

CHAPTER 6

A SUSTAINABLE CAMPUS

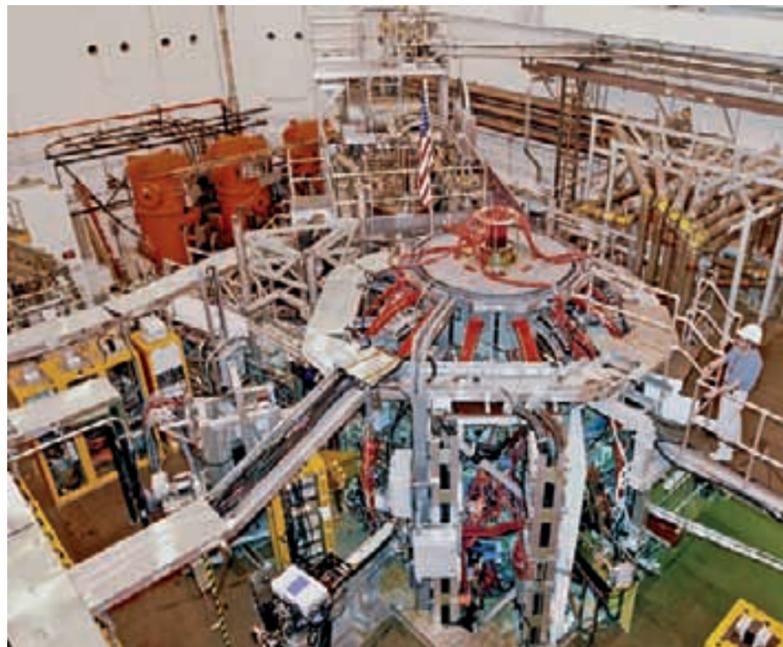
Universities today bear the same responsibility to confront environmental challenges as other institutions, municipalities, and countries around the world, but they can make unique contributions through research, teaching, and student initiatives. Universities also have many opportunities to practice sustainability, through such activities as campus operations and the housing, feeding, and transporting of people. Curbing greenhouse gas emissions tops the list, so in anticipation of increased power demands required by almost two million square feet of new development in the next decade, the Campus Plan recommends strategies to decrease Princeton's "carbon footprint" during this period. Famous for its scenic greenery, Princeton's walkable campus will soon become even "greener" through greater emphasis on transportation initiatives, recycling, conservation education, and better water management.

Sustainability: "meeting the needs of the present without compromising the ability of future generations to meet their own needs" —The United Nations

Sustainability at Princeton

Becoming a dynamic working laboratory to help inspire exemplary global citizenship

Princeton has declared the pursuit of sustainability an institutional priority in its Campus Plan. The University has developed a comprehensive framework to bring that priority into focus on areas that represent its major sustainability challenges. The framework is organized into three themes that complement the existing operational and academic structure: 1) greenhouse gas emissions, 2) resource conservation, and 3) education, research, and civic engagement. Within each theme are specific subject areas managed by the Princeton Sustainability Committee with student, faculty, and staff participation. This committee is responsible for assessing current and historic performance, defining metrics for tracking performance over time, and setting targets that coincide with the current Sustainability Plan timeline.



The National Spherical Torus Experiment at the Princeton Plasma Physics Laboratory

PRINCIPLES

Reduce campus greenhouse gas emissions by implementing alternative energy technologies, energy conservation programs, green building techniques, transportation demand management strategies, and commuter alternatives, while increasing the size of the campus by two million square feet.

Improve natural resource conservation by taking an ecosystems approach to development, integrating landscape and stormwater management strategies.

Foster civic engagement by representing sustainability principles in the built environment, as well as the social, academic, and research environments on campus.

HISTORY

Princeton has a long history of energy and environmental innovation dating back to the founding of the campus in Princeton. The stewardship of the University lands drove the design of the University's first buildings and later Beatrix Farrand's landscape design. The campus hosts one of the nation's most efficient and cost-effective central power facilities, with cogeneration in place since 1996 and chilled water storage since 2006. Princeton installed a 100-well geothermal system in 2003 to serve 207 units at Lawrence Apartments. Diligent maintenance over the years has ensured that the steam and chilled water delivery infrastructure operates at maximum energy and economic efficiency, aided by a real-time computerized central monitoring and dispatch system. Reflecting these efforts, in 2007 the energy plant received an EPA Energy Star CHP (combined heat and power, or cogeneration) Award. The University's CHP system requires approximately 21 percent less fuel than typical onsite thermal generation and purchased electricity, reducing carbon dioxide emissions by an estimated 18,000 metric tons per year, according to the EPA. Energy efficiency initiatives have also been a part of standard operations for many years, including lighting retrofits, window upgrades, improved insulation, and Energy Star appliance use.

In the research arena, Princeton is co-located with more climate change and energy research facilities than any other university in the country:

- Civil and Environmental Engineering— School of Engineering and Applied Science
- Carbon Mitigation Initiative— Princeton Environmental Institute, Geosciences, Ecology and Evolutionary Biology
- Woodrow Wilson School of Public and International Affairs
- Princeton Plasma Physics Laboratory
- Geophysical Fluid Dynamics Laboratory

CHALLENGES FACED BY THE CAMPUS TODAY

The biggest sustainability challenge the campus faces today is reducing greenhouse gas emissions while adding over two million square feet of built environment by 2016. Princeton is not unique in its growth projections, but it is unique in its effort to decrease its carbon footprint with activities on its own campus.

Some 85 percent of the University's carbon footprint is generated by the central power facility that provides power, heating, and cooling to campus buildings. Although additional development would normally require added capacity, the University plans to add two million square feet without an addition to the central plant. This goal will be accomplished through conservation efforts in existing buildings and by providing capacity with energy alternatives that produce no net carbon dioxide or other greenhouse gases.

There are a number of promising options currently being studied for onsite use, including ground-source heat pumps ("geothermal"), biofuels for the central power plant, and solar electric power. Another contributor to the carbon footprint is transportation, including employee commuting, University-related travel, and the on-campus fleet. It is important to note that reducing carbon dioxide emissions requires a multi-faceted effort. Truly addressing sustainability requires a shift in economic models, behavior patterns, political perspectives, international relations, and rewards systems. A combination of social, economic, and energy policies will ensure that the University will succeed in cutting emissions to the levels required given the current scientific consensus.

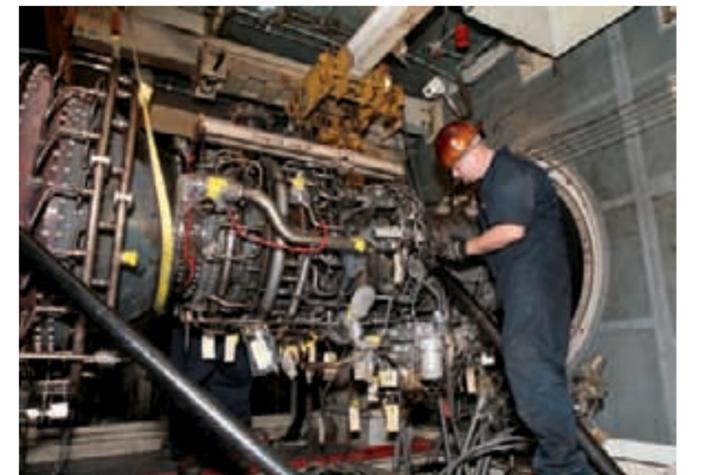
INTEGRATION WITH ACADEMIC PROGRAMS

Sustainability at Princeton enjoys very close ties with academic programs. In fact, students and faculty are a critical driving force behind important campus initiatives.

With support from the Office of Sustainability, campus-based research projects are increasingly being integrated into courses, the results of which will provide data for both the ongoing campus assessment program as well as the overall sustainability movement. Recent or upcoming class projects include an evaluation of impervious surface area changes on campus over time, studies to evaluate the effectiveness of vegetated rooftops ("green" roofs) for insulation and rainwater filtration, sustainable agricultural practices, and strategies for communicating these issues to the general public.



Princeton's cogeneration system typically runs at about 78 percent efficiency compared to the local power grid efficiency of about 40 percent.



Biodiesel testing

Infrastructure is the invisible, literal lifeblood of a campus. A well designed set of support systems allows a campus to grow sustainably and efficiently, making it possible to use limited resources to better support the core mission of the institution.

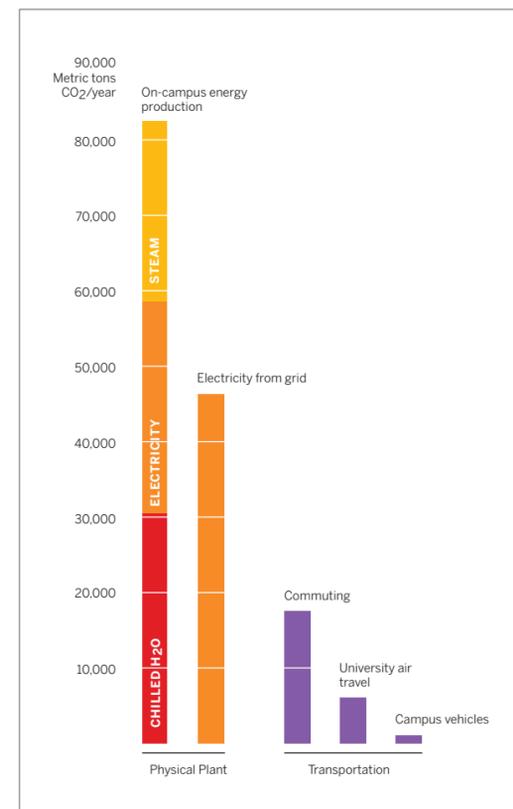
—MICHAEL MCKAY,
VICE PRESIDENT FOR FACILITIES

ADDRESSING GREENHOUSE GAS EMISSIONS

Scientific consensus indicates that developed nations must control emissions within the next decade and reduce emissions dramatically by 2050 to avoid the worst consequences of climate disruption. Reducing greenhouse gas emissions on campus involves all areas of campus operations, but is primarily focused on heating, cooling, electricity, and transportation. The goal of sustainability efforts in this arena is to reduce emissions to 1990 levels while the campus expands dramatically.

Energy efficiency

The Campus Plan recognizes that the first step toward curbing emissions is conserving the energy resources the University currently uses. Examples include: lighting retrofits featuring specialized sensors and more efficient bulbs, research into advanced technologies such as highly efficient LED lighting, tests of alternative lighting such as solar concentrator skylights, window upgrades, replacement of leaking steam traps, steam and chilled water pipe insulation, installation of low-flow bathroom fixtures, and upgraded metering. Princeton's conservation programs benefit from additional programmatic support provided by many student educational initiatives such as "Pull the Plug," a program encouraging students to turn off all sources of power in their rooms when leaving for breaks.



Princeton's greenhouse gas emissions, 2006



On-campus thermal energy storage plant



Geothermal well drilling at Lawrence Apartments

Alternative energy

The campus will soon benefit from aggressive research into zero- or low-carbon energy sources such as geothermal, biodiesel from sustainable sources, and solar electric power. In addition to the geothermal system at Lawrence Apartments, Princeton has already committed to a 400-kilowatt solar panel array on one of its Forrestal Campus warehouses. Consultants are conducting a ground source heat pump (geothermal) study for the main campus to assess its potential for increasing heating and cooling capacity without burning additional fossil fuels. The University is also testing the feasibility of including biodiesel as a fueling option for the central plant.

Transportation

Commitment to a sustainable transportation infrastructure will impact not only the quality of the campus environment, but also that of the region. Commuter miles, all University-related travel, and the on-campus fleet are included in Princeton's transportation emissions inventory as well as small motors used in vehicles caring for the grounds. Cars and delivery vehicles contribute pollutants, require large amounts of impervious paved surfaces, infringe on pedestrians, and cause expensive deterioration of roadways. However, vehicles are also essential, especially for emergency needs, so careful transportation planning is critical as the campus becomes denser. To this end, the Campus Plan has recommended ways to discourage single-occupant driving, enhance links to public transportation, support carpools and emergency ride home programs, and implement transportation demand management strategies.

CONSERVATION

Green construction and renovation

The University requires sustainability performance in its new buildings and major renovations as outlined in the Sustainable Buildings Guidelines. These guidelines require, among other things, a minimum level of energy performance in the building design that is 50 percent better than national code requirements (ASHRAE 90.1). The benefits of an efficient building include downsizing all mechanical systems, reducing the energy demands of the building, and decreasing greenhouse gas emissions. The guidelines also require life cycle cost analysis of major proposed building systems and innovative green design options as well as evaluation of all aspects of building design and performance, from stormwater management to materials choices. The University currently uses the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) checklist to help guide that process, with the goal that every building and major renovation achieve, at minimum, the equivalent of LEED Silver.

Creating high-quality pedestrian and cyclist environments

Promoting quality pedestrian and cyclist environments across the campus not only reduces dependency on vehicles and pollution in the air and on the ground, but also encourages increased physical activity for better health. To achieve these improvements the Campus Plan proposes: extending the existing pedestrian and cyclist circulation network to new areas of campus and employee residential clusters near campus; improving the network in areas where it is deficient; enhancing existing pathways; and instituting an extensive program of landscape design and wayfinding improvements.

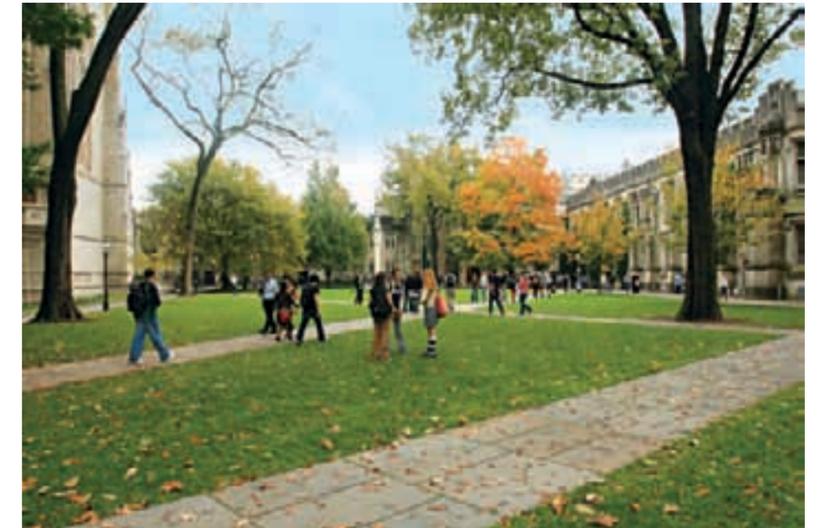
Growing vibrant landscapes

Natural and cultivated landscapes across campus play a critical role in maintaining a healthy ecosystem. While plantings and vegetation keep soils healthy, they also contribute to cleaner air and water, provide shading and improve energy efficiency for buildings, and provide habitat for New Jersey wildlife. The Campus Plan embraces the opportunity to integrate the campus more fully into the local natural landscape through restoration efforts and additional plantings. Robust natural landscapes provide pervious surfaces, thereby improving groundwater recharge, preventing soil and stream bank erosion, and protecting nearby surface waters.

The Campus Plan proposes an extensive series of design improvements that include strategic woodland plantings in degraded areas and stream restoration. Historically, Princeton has irrigated minimally on campus, instead relying on robust plantings that require little maintenance, chemical input, and watering. This approach is a historically sustainable one, requiring far less fossil fuel input than extensive annual or sensitive specialty plantings. While limited specialty plantings are an integral part of the campus character, Princeton will maintain its traditional approach to general landscaping. Goals will emphasize: preserving native soils, increasing pervious surfaces, installing plantings adapted to the local climate and soil types that



In the U-Bikes program, students repair abandoned bicycles and loan them to the University community



McCosh Courtyard

Princeton has a long and rich tradition of sustainable landscapes—a tradition that will be reinvigorated over the next ten years. Systems of collecting and distributing rainwater to irrigate plantings naturally, using native plants in logical ways that don't require chemical fertilizers and pesticides, and restoring and expanding our green areas and woodlands are key strategies for our stewardship of a sustainable campus.

— NATALIE SHIVERS,
ASSOCIATE UNIVERSITY ARCHITECT

require minimal maintenance, favoring organic approaches, and irrigating as an exception rather than a rule. The end result is a campus landscape resilient to most weather fluctuations and therefore more sustainable, efficient, and cost-effective. In keeping with these goals, new buildings on campus are being strategically placed over existing parking lots to enhance green spaces and minimize impervious surface area.

Improving water quality and ecological balance

The Campus Plan identifies stormwater management as one of the most critical and strategic means to promote campus sustainability. Although the campus looks and feels very “green,” large areas of impervious parking lots, roadways, and roofs contribute to increasingly overtaxed stormwater basins, eroded stream banks, polluted water, puddles on campus pathways, and flooding. The proposed landscape-based approach to stormwater management relies on bio-engineered techniques rather than hard infrastructure that disturbs the landscape.

Dining services and sustainable food systems

Dining Services has set specific targets for purchasing improvements. Current initiatives include buying: ecologically friendly seafood in partnership with the Monterey Bay Aquarium Seafood Watch program; fairly traded and socially responsible coffee; expanded organic produce selections; hormone-free and grass-fed meat options; and more local Jersey Fresh produce.

Dining Services also intends to minimize landfill waste by diverting food scraps to a local pig farm, using Green Seal Certified cleaners, and installing high-efficiency dishwashing equipment. The department has also been a key partner, working closely with students and the Office of Sustainability, in the launching of Princeton’s first student-run organic garden. Students were instrumental in creating the campus’ first farmers market, initiated in 2007.



Students at Mathey dining hall



Student organic garden at Forbes College

Green purchasing

Procurement of goods for the campus is a vital part of operations. It is also a source of influence on the consumer market. One of Princeton’s most aggressive green purchasing initiatives is its 100 percent post-consumer chlorine-free recycled paper policy for all standard printing and copying on campus. The goal is to reach 90 percent campus compliance in 2008 with this policy, up from a 2007 compliance rate of about 72 percent. In 2007, this program resulted in an emissions savings equivalent to keeping 40 cars off the road per year.

Conservation of potable water resources

Drinking-quality water is typically used for a wide range of functions on campus, from irrigation and toilet flushing to water fountains and showers. As the campus grows, unless the University conserves, the campus will increase its demands on local resources. The goal of the Campus Plan is to conserve potable water and test alternatives. At the new Chemistry and Butler College building projects, Princeton is installing rainwater capture and reuse systems for, in the case of Butler, irrigation, and in Chemistry, for flushing toilets. Other conservation efforts in all new construction and renovations include installation of low-flow showerheads, toilets, and faucet fixtures, as well as water-free and ultra-low-flow urinals. Students in WaterWatch and Greening Princeton are actively involved in water conservation education in the residence halls and in the larger campus community.

Recycling and reuse

Princeton currently recycles approximately 38 percent of all household items, including bottles, cans, cardboard, paper, scrap metal, and food scraps. The goal is to reach at least 50 percent by 2012. Strategies to increase recycling rates include introducing more uniform and visible labeling for all containers, expanding receptacle locations, and augmenting year-end recycling services for student move-out. With a 38 percent recycling rate, the University consistently performs better than any other Ivy League school in total recycling and per capita recycling. Contributing to these efforts, Forbes and Mathey colleges recently chose to refinish rather than replace most of their dining hall furniture. Student ecology representatives (“Eco-Reps”) also help in the effort through active leadership in the residential colleges.



On campus farmers market

COMMUNICATING SUSTAINABILITY

Sustainability initiatives are never fully successful until local and national communities learn about them and what they can achieve. In an effort to engage the student body in communicating its experiences in sustainability, the Office of Sustainability began the Princeton Student Environmental Communication Network (SECN) in the fall of 2006. Students learned how to produce professional-level radio programs that were subsequently aired nationally and on regional radio networks. The program is being developed into a spring 2008 student-initiated course that will cover both radio and video production as well as academic study of ethics in journalism and the development of the environmental communication field. The long-term SECN goal is to establish a true network, engaging institutions of higher education across the nation. The “Sustainability at Princeton” website was launched in 2007 and can be found at www.princeton.edu/sustainability.

THE CAMPUS AS AN ENVIRONMENTAL LABORATORY

There’s a good chance that sometime last winter, a team of undergraduates measured the heat escaping from the windows of a campus building, while inside, a group of professors and graduate students huddled together, discussing ways to strengthen international agreements to control global climate change. Such is the nature of environmental studies at Princeton—investigations that span a wide spectrum of disciplines, from the sciences to the humanities, and which operate across a wide range of scales, from the local to the global. Moreover, if the findings of the undergraduates result in more energy-efficient windows on campus, while the deliberations of the faculty members and graduate students result in a more effective successor to the Kyoto Protocol, then both groups will have fulfilled the University’s pledge of service to the nation and the world.

Interest in environmental issues at Princeton is on the upswing, as reflected by growing enrollment in courses with environmental themes, increased participation in campus organizations devoted to environmental causes, and more and more research projects devoted to understanding and solving environmental problems. We have seen such upswings before, but what distinguishes the current one is the way in which it permeates our campus.

Two years ago Princeton became the first major university to switch entirely to recycled paper for all our basic uses. Observant diners may note that virtually all of the seafood served at campus dining facilities now comes from sustainably harvested species, the result of a partnership between Dining Services and student activists. The University has made energy efficiency a requirement in the design of new buildings. Meanwhile, faculty and students continue to study a wide range of environmental issues relevant to their daily lives and to international policy. Which is preferable—organic produce that is flown in from California or conventionally-grown produce from here in New Jersey? How does air pollution in China affect public health in the United States? Will the increased use of biofuels result in the destruction of tropical forests?

The bottom line is that we have far to go in our efforts to address environmental issues on campus and around the world. There is no justification for complacency. But there is plenty of reason for optimism.

David Wilcove
Professor of Ecology and
Evolutionary Biology and Public Affairs