figure reflects only commuting and air travel. If we include the other four areas considered by this report, transportation becomes a larger factor in carbon emissions which cannot be ignored given the goal of climate neutrality advocated by this report.

2. **Fostering a green campus culture.** Beyond concrete emissions reductions, mitigating the environmental effects of transportation has important positive

²⁴⁹ Mark Smith, "Working Carbon Emissions Inventory for Princeton University." April 2007.

externalities. Princeton needs to develop a green culture on campus, one sympathetic to and engaged with the goals of sustainability. Changes to transportation, an essential part of the American lifestyle, can stimulate more sustainable behavior. Including transportation in Princeton's ecological footprint will inspire employees and students to buy into sustainability.

3. Fulfilling our ethical responsibility. As a leading university and model for others, it is Princeton's duty to address the full range of its ecological footprint.

2. Promoting Sustainability within Six Sectors of Princeton Transportation.

This report presents each of the six sectors of transportation in turn, starting by illustrating each sector's importance to sustainability and outlining its current status at Princeton, including existing problems and areas for improvement. The report then documents the relevant strategies employed at other universities to combat these problems and analyzes which can be most effective at Princeton. Finally, using this analysis, the report presents its recommendations for each sector.

2.1 Employee Commuting Travel

Employee commuting travel accounts for 10% of total campus emissions in Princeton's current carbon inventory.²⁵⁰ It is believed that this figure underestimates the true portion.

²⁵⁰ Smith.

Commuting is thus a significant part of Princeton's emissions. "Greening" commuting will reduce carbon emissions and is an ideal mechanism for fostering a green campus culture by exposing Princeton's employees to sustainability on a personal and daily level.

Princeton's efforts to curb commuting are few. The university subsidizes homeowners' costs for employees who elect to live within a nine mile radius of campus. The administration has held firm on this stipulation making the program an effective means of reducing employee commuting distances. Aside from this initiative, however, Princeton has done little to manage employee commuting. Princeton has no carpool or vanpool program, public transport is not subsidized, parking is free, and those who do choose to carpool are given no preferential parking. In short, there is no incentive not to drive one's own car to work. As a result, 84% of faculty and staff use their own vehicles to get to work each day.²⁵¹

Countless other schools, by comparison, have made considerable efforts at controlling employee commuting. In 2006, the Environmental Protection Agency and the Department of Transportation named 72 colleges as the "Best Workplaces for Commuters." During the previous year, these 72 schools saved 30 million gallons of gasoline in reduced commuting through alternative transportation initiatives aimed at reducing single-occupancy commuting.²⁵² This equated to 260,000 metric tons of CO₂

²⁵¹ Princeton University: Princeton Campus Plan. *Commuter Modal Split*. [updated 20 December 2006, Accessed 24 April 2007]. Available from <http://campusplan.princeton.edu/campus-plan/themes/transportation/analysis-4.php>.

²⁵² U.S. Environmental Protection Agency: Best Workplaces for Commuters. *2006 List of Best Workplaces for Commuters from Colleges and Universities: Fast Facts*. [Accessed 20 Mar. 2007] Available from <http://www.commuterchoice.gov/pdf/colleges-fast-facts508.pdf>.

reduced, the equivalent of 50,000 passenger cars driving for an entire year or the electrical power required by 33,000 homes.²⁵³ These considerable environmental savings were accompanied by gasoline savings yielding \$86 million.²⁵⁴

To become a “Best Workplace for Commuters,” a college must satisfy detailed criteria. First, a university must either pay a \$30 dollar-per-month subsidy for employee public transportation, pay employees who carpool or vanpool \$30 dollars per month, offer a telework program that reduces commuter trips by at least 6%, or simply pay employees at least \$30 a month not to drive to work. Most schools fulfill this requirement through subsidized public transit. The University of Colorado at Boulder, for example, makes public transit free for their employees.²⁵⁵

Second, a “Best Workplace” must provide at least three additional measures that promote alternative transportation. These can include a carpool or vanpool service facilitated by an online-matching program. Vanpools are an inefficient use of capital and so are less economically preferable.²⁵⁶ Not only must the university pay for the vans, but the vans provide returns to the university only during the time when employees are commuting to and from work. This inefficiency is avoided if the university employs a private company

²⁵³ 2006 List of Best Workplaces for Commuters from Colleges and Universities: Fast Facts.

²⁵⁴ 2006 List of Best Workplaces for Commuters from Colleges and Universities: Fast Facts.

²⁵⁵ To learn more about the University of Colorado-Boulder’s free public transit for employee (ECO Pass) program, please see: <http://ucbparking.colorado.edu/AlternativeTransportation/Default.asp?Action=ViewAnyPage&ID=57>.

²⁵⁶ Elizabeth Bogan. Senior Lecturer in Economics at Princeton University. Personal Interview. 28 March 2007.

to provide the vanpool service. Both the University of Michigan and Maryland have employed VPSI, a private vanpool company, to install successful vanpool services.²⁵⁷ Carpool programs, however, are more numerous and have been successful at Vanderbilt, Duke, and Emory among many others.

Schools can also promote alternative transportation by subsidizing parking fees for carpoolers and vanpoolers (as Duke and Vanderbilt have done). Other schools like Indiana University reserve the best parking spots for carpoolers. Preferential parking can also be instituted based on vehicle fuel-efficiency; the University of Miami gives a 50% reduction on parking fees to drivers of hybrids.²⁵⁸ Prizes and financial incentives are other means of encouraging alternative transportation. Emory has a “Cash for Commuters” program which pays employees three dollars a day for 90 days to try alternative transportation. Commuters are also rewarded for their participation by being automatically entered to win commuter prizes, which consist of gift cards and gas cards.²⁵⁹

To qualify as a “Best Workplace,” schools must also provide an emergency ride home option for employees who are forced to leave work early or stay late, appoint a coordinator of commuting with his own office and with access to centralized commuter

²⁵⁷ Michelle Romano Rockwood. Marketing Coordinator, MichiVan. Phone Interview. 25 April 2007.

²⁵⁸ Campus Climate Challenge. *New Energy for Campuses: Energy-Saving Policies for Colleges and Universities*. [Accessed 28 April 2007] Available from http://www.energyaction.net/documents/new_energy.pdf.

²⁵⁹ To learn more about alternative transportation at Emory, please see <http://www.epcs.emory.edu/alttransp/>.

information, agree to use the “Best Workplace” logo on promotions, and provide the EPA with annual updates. Finally, the school must commit to reduce single-occupancy commuting by 14% within 18 months.

The criteria necessary to becoming a “Best Workplace” are meaningful and can start Princeton on the path toward a more sustainable commuter network. Many, if not most, of the criteria are feasible for Princeton to adopt. As a further incentive to qualify, it should be noted that Dartmouth, Cornell, Columbia, Stanford, Rutgers, MIT, Harvard, and Yale were all named “Best Workplaces for Commuters” in 2006. These schools are our peers and we must join their ranks. Thus, I recommend that Princeton become a “Best Workplace for Commuters.” To do this the university must:

- Charge for Parking. A parking fee is foundational to all other alternative transportation initiatives. Without it, there is little incentive not to drive alone to work. A further study should be conducted to determine the price which incorporates the environmental externalities of driving. In the absence of such a study, Princeton should at least charge a fee equal to the maintenance cost of a parking spot. Charging for parking when it is currently free will be unpopular. In the absence of developed alternative transportation options, it can also be argued that the fee is elitist and unfair to low-income workers who have to drive to work.²⁶⁰ Given these concerns, it may be optimal to give a simultaneous pay raise

²⁶⁰ It should be noted that Emory was able to successfully double its parking fee from \$300 to \$600 this year without significant opposition. Emory does, however, offer a parking fee subsidy to low-income employees. To learn more, please see <http://www.epcs.emory.edu/park/Final%202007%20University%20Parking%20Rate%20FAQs.pdf>.

to all employees that is equal to the parking fee. This solution, what has been called ‘parking cash out,’ produced a 13% reduction in single-occupancy vehicle use when it was implemented at eight locations in Los Angeles.²⁶¹

- Institute an employee carpool program or a vanpool if it can be outsourced. This program must be facilitated by an online matching program. Those participating in the program must have access to an emergency/guaranteed ride home. Princeton should consider contracting with VPSI.
- Subsidize parking fees for carpoolers or vanpoolers.
- Establish preferential parking based on vehicle occupancy and fuel-efficiency.
- Institute a “Cash for Commuting” program like Emory’s that pays employees 3 dollars a day for 30 days that they carpool to work.²⁶²
- Enroll all carpoolers in a pool for prizes.
- Subsidize public transit by at least \$30 per month. A study analyzing the employee demand for public transit should be conducted to determine the feasibility of increasing the subsidy.
- Establish a coordinating position in charge of overseeing all alternative transportation programs. I recommend hiring somebody for a new position rather than expanding the responsibilities of a current employee. This coordinator must have an office where commuter information can be accessed.

²⁶¹ Michael D. Meyer, “Demand Management as an Element of Transportation Policy: Using Carrots and Stick to Influence Behavior.” *Transportation Research Part A* Vol. 33 (1999), 595.

²⁶² An employee may only participate once.

- Publicize the benefits of using alternative transportation. One study found that effective marketing could reduce automobile use by 6% to 14%.²⁶³
- Commit to a 14% reduction in the number of employees who drive to work alone within 18 months.

Even if Princeton chooses not to adopt the EPA logo and become an official “Best Workplace for Commuters,” fulfilling the program’s criteria will decrease carbon emissions and encourage employees to incorporate sustainability into their daily lives.

2.2 Student Travel

During the 2003-2004 school year, the Parking Office issued a little over 2,000 parking permits to the combined undergraduate and graduate student body.²⁶⁴ Given this car ownership and the estimated miles driven per week by Princeton students (30.7 according to a 2004 survey), on-campus student travel contributes approximately 950 tons of CO₂ to the atmosphere every year and burns around 90,000 gallons of gas.²⁶⁵ These emissions are in addition to those created by student vacation travel and travel at the beginnings and ends of school years. Minimizing student travel thus has the potential for small but measurable reductions in CO₂ emissions. Incorporating sustainability at Princeton,

²⁶³ T. Litman, “TDM Marketing: Information and Encouragement Programs.” Online TDM Encyclopedia [updated 12 Mar. 2007, accessed 5 May 2007]. Available from <http://www.vtpi.org/tm/tm23.htm>.

²⁶⁴ Stephanie Tatham, “PEOC Transportation Report:” 4

²⁶⁵ Lyon, Susan and Lester Mackey, “On the Move: Reducing Princeton’s CO₂ Emissions One Gallon At a Time.” Chapter on Transportation for Princeton course ENV-ST01. 7 Jan 2007: 4.

however, is not solely focused on reducing emissions; it is also dedicated to producing environmentally-conscious citizens. Regulating student travel emissions can be an effective tool in this capacity.

Currently, Princeton charges \$155 per year for a student parking permit and prohibits freshmen from having cars on campus. Starting in the fall of 2009, sophomores will not be allowed cars on campus either. Princeton does have a ZipCar program housed in Frist through which students can rent cars, but it is not very well publicized. The university is also currently expanding the campus shuttle system. Princeton is not considering student travel over vacations or at the beginning and ends of school years in its carbon inventory. These factors, however, have not generated much attention and this report has found no other attempts to either inventory or mitigate this source of emissions. Confronting this issue may be a way to both take the lead in a new sector of sustainability and expose Princeton students to sustainability on a personal level.

Some schools have done far less than Princeton to reduce student car ownership and use on campus. Amherst and Dartmouth, for example, charge only 60 dollars per year for student parking and both Middlebury and Harvard provide free parking to their students. This provides little incentive not to bring a car to school. Schools like Cornell and the University of Colorado at Boulder, on the other hand, charge significantly more for parking; CU-Boulder's permit fees range from 195.50 to 323 dollars per year.²⁶⁶ The

²⁶⁶ University of Colorado at Boulder: Parking & Transportation Services. *Student Permit Prices*. [Accessed 20 Mar 2007] Available from <http://ucbparking.colorado.edu/Students/Default.asp?Action=ViewAnyPage&ID=84>.

University of Hawaii charges 336 dollars per year. Some schools have increased fees to reduce student cars on campus. Stanford has opted for a different incentive system: its “Clean Air Cash” program pays students who live off campus 216 dollars a year not to drive their own car to school.²⁶⁷ Schools can also restrict student car ownership on campus by limiting the number of available spots. Both Drexel and the University of Kentucky use parking permit lotteries to limit the number of student cars on campus. Many schools offer ride-board services with which students can coordinate shared rides with other students. Middlebury has proposed giving parking fee rebates to students who offer four or more rides on its online ride-board program as an incentive to use the system.²⁶⁸

Student travel at Princeton is not great enough to justify drastic measures restricting car ownership on campus. Rather than increase parking fees (which are already relatively high compared with other schools) or implement a parking lottery or pay students not to bring cars to school, Princeton should largely build upon what it already has. With its concentrated campus, access to the Dinky, and expanding shuttle system, Princeton already provides many reasons not to own a car on campus. To add to these incentives, I recommend the following:

²⁶⁷ Stanford University: Parking & Transportation Services. Clean Air Cash. [Accessed 27 Mar. 2007] Available from http://transportation.stanford.edu/alt_transportation/CleanAirCash.shtml.

²⁶⁸ “Carbon Neutrality at Middlebury College: A Compilation of Potential Objectives and Strategies to Minimize Campus Climate Impact.” Report prepared by the Students and Faculty of ES 010 for the Carbon Reduction Initiative Working Group of the Community Council. 19 Jun. 2003: 112.

- Publicize the ZipCar program more aggressively. Many students with cars on campus drive only infrequently. These drivers are prime potential users of the ZipCar program. If these students were aware of the program, they might not feel a need for a car on campus.

Princeton cannot realistically affect what students do during vacations and students must come to school at the beginning of the year and leave at the end. To address the emissions from this transportation, I recommend the following actions:

- Create a ride-board program. This program should be well-advertised and linked from POINT. Students who ride-share four or more times should be given a parking fee rebate like the one proposed at Middlebury.
- Include these less traditional factors of student travel to the carbon inventory. I recommend the inventory be assessed through a voluntary survey system. At the beginning of each school year and at the end of each vacation, every student should be e-mailed a survey asking him or her where they traveled and what mode of transportation they took. The survey will then calculate the carbon emissions created by the trip and display it to the student. This provides each student with a look at a part of their ecological footprint; this personalizes sustainability. It also expands Princeton's environmental responsibilities beyond what other schools are doing.

2.3 Food Transport

Food transport is not widely considered in campus emissions inventories and it has not been included in Princeton's. The exact size of campus food transport emissions is currently unknown, but with 22 vendors delivering to Princeton at least three times a week, it is a significant source of CO₂ that cannot be ignored by the university.²⁶⁹

Princeton has already made substantial efforts to mitigate the environmental impact of its food services. In fact, in 2006 Princeton made the College Sustainability Report Card's "A" list for food services. Stu Orefice, head of Princeton's Dining Services, is very receptive to opportunities to green his department and is largely responsible for the successes already achieved. According to Mr. Orefice, there has been a philosophical change within Dining Services during the last several years largely inspired by student interest and passion. Dining Services is now committed to being green. Whereas five years ago, the location of Princeton's food vendors didn't matter, it is now taken into consideration. Indeed, of the 52 vendors who deliver to Princeton more than once or twice a year, 51 are from the tri-state area and 32 of these are from New Jersey itself. The one vendor outside the region is Carrabassett Spring Water from Gorham, Maine.²⁷⁰ Dining Services is currently considering a bid from a New Jersey company to replace this contract.

²⁶⁹ Stu Orefice. Princeton Director of Dining Services. Personal Interview. 28 April 2007.

²⁷⁰ Interview with Stu Orefice.

In addition to contracting with regional vendors, thereby reducing food transport miles, Princeton Dining Services has taken several smaller steps to reduce the transportation associated with food on campus. Dining Services has worked to reduce the number of days per week that each vendor delivers. It has also tried to consolidate vendors so that fewer companies deliver to campus. Finally, Dining Services employs a central bakery at Rockefeller College to provide baked goods for all of campus. This eliminates the need for Princeton to contract a vendor to deliver baked goods to campus.

Dining Services' participation in the Food Project's "Real Food Challenge," a nationwide program to encourage universities to consume 20% more "real" food within five years, may also lead to food transport reductions.²⁷¹ In accordance with the project's timeline, Dining Services is hiring an intern this summer to develop target purchasing levels for the different categories of "real food." These categories include humane, ethically-produced, organic, fair trade, and, significant to this study, local. The targets will determine what percentage of different kinds of food (such as meats, dry goods, fish, etc.) must be purchased from each "real" food category. These targets will likely lead to an increase in the percentage of locally-grown food consumed by Princeton. Additionally, Mr. Orefice is currently developing a priority list of projects he would like Dining Services to undertake. Buying locally is high on this list.

Setting and achieving a high local-food target and implementing Mr. Orefice's list of priority projects, however, will require more money. Buying locally is more expensive;

²⁷¹ The Food Project. *The Real Food Challenge*. [Accessed 30 Apr. 2007] Available from <http://www.thefoodproject.org/uploadedfiles/RFCWebBrief.pdf>.

there is a premium on local food. Last year, for example, Mr. Orefice began purchasing grass-fed, local beef for campus hamburgers.²⁷² This initiative reduced food transport miles but the project was only possible because Mr. Orefice had managed to keep enough left over from his budget to buy the more expensive beef. The Dining Services budget cannot be stretched to incorporate more such projects. Thus, Mr. Orefice's ability to further buy locally and decrease carbon emissions is restricted by his budget.

A further impediment to minimizing food transport on campus is an out-dated food storage facility that provides inadequate storage space. As a result, many vendors must make five deliveries each week because Princeton lacks the capacity to store enough food for multiple days.

Although many schools around the country are making efforts to purchase more of their food locally (including Grinnell and Middlebury as two of the most aggressive), the most relevant model for Princeton is Williams College²⁷³. In the last year, Williams has begun purchasing all its milk from an in-state farm that uses grass-fed, hormone free cows.

Almost all of its summer and most of its winter vegetables are now purchased from a family farm only 10 minutes from campus. Williams gets its mushrooms, honey, apples, granola, ice cream, and cheese from local producers as well. In total, Williams has

²⁷² Interview with Stu Orefice.

²⁷³ To learn more about Grinnell and Middlebury's local food initiatives, please see <http://www.grinnell.edu/offices/dining/localfoods/> for Grinnell and http://www.middlebury.edu/campuslife/dining/news/2006/dining_general_632991786316030192.htm for Middlebury.

increased its local and organic food consumption by 30%.²⁷⁴ These initiatives have only been possible because Williams expanded its dining services budget to incorporate a 20 cent-per-meal premium for local and organic food. To get the budget increase, dining services had to calculate the total additional cost (the premium) for the local and organic food it hoped to buy, and present its report to the budget approval board.²⁷⁵ Williams has hired a summer intern to research further opportunities for buying locally.

To overcome the monetary restrictions that are currently preventing Dining Services from buying more locally, Princeton should emulate the Williams model. Thus, I recommend that:

- Dining Services prepare a detailed report outlining the local food purchases it would like to make and explicitly quantify the premium required to make these purchases.
- Princeton create and pay for at least one full-time, Dining Services intern to help generate this report by researching local food opportunities.
- Princeton approve at least a 20 cent-per-meal increase for Dining Services' budget in the interim before Dining Services can provide a detailed plan for local food purchasing with an exact cost.
- Alternatively, if the university creates a green loan fund, Princeton should allow Dining Services to receive funds proportional to the carbon emissions it saves by

²⁷⁴ Williams College. Sustainable Williams. *Buying Local/Organic*. [Accessed 2 May 2007] Available from http://www.williams.edu/resources/sustainability/food_buying.php.

²⁷⁵ Robert Volpi. Williams College Director of Dining Services. Phone Interview. 1 May 2007.

buying locally. For example, if Dining Services can show that buying water from New Jersey instead of Maine will save X pounds of CO₂, the loan fund should give the department Y dollars of green credits to spend.

To further reduce food transport emissions, I recommend that:

- Princeton expand the current food storage facilities or build new, larger facilities so as to reduce the number of vendor trips to campus
- Dining Services put pressure on its vendors to incorporate fuel-efficient vehicles into their fleets and to tailor the size of their vehicles to the size of the delivery.²⁷⁶

2.4 Faculty Air Travel

According to Princeton's current carbon inventory, faculty air travel creates 4,114 metric tons of CO₂ or approximately 3% of campus emissions.²⁷⁷ This value is likely an underestimation, but faculty air travel does not represent an enormous proportion of campus emissions. Still, these emissions must be mitigated to reach climate neutrality. Additionally, this report advocates that faculty be encouraged to integrate sustainability into their courses and lives. Having faculty fly less out of concern for the environment is one way to accomplish this goal.

²⁷⁶ One of Princeton's vendors, J. Vrola Inc, a wholesale meat company, already does this.

²⁷⁷ Smith

Universities can reduce faculty air travel by discouraging (or even restricting) travel or by providing video-conferencing facilities. Princeton already possesses three video-conferencing spaces on campus – Wallace 001, Friend 003, and Robertson 16 – and a portable video-conferencing unit. In the current academic year up until May 4th, 77 video-conferences have been held on campus, 3 by courses, 21 by administrative departments, and 53 by academic departments.²⁷⁸ The demand has been great enough, in fact, to necessitate a fourth video-conferencing site, which is currently in the planning stages. Currently, however, there are no incentives encouraging video-conferencing and prices are high enough to discourage wider use. Neither are there any restrictions on air travel. Princeton's inventory of faculty air travel could use improvement. Currently, the inventory figure is based on the flights booked through University Travel Portal, the campus travel agency. Booking through Travel Portal is not mandatory, however, so the current value of air travel emissions is based on an estimate that 90% of travel is booked through Travel Portal.

The strategy to reduce faculty air travel most common among other universities is, just as at Princeton, to provide video-conferencing as an alternative to flying. This report knows of no school that has discouraged or prohibited its faculty from flying. It is wise for Princeton to avoid such strategies. The faculties of high-caliber research universities must travel. Michigan State University has proposed a reasonable solution to the problem of faculty air travel. This proposal inventories all

²⁷⁸ Michael Mills. Manager of Princeton Media Services. Phone and E-mail Interview. 3 May 2007.

travel through a website and calculates the emissions travel creates. The university would then purchase offsets for these emissions. This, in addition to an expansion of video-conferencing, is a sensible approach for Princeton to take. Thus, I recommend the following:

- Keep an accurate inventory of faculty air travel. Princeton should require its faculty to record their travel through Travel Portal, even if they do not book through this agency. Princeton can then purchase offsets for the emissions caused by this travel.
- Build a high-end video-conferencing facility. According to Michael Mills, manager of Princeton Media Services, demand justifies new facilities. Mr. Mills, in fact, has already been in discussion with two academic departments about building facilities. A high-end videoconferencing facility that is “sexy” and enjoyable to use will encourage more professors to use video-conferencing instead of flying. This and all facilities, however, must be available at a nominal cost to users. Using video-conferencing must be cost competitive with traveling. Falling technology prices make this a viable proposal, though a subsidy may still be necessary.²⁷⁹
- Reward video-conferencing. Princeton should create financial incentives for faculty members who save the most air travel miles each year through videoconferencing.

²⁷⁹ Interview with Michael Mills.

2.5 On-Campus Vehicles

Princeton's campus fleet has 631 vehicles. In 2006, these vehicles consumed 108,000 gallons of gasoline and 29,000 gallons of diesel.²⁸⁰ This represents around 950 metric tons of CO₂ produced by Princeton's campus fleet last year.²⁸¹ Although this accounts for less than one percent of total campus emissions, the university fleet is highly visible and thus has the potential to become a prominent display of Princeton sustainability.

Princeton has already begun purchasing hybrid and electric vehicles, such as the Prius and the GEM, as part of a green vehicle pilot program. The new vehicles have been favorably received by personnel on campus and the university plans to expand the program. Additionally, one of Princeton's three campus shuttles runs on compressed natural gas, which is more environmentally-friendly than gasoline or conventional diesel. Most of the vehicles on campus, however, still run on gasoline and diesel. These fuels need to be phased out.

Many colleges and universities have begun integrating alternative and renewable fuels into their campus fleets. A large percentage of The University of Minnesota's fleet is powered by E-85 ethanol, with 50 vehicles powered by B-20 biodiesel. Cornell's farm services run exclusively on biodiesel. The University of Florida campus fleet now contains 45 flex vehicles that run on ethanol and normal gasoline. In addition, UF's purchasing policy buys only hybrid and flex-fuel vehicles. Harvard has also begun using

²⁸⁰ Lyon and Mackey, 4-5.

²⁸¹ Smith. Carbon Inventory.

renewable fuels and 65 of its campus vehicles now run on soy-based biodiesel. This reduces campus emissions and is, due to a tax credit, cost neutral as compared with regular diesel.²⁸² Harvard now consumes around 2,000 gallons of biodiesel every two weeks which it distributes from a central filling station.

Princeton is already on the right path to greening its campus fleet, so the range of suggestions for improvements are limited. Though many schools have begun using both ethanol and biodiesel on their campuses, biodiesel is the better choice for a renewable fuel at Princeton because of its availability; there are five distributors of biodiesel in New Jersey but none for ethanol.²⁸³ There is also a question of performance; vehicles are 20% less fuel efficient using ethanol.²⁸⁴ Thus, this report recommends the following:

- Integrate biodiesel into the campus fleet. Biodiesel is 80% cleaner than gasoline or regular diesel and is nearly cost neutral compared to conventional fuels (as at Harvard).
- Continue buying hybrid, flex-fuel, and electric vehicles. Whenever Princeton needs a new vehicle, it should pay the premium for a fuel-efficient vehicle if there is a reliable model.

²⁸² Dave Harris. Manager of Passenger Transport and Fleet Management Services, Harvard University. Phone Interview. 6 April 2007.

²⁸³ The Official Site of the National Biodiesel Board. *Biodiesel Distributors: New Jersey*. [updated 4 May 2007, Accessed 4 May 2007] Available from <http://www.nbb.org/buyingbiodiesel/distributors/showstate.asp?st=NJ>.

²⁸⁴ Keith Rule. Environmental Project Engineer for the Princeton Plasma Physics Laboratory. E-mail interview. 4 May 2007.

- Phase out gasoline and regular diesel in favor of more environmentally-friendly fuels with lower life-cycle costs.

2.6 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 and requires more transportation, making it more difficult to meet the emission goals set by this report. If Princeton is to meet these goals while simultaneously expanding, the university needs to incorporate sustainable principles into the planning of future growth. Transportation Demand Management (TMD) seeks to institutionalize techniques to minimize the campus transportation load, thereby withstanding the pressure to grow created by university expansion.

Princeton Borough law requires that Princeton provide enough parking for all its employees and so the university is committed to increasing the supply of parking for the expansions of the next decade.²⁸⁵ For a university like Princeton, there are two way of supplying more parking spots – with surface lots or parking garages. It is substantially cheaper to build lots as opposed to garages; the average cost of surface (lot) parking is 1,500 dollars per space whereas the average garage spot costs 17,400 dollars.²⁸⁶

Economically, then, it makes greater sense for a university to build parking lots where it

²⁸⁵ Natalie Shivers. Associate University Architect for Planning, Princeton University. Personal Interview. 4 May 2007.

²⁸⁶ The U.S. Environmental Protection Agency: Best Workplaces for Commuters. *The Business Case for Commuter Benefits at Colleges and Universities*. [Accessed 20 Mar 2007] Available from http://www.bwc.gov/pdf/college_university%20case_FINAL_508.pdf.

can buy more than 11 spots for the cost of one garage spot. Cost, however, is not the only factor; for Princeton, space is crucial. Parking garages require considerably less space than surface lots. Garages also produce far less rainwater run-off (which contains numerous contaminants, mostly metals, toxic to the local ecosystem) than do surface lots.²⁸⁷ From the perspective of sustainability, garages are a better option than surface lots.

Though garage parking is better for the environment, it is, as previously mentioned, more than eleven times more expensive per spot than surface parking. This is not favorable to a fiscally-driven institution. Since surface parking is too land-intensive and environmentally unfriendly and garage parking is too expensive, an expanding university must consider whether it should increase its parking supply at all. If most employees carpooled or used public transit, then there would be hardly a need for additional parking spaces. The question thus becomes: can universities fund alternative transportation for their employees more cheaply than they can pay for necessary parking? As Cornell University expanded in the early nineties, it was confronted with this question. It showed that the answer can be yes.

²⁸⁷ John J. Sansalone et al, "Fractionation of Heavy Metals in Pavement Runoff." *The Science of the Total Environment* Vol. 189-190 (1996): 371 – 378. (371)

In 1991, planned expansions to Cornell's campus created a demand for 2,500 new parking spaces.²⁸⁸ The prospect of these new spots raised multiple concerns for university planners. First,

²⁸⁸ U.S. Environmental Protection Agency: Best Management Practices for Colleges and Universities. *Transportation: If You Build It, They Will Come (and other tales of how free-fare transit saved \$40 million at Cornell)*. [Updated Jan. 2006, Accessed 21 Mar. 2007] Available from <http://www.bwc.gov/pdf/cornell-transportation-2-7-06.pdf>.

they were unhappy about the cost of construction of new parking garages (including one 1,200-spot garage). Second, they were concerned about the loss of green space the new parking would entail. Third, they were worried about the increased commuting mileage and the ensuing traffic and environmental pollution. In short, Cornell faced a situation much like the one Princeton faces today. Cornell decided that instead of building new parking infrastructure, it would instead develop a rigorous alternative transportation and TDM program.

Rather than fit campus parking to the driving behavior of employees, Cornell decided to sculpt driving behavior to the existing parking supply. To do this, Cornell implemented many of the strategies presented in section 2.1 including a carpool program, higher parking fees, preferential parking, and subsidized employee public transit. What makes Cornell's model especially compelling, however, is that it has organized its TDM initiatives into an administrative body with institutional power. All of Cornell's alternative transportation initiatives are run by the university Transportation Demand Management Program (TDMP). This centralization fulfills a "Best Workplace" guideline and enables Cornell to formulate a cohesive and comprehensive program for reducing university travel. Cornell has also given TDMP a voice in the master campus planning process, thus institutionalizing TDM practices and ensuring that the university expands with an eye to sustainable transportation. Cornell's TDMP also has its own budget of

\$630,000 dollars a year, which is funded by parking permit fees. This financial autonomy has allowed Cornell's TDMP the flexibility to develop creatively and independently.²⁸⁹

The success of Cornell's TDM has been tremendous. In TDMP's first year, parking permits fell by 25% and campus carpooling increased by 10%.²⁹⁰ Every year, Cornell commuters travel 10,000,000 fewer car-miles and save 417,000 gallons of fuel.²⁹¹ This represents a 6,700,000 pound reduction in annual CO₂ emissions. The program also saves money, both for commuters and for the university. In its 15 years of existence, Cornell's comprehensive TDM program has saved over 40 million dollars in construction costs and transportation costs.²⁹²

Princeton cannot completely emulate Cornell's model. When Cornell began its TDM program, the baseline of alternative transportation (public transit) was more developed than it is currently at Princeton. This allowed Cornell to develop its program rapidly. For Princeton, the motto must be "evolution, not revolution."²⁹³ Until Princeton can show evidence of a well-developed system of alternative transportation, it will be compelled by the local ordinance to provide parking equal to the number of employees. Though these factors reduce Princeton's ability to prevent parking construction, instituting a TDM

²⁸⁹ UCLA uses a similar system. At UCLA transportation services is an independent, for-profit entity and it uses some of its profits to invest in alternative transportation options (12% of parking fees support a carpool program).

²⁹⁰ Cornell University: Cornell Sustainable Campus. *Getting Around: Transportation Demand Management*. [Accessed 3 May 2007] Available from <http://www.sustainablecampus.cornell.edu/gettingaround/demand.html>.

²⁹¹ "If You Build It, They Will Come."

²⁹² "If You Build It, They Will Come."

²⁹³ Interview with Natalie Shivers.

program similar to Cornell's can institutionalize alternative transportation and lower the number of single-occupancy vehicles on campus. This report recommends that Princeton:

- Create an Office of Transportation Demand Management. This Office must be involved in all campus planning and should be funded by parking permit fees. This office should also oversee all commuter and alternative transportation initiatives and merge them into a comprehensive TDM plan. The office should incorporate the coordinator of commuting already proposed by this report.
- Work with local governance to expand the regional public transit.
- Build parking garages instead of surface lots.
- Work with local governance to create an exemption from the regulation requiring parking for all employees if a viable TDM system is in place.