

The Impact of Princeton University













Education and Innovation Enterprise and Engagement

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Table of Contents

Executive Summary	2
Introduction	12
Part One: Educating Students for the Future	16
Part Two: Research at Princeton—a Foundation for the Future	22
Part Three: Princeton and the Innovation Economy	30
Part Four: The Impact of University Spending	38
Part Five: Community Engagement at Princeton	54
Part Six: Growth and Sustainability	64

Princeton is noted for its strengths in undergraduate teaching and research



Executive Summary



One of America's oldest educational institutions, Princeton University is ranked among the world's leading teaching and research universities. The University is noted for its strengths in undergraduate teaching and its research in areas as diverse as genomics, neuroscience, high-energy physics, public policy, economics, financial engineering, and climate change.

Princeton's impact, however, extends well beyond its programs of teaching and research. The University is located in several communities in central New Jersey and it contributes in a variety of ways to the continued growth of the economy and to the vitality of civic and cultural life in the Princeton area, in New Jersey, and beyond.

In order to assess its contribution to the Princeton area, Mercer County, and the State of New Jersey, the University asked Appleseed—a consulting firm with extensive experience in economic and community impact analysis—to undertake a wideranging analysis of Princeton's impact. This report presents the results of Appleseed's analysis.

Educating Students for the Future

The education of both undergraduate and graduate students is at the core of Princeton's mission.

- In the fall of 2007, 7,225 students were enrolled at Princeton University, including 4,845 undergraduates and 2,380 graduate students.
- In 2007, approximately 15 percent of all Princeton undergraduates came from communities across New Jersey. Other students came from the other 49 states and the District of Columbia and from more than 90 other countries.
- More than 55 percent of Princeton's undergraduates receive financial aid, with an *average* grant for students on aid of more than \$33,000.



- In 2007, more than 6,000 Princeton alumni (people with undergraduate or graduate degrees, or both) were living in New Jersey.
- Princeton's academic programs provide both undergraduates and graduate students with the knowledge and skills they need to succeed in an economy that is increasingly knowledge-driven, global, and entrepreneurial—and that increasingly requires an ability to think and work across boundaries. The University also prepares them for active engagement in their communities, in civic life, and in the arts. Examples of innovative crossdisciplinary programs include:

Princeton's **Integrated Science Curriculum**, launched in 2004, which prepares students to work in a world in which the most important scientific advances are likely to occur through collaboration across the various science disciplines.

The Keller Center for Innovation in Engineering Education, which was established in 2005 to provide the University's engineering students with social, economic, and environmental context for the careers they will pursue after graduation, and encourages non-engineering students to enroll in engineering classes. The Keller Center is part of Princeton's School of Engineering and Applied Science, which offers more than 20 courses that engage hundreds of students from outside of the engineering school each semester. A recent gift will encourage greater linkages between engineering and the humanities.

The **Bendheim Center for Finance**, which offers an undergraduate certificate in finance. The program, which helps students develop an understanding of the financial dimensions of whatever field they choose to work in, awards about 100 certificates each year.

The **Program in Science, Technology, and Environmental Policy** (STEP), which is based in the Woodrow Wilson School of Public and International Affairs with strong ties to the Princeton Environmental Institute, teaches undergraduate and graduate students to address problems of science and technology policy with the tools of political and economic analysis.

Princeton a Foundation for the Future

As a major research university, Princeton is a long-time contributor to America's position as the world leader in science, innovation, and social science research. Princeton in fiscal year 2007 spent \$218.8 million on research—more than 90 percent of which was funded through federal grants and contracts. While most of this research was in the natural sciences and engineering, Princeton also receives millions of dollars for social science and humanities research from federal and private sources.

• Notable research centers and programs at Princeton include:

The **Princeton Environmental Institute**, where University researchers from multiple disciplines work on topics such as the development of clean energy technologies and developing new approaches to predicting the course of climate change.

The **Princeton Institute for the Science and Technology of Materials** (PRISM), a multidisciplinary center that aims to develop a better understanding of materials, working not only across disciplines, but also with industry researchers.

The **Princeton Plasma Physics Laboratory**, a federally funded laboratory managed by the University that is among the world's leading centers for fusion energy research.

Drawing on the research capabilities and commitment to public service of the Woodrow Wilson School's faculty and students, the **Policy Research Institute for the Region** (PRIOR) addresses public policy issues facing New Jersey, New York, and Pennsylvania. Its work has focused on areas as diverse as school finance, transportation, the impact of immigration, and dealing with climate change.

- The University also contributes to economic and intellectual growth through research partnerships with New Jersey companies. The University's research partners during recent years have included large, established firms such as Merck, Johnson & Johnson, and the Sarnoff Corporation; and younger, entrepreneurial companies such as Global Photonic Energy Corporation of Ewing and Sensors Unlimited of Princeton.
- The University partners with New Jersey-based universities and foundations to research social policy and health issues. New Jersey research partners include the Robert Wood Johnson Foundation, Rutgers University, and the New Jersey Department of Health and Senior Services.



Princeton and the Innovation Economy

One of the ways universities stimulate a community's or a region's economy is by working with local entrepreneurs and the broader business community to translate new knowledge into new products, businesses, and jobs. Collaborative relationships among University researchers and local companies play an important role in this process, but Princeton also supports programs that specifically encourage the use of its intellectual capital to generate growth.

- Between 2002 and 2007, the University entered into 119 patent license and option agreements with private companies and institutions for use of Princeton's intellectual property, resulting in 225 licensed technologies.
- University licensees include a number of New Jersey technology companies, such as Lawrencevillebased Generation Biotech, Manalapan-based Access Optical Networks, and Princeton-based Celator Pharmaceuticals.
- Princeton alumni and faculty also have founded businesses in New Jersey in a wide range of industries.
- From its beginnings in the 1970s, the **Princeton Forrestal Center** in Plainsboro and South Brunswick Townships has evolved into one of the country's most successful university research and office parks. The Forrestal Center now has 6.5 million square feet of office space, with more than 190 businesses that collectively employ more than 11,000 people. It also provides housing, hotels, retail establishments, and more than 600 acres of permanent open space.

The Impact of University Spending

Princeton University generates more than \$1 billion in revenues (endowment earnings, gifts and grants, tuition payments, federal research funds, etc.)—more than 98 percent of which comes from sources outside the Princeton area, and most of which is spent within New Jersey on payroll, purchasing, construction, and other University purposes.

- During fiscal year 2007, Princeton University employed 5,256 people, of whom 88 percent worked full-time. The University's payroll in 2007 totaled approximately \$358 million, with an additional \$113 million spent on employee benefits.
- Salaries and wages paid to University employees who live in the Princetonarea zip codes totaled \$184 million— 51 percent of the University's total payroll. About 4 percent of all employed residents in the Princetonarea zip codes worked for the University.



- In fiscal year 2007, Princeton University spent \$82 million on purchases of goods and services (other than construction) from New Jersey vendors, including \$29 million paid to businesses located within the Princeton area, and \$15.3 million paid to vendors located in other Mercer County zip codes.
- Princeton also generates jobs and economic activity through its investments in University facilities. In fiscal year 2007, the University spent \$100 million on capital construction and major maintenance projects with New Jersey contractors, including \$17.6 million paid to construction firms located in the Princeton area, and \$10 million paid to contractors located in other Mercer County zip codes.
- Some of the money paid to the University's suppliers and contractors is used by these companies to buy goods and services from *other* local businesses. Similarly, University employees (and people who work

for its contractors and suppliers) use part of their earnings to buy goods and services from local businesses. It is estimated that through these "multiplier effects," Princeton's spending on payroll, purchasing, and construction in fiscal year 2007 generated:

\$295 million in additional economic activity and more than 1,740 full-time equivalent jobs (FTEs) throughout Mercer County; and

Approximately \$465 million in economic activity and 2,780 FTEs throughout the state (including Mercer County).

 Combining the direct, indirect, and induced effects of Princeton's spending on payroll, purchasing, and construction, it is estimated that in fiscal year 2007, the University directly accounted for \$725 million in economic activity and 7,608 FTEs in Mercer County; and \$980 million in economic activity and 9,380 FTE jobs throughout New Jersey.

Student and Visitor Spending

- In 2007, it is estimated that offcampus spending by Princeton University students totaled nearly \$34 million. This spending directly supported approximately 550 FTEs —most of them in the Princeton area. Through the multiplier effect, offcampus student spending generated an additional \$17.5 million in economic activity in Mercer County and 130 FTEs.
- An estimated 718,000 people visited the Princeton campus in 2006–07 for athletic events, alumni events, Commencement, theater and other performances, as well as academic conferences and various other purposes.

- It is estimated that off-campus spending by visitors from outside Mercer County totaled approximately \$37 million during the 2006–07 academic year.
- When we combine the impacts of University, student, and visitor spending, it is estimated that Princeton directly and indirectly accounted for

\$833 million in output and 8,951 FTEs in Mercer County; and

\$1.09 billion in output and 10,655 FTEs throughout New Jersey.

State and Local Taxes, Payments, and Other Support

- In 2007, Princeton withheld \$14 million in state income taxes from the wages and salaries paid to its employees and paid \$1.35 million in energy taxes and fees.
- University spending on payroll, purchasing, and construction indirectly generated approximately \$21 million in additional taxes paid to the State of New Jersey by University employees, suppliers, contractors, and their employees.
- At the local level, the University pays property taxes on numerous properties, some of which qualify to be tax-exempt. It also pays a variety of user fees, such as sewer and water fees. In fiscal year 2007, Princeton

paid a total of \$10.15 million in taxes and fees to municipalities and school districts in the Princeton area and to Mercer County.

- In addition to these taxes and fees, the University makes voluntary payments to several local government entities. These payments totaled \$1.145 million in fiscal year 2007.
- In 2007, Princeton Forrestal Center in Plainsboro and South Brunswick Townships—one of the region's most successful office and research parks generated more than \$29 million in property tax payments to local governments and school districts.

Community Engagement at Princeton

Beyond those impacts that can be measured in terms of dollar amounts, jobs, or businesses started, Princeton students, faculty, and staff members, as well as the University itself as an institution, are engaged in a variety of activities and programs that contribute to the quality of life in Princeton-area communities.

- The University offers several programs that provide local elementary and high school students with opportunities for educational enrichment, such as the **Princeton University Preparatory Program**, for high-achieving, economically disadvantaged high school students from Ewing, Princeton, and Trenton public schools.
- The University provides opportunities for educational enrichment to adults living in the community. Through its Community Auditing Program, the University allows community residents to sit in on selected courses. In 2006–07, 1,212 people audited courses at Princeton, of whom 578 were residents of Princeton Borough or Princeton Township.
- The **Program for Exceptional High School Students** allows qualified students from area public and private high schools to enroll in classes at the University. In the fall of 2006, 42

students from 23 schools, including the Ewing, Hamilton, Lawrence, Princeton, South Brunswick, Trenton, and West Windsor-Plainsboro school districts, were enrolled in the program. Students took classes in science, world languages, math, and computer science.

- During the 2006–07 academic year, 34 percent of Princeton students reported that they participated on a weekly basis in some form of community service, representing more than 106,000 service hours over the course of the academic year.
- The Community-Based Learning Initiative (CBLI), a collaboration of students, faculty, and community-based organizations, encourages Princeton students to combine classroom learning with related work in the community. In 2006–07, 300 students enrolled in 17 CBLI courses, working with more than 50 community organizations in New Jersey.



- As a cultural center, the University helps make Princeton and the surrounding communities more attractive places to live and work through various events and activities made available to local residents. McCarter Theatre Center, for example, is one of New Jersey's leading performing arts centers. McCarter offers more than 200 performances each year, showcasing theater, dance, concerts, and other special events. In 2007, approximately 180,000 people attended performances at the McCarter and Berlind theaters.
- The University also works as a partner with local governments and community organizations on a variety of programs and initiatives.
- In 1967, the University was a founding member of **Princeton Community Housing**. Today,

Princeton Community Housing provides affordable housing to residents of five housing developments with a total 463 units.

- In 2007, the **Greening Princeton Farmers' Market** was established on campus by University students to support local farmers, promote local agriculture, and educate students and community residents about sustainable food.
- Local high schools and community groups frequently use University sports and athletic facilities, totaling more than 2,000 hours in practice, competition, and recreation in 2007.
- Local schools, institutions of higher education, religious groups, and others use University facilities for large-scale gatherings such as graduation ceremonies, concerts, and other special events.



Growth and Sustainability

Over the next five to 10 years, the University's role in the local economy is likely to increase.

- The University estimates that by fall of 2012, undergraduate enrollment will increase to 5,200—an increase of 7.3 percent over the 4,845 undergraduates enrolled at Princeton in 2007. Graduate enrollment is projected to increase by an average of 1 percent annually, to approximately 2,600 in 2016.
- Through 2016, Princeton is planning to add approximately 2 million square feet to its physical plant. Planned new construction includes:
 - New buildings for the arts, including performance space and a satellite location of the Princeton University Art Museum;
 - New buildings for neuroscience, chemistry, and a new center for energy and the environment; and
 - New housing for graduate students, faculty, and staff.
- In order to allow both the University and the community to realize the benefits of growth while avoiding potential adverse impacts, Princeton has undertaken a series of initiatives based on its comprehensive Sustainability Plan and is seeking to address community concerns about traffic circulation—especially through improvements being proposed as part of its Arts and Transit Neighborhood near Alexander Street and University Place. The Sustainability Plan has three major components: greenhouse gas reduction; resource conservation; and research, education, and civic engagement. The plan will help the University reduce carbon emissions to 1990 levels by 2020.

As it has been for many years, Princeton University today is a significant contributor to the economic, civic, and cultural vitality of the Princeton area, the surrounding region, and the State of New Jersey. The University's strengths in undergraduate and graduate education and in critical areas of research, its track record in supporting the translation of new knowledge into the innovations that drive the economy, and its plans for the continuing development of its campus, all suggest that the investments Princeton is making today can help provide a strong foundation for continuing prosperity tomorrow.



The University contributes in a variety of ways to the continued vitality of the economy

Introduction



Princeton University is one of America's oldest educational institutions, and is consistently ranked among the world's leading universities. It is highly regarded for the quality of the education it provides its students, particularly through its commitment to undergraduate teaching. At the same time, Princeton is known worldwide for the quality of its research in areas as diverse as genomics, neuroscience, high-energy physics, public policy, economics, financial engineering, and climate change. Through cross-disciplinary study, faculty members and students engage in the discovery and transfer of new knowledge.

Princeton's impact, however, extends well beyond its programs of teaching and research. The University is located in several communities in central New Jersey and it contributes in a variety of ways to the continued vitality of the economy—in the Princeton area, in New Jersey, and beyond. It does so by supporting the growth of both new and existing businesses and by providing services to Princeton-area communities. Moreover, the University is in its own right a significant employer; and it generates additional jobs and economic activity through its purchases of goods and services, and through its investments in both new and existing facilities. It also plays an important role in the region as a hub for a wide range of cultural events and opportunities.

In order to assess its contribution to the economy of the Princeton area, Mercer County, and New Jersey, the University asked Appleseed—a consulting firm with extensive experience in economic and community impact analysis—to undertake a wideranging analysis of Princeton's impacts. This report presents the results of Appleseed's analysis.

Organization of the report

Part One of the report discusses Princeton's role as an educational institution—one that prepares its students to live and work in an increasingly integrated, technologically complex, fast-changing world. Part Two examines the multiple ways in which University research contributes to economic growth. Part Three of the report describes how the University contributes to the creation and growth of new businesses, especially in central New Jersey.

Part Four of the report focuses on the economic impact of University spending for payroll, purchasing, and construction, and of spending by Princeton students and visitors to the University. It also discusses the University's impact on state and local government finances. Part Five describes the multiple ways in which the University engages with communities in the Princeton area—as an educational and cultural resource, through volunteer and community-based learning programs, and more.

Finally, Part Six of the report looks to the future of the University's relationship to the Princeton area, the surrounding region, and the state, highlighting in particular several reasons why the University's economic impact is likely to increase during the course of the next decades and highlighting as well several aspects of Princeton's campus plan and its new sustainability plan that are likely to have particular impact on the surrounding community.





Figure 1: Map showing the zip code boundaries that approximate the Princeton area and Mercer County

A note about geography

In this report, we discuss the University's impact at three different geographic levels—the Princeton area, the rest of Mercer County, and the rest of New Jersey. However, because much of the data used in the report is available only by zip code, we defined these three areas by zip code, as follows:

- Princeton-area zip codes (08536, 08540, 08542, 08544, and 08550);
- A group of zip codes that roughly correspond to the portion of Mercer County that lies outside the Princeton-area zip codes; and
- The remainder of New Jersey.

A map defining these areas appears above. When we discuss the impact of University, student, and visitor spending on the economy of Mercer County (in Part Four of the report), we include only the Princetonarea zip codes that are within Mercer County,¹ and the zip codes that correspond with the rest of Mercer County. We do not include zip code 08536 (Plainsboro), which is included in our definition of the Princeton area, but is not in Mercer County. The education of both undergraduate and graduate students is central to the University's mission

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Part One: Educating Students for the Future

Princeton is a leading research university—but one with a particularly strong commitment to teaching. The University seeks to achieve "the highest level of distinction... in the education of graduate students. At the same time, Princeton is distinctive among research universities in its commitment to undergraduate teaching." The education of both undergraduate and graduate students is thus central to the University's mission—and to its role in supporting the continued growth of the knowledge economy.

Princeton students and alumni

In the fall of 2007, 7,225 students were enrolled at Princeton University, including 4,845 undergraduates and 2,380 graduate students. Students come to Princeton from every state in the U.S. and more than 90 countries. In 2007, approximately 15 percent of all Princeton undergraduates came from communities across New Jersey.

More than ever, the opportunities that Princeton offers are available to students from a broad range of socioeconomic backgrounds. More than 55 percent of Princeton's undergraduates receive financial aid, with an average grant for students on aid of more than \$33,000.

Just as a significant number of students come to Princeton from communities across New Jersey, a significant number of Princeton alumni remain in the state. In 2007, more than 6,000 Princeton alumni (people with undergraduate or graduate degrees, or both) were living in New Jersey, including more than 1,600 alumni who were living in the Princeton-area zip codes.

Preparing students for an economy built on knowledge and innovation

As Princeton president Shirley M. Tilghman noted in a recent Commencement address, "the University seeks to instill in its students a broad intellectual curiosity that embraces open-mindedness coupled with critical thinking; respect for our moral and cultural inheritance coupled with a capacity for innovation and change..." At the same time, it offers students "ample opportunity to explore and then deepen their academic interests."

Princeton's academic programs provide both undergraduates and graduate students with the knowledge and skills they will need to succeed in an economy that is increasingly knowledge-driven, global, and entrepreneurial— and that increasingly requires an ability to think and work across disciplines. The following are just a few examples of innovative programs.

Providing a wider context for engineering

The Keller Center for Innovation in Engineering Education was established in 2005 to provide the University's engineering students with social, economic, and environmental context for the careers they will pursue after graduation, and encourages non-engineering students to enroll in engineering classes. The Keller Center is part of Princeton's School of Engineering and Applied Science, which offers more than 20 courses that engage hundreds of students from outside of the engineering school each semester. A recent gift will encourage greater linkages between engineering and the humanities.

One of the center's courses, **High-Tech Entrepreneurship**, draws both undergraduate and graduate students from a wide range of disciplines. The course addresses the challenges of evaluating new technologies and business ideas for commercial feasibility, determining how best to implement those ideas, attracting the resources needed to start a new venture, preparing comprehensive yet focused business plans, structuring and negotiating important business relationships, and managing early stage companies toward "launch velocity."

Other Keller Center courses include:

Entrepreneurial Engineering, Lab in Conservation of Art, The Science and Technology of Decision Making, and Engineering Projects in Community Service.

- Launched in 2004, Princeton's **Integrated Science Curriculum** embodies a new approach to introducing undergraduates to the study of science. Students who enroll in the program take a series of interdisciplinary courses in their first, second, and third years, all of which combine elements of physics, chemistry, biology, and computer science, and sometimes other disciplines as well. The program is rigorously quantitative-training students to see mathematics as the "common language" of science. While students still major in a single discipline, the Integrated Science Curriculum teaches them to think (and gives them experience in working) across disciplines. The program's goal is to prepare students to work in a world in which the most important advances are likely to occur not within traditional fields of science, but through collaboration across them.
- One of the most popular undergraduate programs in Princeton's School of Engineering and Applied Science is **Operations Research and Financial Engineering**. Students use quantitative tools to develop simulations and models that can help solve problems in risk management,

resource optimization, computational biology, securities, pricing, econometrics, and more. Recent undergraduate senior theses have included an analysis of airline check-in and baggage handling and strategies for participants in the European Union's CO₂ market.

- The Program in Applied and **Computational Mathematics** applies quantitative analysis to problems in the sciences, economics, and engineering. Students may apply for graduate admission or to participate in a highly competitive undergraduate certificate program. The program is centered around core faculty members and associate faculty from a wide variety of departments at Princeton. Students develop computational modeling and simulation techniques in a variety of fields, including biology, engineering, and economics. Undergraduates typically apply for the program at the beginning of their junior year and conduct an independent study under the guidance of an adviser to complete the certificate.
- The **Program in Translation and Intercultural Communication** educates students about the important role that translation plays across academic fields and in cultural

understanding. Though the program takes linguistic translation as its base and has a strong international flavor, it also encourages students to study other forms of discourse (the languages of different scholarly disciplines, for example), and seeks to foster lively debates among the social sciences, natural sciences, humanities, material sciences, engineering, and the arts. The program includes professors in 17 departments, programs, and centers.

- Established in 1997, the **Bendheim Center for Finance** offers an undergraduate certificate in finance. The program, which helps students develop an understanding of the financial dimensions of whatever field they choose to work in, is among the most popular of the University's undergraduate certificate programs, with about 100 certificates awarded each year.
- The Woodrow Wilson School of Public and International Affairs (Woodrow Wilson School) helps undergraduate and graduate students prepare for careers in government and public policy. The school accepts about 90 undergraduates in their junior year who want to focus on domestic and international policy



issues ranging from urban economic development to the environment. In 2008, the Center for Health and Wellbeing at the Woodrow Wilson School started offering an undergraduate certificate program in global health and health policy. The Woodrow Wilson School also offers master's degrees in public affairs and public policy, and a Ph.D. in public affairs.

• The Woodrow Wilson School's **Scholars in the Nation's Service** is a highly selective initiative that prepares students for careers in the

U.S. federal government. Beginning in a student's junior year, the program includes a summer federal government internship, approximately two years of federal government service after college, and a master's degree in public affairs from the Woodrow Wilson School.

• Through a partnership with the UMDNJ-Robert Wood Johnson Medical School and the Graduate School of Biomedical Sciences at Rutgers University, students can pursue the Ph.D. portion of an M.D.-Ph.D. at Princeton.



Preparing students for a more sustainable future

The **Princeton Environmental Institute (PEI)** offers an undergraduate certificate in environmental studies. The fivecourse program, open to students from all disciplines, includes courses on land-use, biodiversity, energy and climate, regional planning, and environmental policy. The program culminates in a senior thesis, and PEI also helps fund students' innovative field research and summer internships. Through the Universitywide Grand Challenges initiative, PEI administers a program that funds interdisciplinary faculty research and course development and student internships and research that seek to solve significant global challenges related to climate and energy, sustainable development, and infectious disease.

At the Woodrow Wilson School, the Program in Science, Technology and Environment Policy (STEP) offers students a variety of opportunities to develop their interests in environmental policy and sustainability. Undergraduates at the Woodrow Wilson School can pursue individualized programs focusing on these areas and undergraduates in other schools can earn a Certificate in Science, Technology, and Environmental Policy. At the graduate level, students can earn both M.P.A. and Ph.D. degrees with a concentration in STEP.

Princeton's focus on sustainability is also reflected in the University's announcement in 2008 of a new undergraduate certificate program in sustainable energy. To earn a certificate, students are required to complete six courses on energy technology, climate change, and related topics, as well as a senior research project.

A commitment to excellence

A report prepared in 2005 for the National Academy of Sciences noted:

We live in a knowledge-intensive world. "The key strategic resource necessary for prosperity has become knowledge itself, in the form of educated people and their ideas."The focus of global competition is no longer only on manufacturing and trade, but also on the development and recruitment of "the best and the brightest" from around the world.²

Princeton University serves as a nexus for scholars, researchers, students, and decision makers to explore ideas and address the needs of society. Its educational mission is to prepare students to help address the challenges of the future. It aims to enroll the most capable students from all parts of the world, irrespective of their financial circumstances, and to provide them with an educational experience that strengthens their intellects, sharpens their skills, and expands their horizons—aiming in all that it does for the highest possible standards of excellence.

2. Committee on Prospering in the Global Economy of the 21st Century, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future* (Washington: National Academies Press, 2005), p. 162.





Part Two: Research at Princeton a Foundation for the Future

Research conducted at America's universities has been a vitally important factor in the growth of the U.S. economy. Today, it is still one of America's greatest sources of competitive advantage.

> Since the Industrial Revolution, the growth of economies throughout the world has been driven largely by the pursuit of scientific understanding, the application of engineering solutions, and continual technological innovation. Today, much of everyday life in the United States and other industrialized nations... is the product of investments in research...³

Princeton has long contributed to America's position as the world leader in science and innovation. Research at Princeton also directly strengthens New Jersey's economy—and, in particular, the economy of the Princeton area.

- Each year Princeton attracts hundreds of millions of dollars in outside funding, most of which is spent locally.
- University research expands the boundaries of knowledge in areas that in the years ahead are likely to be continuing sources of innovation and economic growth.
- Through collaboration with corporate partners, University researchers support the growth of New Jersey companies both large and small.
- The "intellectual capital" created by University researchers provides a foundation for the creation of new products and services, new businesses, and new jobs.

This part of the report highlights Princeton's contributions in the first three of these areas. Part Three addresses the creation of new businesses.

^{3.} Committee on Prospering in the Global Economy of the 21st Century, *Rising Above the Gathering Storm*, p. 42.

External funding—creating jobs and economic activity in the Princeton area

Princeton's research attracts hundreds of millions of dollars annually in outside funding, most of which is spent locally. As Figure 2 shows, Princeton in fiscal year 2007 spent \$218.8 million on research—more than 90 percent of which was funded through federal grants and contracts. About 9 percent of Princeton's total spending on research in fiscal year 2007 was funded from private sources and less than 1 percent from state government sources.



Building a foundation for future economic growth

In the long run, however, the year-to-year impact of research spending on the local economy is less important than the role the University plays in developing the new knowledge that provides the foundation for future growth. Research centers and programs at Princeton are today conducting research in a number of areas that could in the future have—and in some cases are already having—a significant impact on the economy. For example:

- The Princeton Institute for the Science and Technology of Materials (PRISM) is a multidisciplinary center that aims to develop a better understanding of materials. Its approach emphasizes not only collaboration across disciplines, but also with researchers outside the University, especially in industry.
- More than 65 Princeton faculty are affiliated with the **Princeton Environmental Institute**, which provides a home for much of the University's work on climate change, sustainability, and related topics. The institute's research is conducted primarily through five programs:

The Carbon Mitigation Initiative, a

joint effort of Princeton, BP, and Ford Motor Company, aims to develop practical approaches to reducing or capturing carbon emissions.

The Cooperative Institute for Climate

Science, founded in 2003, is a joint effort of the University and the National Oceanic and Atmospheric Administration's Geophysical Fluid Dynamics Laboratory located in Plainsboro; its goal is to be a leader in understanding and predicting climate change, and "the co-evolution of society and the environment."

The **Energy Group** seeks to develop long-term solutions to energy problems through the collaboration of engineers and experts in energy policy.

The **Center for Environmental Bio-Inorganic Chemistry** focuses on the impact of trace chemicals on aquatic ecosystems.

The **Center for Biocomplexity** seeks to understand the organization of complex ecosystems.

• The Lewis-Sigler Center for Integrative Genomics was

established in 1999 to engage in both research and teaching at the intersection of biology and the more quantitative sciences, with a particular focus on effective use of the massive volumes of data that have been generated in the course of sequencing the human genome. The center brings together Princeton researchers from a variety of fields, such as molecular biology, chemistry, computer science, and chemical engineering.

The **Princeton Neuroscience Institute**, established in 2005, is devoted to the study of brain functions, the nervous system, and human behavior. At the institute's **Center for the Study of Brain**, **Mind, and Behavior**, researchers are seeking "to understand how the physical mechanisms of the brain give rise to the functions of the mind." The center brings together researchers from a variety of disciplines, including

Researching nuclear fusion as a safe, clean, and reliable source of energy

The **Princeton Plasma Physics Laboratory** (PPPL) is a national research center managed by the University under a contract with the U.S. Department of Energy. Its principal focus is on creating the base of scientific and technical knowledge needed to develop nuclear fusion as a safe, economical, and environmentally friendly source of energy.

Fusion research at Princeton dates to the 1950s, when the U.S. Atomic Energy Commission began to support the pioneering work of a team of researchers led by Professor Lyman Spitzer. Today, PPPL is located on an 88-acre site at the Princeton Forrestal Center, and employs 440 scientists and staff. Its fiscal year 2007 budget was about \$74 million.

One of the major research projects supported by PPPL researchers is an international program to develop an electricity-producing fusion power plant under construction in France called ITER. When operational, ITER is expected to generate 500 MW of fusion power—10 times more energy than would be required to heat plasma to the right temperature.

In addition to its role in fusion research, PPPL conducts basic and applied research in other areas. Under a series of contracts with the Department of Defense's Picatinny Arsenal (located in Morris County, New Jersey), for example, PPPL researchers have developed a laptop-based system called the Miniature Integrated Nuclear Detection System (MINDS) that can detect and identify radioactive materials for use in homeland security or transportation rule compliance.

The laboratory is the site of the University's graduate programs in plasma physics and plasma science and technology. The laboratory also conducts educational programs for schoolchildren and teachers, which are described in Part Five.

mathematics, physics, chemistry, molecular biology, neuroscience, and psychology, and provides a focal point for collaboration with several other universities, including Harvard, Cornell, the University of Pennsylvania, and the University of Medicine and Dentistry of New Jersey.

 In 2007, the University received a \$30 million gift to establish the McDonnell Center for Systems Neuroscience within the Princeton Neuroscience Institute. The center's research focuses on how information is represented in neurons and on neural dynamics—activity within and among nerve cells that occurs during decision making, planning, or while playing sports.

- Researchers at the Center for Information Technology Policy and the Princeton Architectural Lab for Multimedia and Security are working on several fronts to enhance the security of the Internet—from enhancing the security features of PDAs and cell phones to collaborating on the Global Environment for Network Innovation—a proposed network "test bed" that would allow researchers to experiment with ways to improve Internet operations, without affecting the Internet itself.
- A Princeton-led team of researchers from several universities has developed a technique called **flash nanoprecipitation**. They are now using it to create nanoparticles that can efficiently be delivered deep into human tissue. This new technology can potentially be used for more targeted and effective drug delivery, or to deliver imaging agents that will enhance the quality and accuracy of diagnostic imaging.
- Supported by a \$100 million gift from alumnus Gerhard Andlinger, Princeton in 2008 announced creation of the Andlinger Center for Energy and the Environment. Building on the University's strengths in engineering, science, and public policy, the new center will focus on research in areas such as improving energy efficiency and developing sustainable sources of energy.

While some researchers at Princeton are helping to provide the scientific and technological basis for future economic growth, others are focusing on issues that affect how the benefits of prosperity are shared, and how communities cope with change. For example:

• Princeton's **Center for Economic Policy Studies** conducts research on a broad range of economic and social issues. Recent topics have included: the impact of offshoring on the mix of jobs available to U.S. workers, and the implications of this changing mix for education in the U.S.; and the impact of Hurricane Katrina on the employment, education, and health of its victims.



• The Bendheim-Thoman Center for Research on Child Wellbeing conducts research on the needs of children in U.S. cities, especially those living in single-parent families, and on public policies that affect these children. Much of the work of its Fragile Families project is based on a longitudinal study of 5,000 children born in U.S. cities between 1998 and 2000.

- The Center on Migration and Development has conducted extensive research on the children of immigrants to the United States. Recent research has focused on factors that have led some children of low-income immigrant families to create "success out of disadvantage." Researchers at the Office of Population Research, under a grant from the Russell Sage Foundation, are studying new immigrant destinations.
- The Center for Arts and Cultural Policy Studies was created to improve the clarity, accuracy, and sophistication of discourse about the nation's artistic and cultural life. Its programs and activities are designed to create an infrastructure of welltrained scholars who have access to regularly collected information about cultural organizations, activities, and providers and who produce timely research and analysis on key topics in arts and cultural policy.



• The Policy Research Institute for the Region (PRIOR) addresses policy issues facing state and local governments in New Jersey, New York, and Pennsylvania. Its work has focused on areas as diverse as school finance, transportation, the impact of immigration, and dealing with climate change.

Research partnerships with New Jersey companies

The University contributes to economic growth through research partnerships with New Jersey companies—both large established firms and young, entrepreneurial companies. The partnerships represent one of the most important ways in which the knowledge developed at the University is shared with the private sector, and contributes to the region's, the state's, and the nation's economy. For example:

- Researchers at PRISM and in several academic departments have in recent years worked with the Sarnoff Corporation on several projects in micro-electronics and opto-electronics.
- In 2006, Merck committed \$5 million to create the Merck Center for Catalysis at Princeton. The center is headed by Professor of Chemistry David MacMillan, whose team has developed a new method

for assembling organic molecules that promises to reduce the cost of developing new drugs.

- Johnson & Johnson has for several years supported research in Princeton's Department of Psychology on reversing the effects of sleep loss on the production of brain cells.
- Researchers at PRISM are working with South Brunswick-based Princeton Scientific Instruments—

a firm that develops optoelectronics for astronomical and military uses—on the development of imaging technology to be used in the detection of missile plumes.

- The Princeton Operations division of Maryland-based Research Support Instruments, Inc., located in South Brunswick, develops new products in microelectronics and plasma physics. It works closely with several researchers in the University's Department of Mechanical and Aerospace Engineering.
- Universal Display Corporation, based in Ewing, is a leading developer of organic light-emitting diode (OLED) technology for use in flat-panel displays. The company has had a series of contracts and cooperative agreements with PRISM relating to OLED technology.
- Professor of Computer Science Perry Cook is working with colleagues at the University of British Columbia to develop audio and video-based cues for devices that can help stroke victims and other people with aphasia to communicate. The NIH-funded work could be used in devices manufactured by Lingraphica, a Princeton-based company.
- Princeton-based Sensors Unlimited Inc. has benefited from research collaboration with the University. Before being acquired by Goodrich Corporation in 2005, the company developed optoelectronic devices for NASA and other aerospace clients. The company's founder, Greg Olsen, was appointed in 2007 as the Keller Center for Innovation in Engineering Education's entrepreneur-inresidence.

Research partnerships with New Jersey institutions

The University partners with New Jersey-based universities and foundations to research social policy and health issues. Notable examples include:

- Researchers in the sociology department, in partnership with the Princeton-based Robert Wood Johnson Foundation, are at the forefront of researching immigration's impact on the healthcare system.
- Researchers at the University's Bendheim-Thoman Center for Research on Child Wellbeing have worked closely with officials in the **City of Newark** to develop strategies aimed at meeting the needs of the city's low-income families and children.
- In the 1990s, Szymon Suckewer, a professor of mechanical and aerospace engineering and the co-director of the Program in Plasma Science and Technology, developed femtosecond lasers with extremely short, precise pulses of light. He is leading a team of researchers at Princeton and the **University of Medicine and Dentistry of New Jersey** to develop eye surgery procedures that do not require an incision, termed FemtoLASIK.

- Jianqing Fan, a professor of operations research and financial engineering, is using statistical tools in his work with researchers at the Keck Center for Collaborative Neuroscience at **Rutgers University** to study the relationship between inflammation and neurodegeneration in patients with spinal cord injuries.
- The University received a total of nearly \$1 million in fiscal year 2007 from the New Jersey Commission on Science and Technology for stem cell research and the New Jersey Department of Health and Senior Services for cancer research.



Knowledge that generates growth

Princeton is a place where researchers pose and answer questions that help to generate scientific discoveries, technologies, and ideas that shape society. Basic research in areas such as theoretical physics may over time lead to major breakthroughs of profound significance to society (although in the near term, it is the quest for answers to basic questions, and not potential consequences, that drives such research). At Princeton, such foundational research occurs side by side with work that University researchers undertake, often in collaboration with corporate partners, that is aimed at solving specific practical problems.

Between these two ends of the spectrum, however, there lies a broad range of research that the late Donald Stokes, a former dean of Princeton's Woodrow Wilson School and a leading authority on science and technology policy, called "use-inspired basic research." This is the realm of scientific inquiry that uses the tools of basic research to answer fundamental questions—but is motivated in doing so by the need to address specific, real-world problems.⁴

Much of the research at Princeton—from the quest for cleaner forms of energy to the search for a deeper understanding of brain functions—falls into this category of use-inspired basic research. It is the area in which Princeton's research enterprise is growing most rapidly. And it is here that University research has perhaps the greatest potential to generate new economic growth—in the Princeton area, in New Jersey, and beyond.

4. Donald E. Stokes *Pasteur's Quadrant: Basic Science and Technological Innovation* (Washington, D.C.: The Brookings Institution, 1997), p. 73.

Technology transfer at Princeton has produced significant results

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Part Three: Princeton and the Innovation Economy



One of the most critical factors affecting a university's impact on a community's or a region's economy is how effectively the university, local entrepreneurs, and the broader community support the translation of new knowledge into new products, new businesses, and new jobs. The web of collaborative relationships among University researchers and local companies already described illustrates the importance of these connections, but there are also other ways in which Princeton supports and encourages the use of its intellectual capital to generate growth.

Technology transfer

The most formal way in which the University promotes new product and business development is by licensing the results of research to private companies for commercial use.

During the past several years, technology transfer at Princeton has produced some significant results. Between 2002 and 2007 (as shown in the table below), the University has:

- Filed 606 new U.S. patent applications;
- Been awarded 166 new U.S. patents;
- Entered into 119 patent license and option agreements with private companies and institutions for use
- of Princeton's intellectual property, resulting in 225 licensed technologies; and
- Assisted in the creation of 11 new companies started specifically to bring to the marketplace technologies initially developed at Princeton.

Table 1: Technology transfer activity, FY 2002–07

	2002	2003	2004	2005	2006	2007
Invention disclosures	104	82	94	75	106	76
New patent applications filed	101	117	98	80	103	107
Patents issued (U.S.)	-	45	38	27	30	26
Patents issued (international)	-	-	-	-	-	14
Patent license & option agreements	14	18	24	15	25	23
Technologies licensed	-	-	137	36	27	25
Start-up companies formed	-	-	4	3	2	2

In some cases, technology licensing agreements between the University and companies in New Jersey and other states have led to the introduction of significant new products. One such example is Alimta[™], a drug developed by Eli Lilly and Company that can help reduce the size of cancer tumors, including those resulting from malignant pleural mesothelioma.

It is not just established firms, however, that benefit from licensing agreements with the University. Young New Jersey companies that have licensed technologies from Princeton include:

- Generation Biotech, LLC—a Lawrenceville company, founded in 2000, that is developing a technology for extracting and analyzing genomic DNA.
- Access Optical Networks, Inc. —a Manalapan company that develops holographic storage systems for optical networks.
- **Celator Pharmaceuticals**—a privately held, Princeton-based bio-pharmaceutical company that is



working to develop more effective cancer treatments. (The company has to date attracted more than \$40 million in private investment.)

- Global Photonic Energy Corporation (GPEC) — a Ewingbased company that is engaged in the development of renewable energy technologies, with a particular emphasis on photovoltaic and hydrogen technology. GPEC has collaborated with University researchers on several projects, and in 2004 funded a prize that is awarded annually to the Princeton student doing the most innovative work in the field of solar energy.
- **InSitech**—an intermediary organization created to commercialize new technologies initially funded by Picatinny Arsenal. InSitech has licensed MINDS, a laptop-based radiation detection system (described in Part Two) developed at the Princeton Plasma Physics Laboratory.

Table 2: Partial listing of New Jersey-based companies founded by Princeton University alumni and faculty

Company	Location	Employees	Relationship
ALK Technologies	Princeton	135	Faculty
Atopia Research	Princeton	2	Faculty
Global Photonic Energy Corp.	Ewing	5	Faculty
Michael Graves & Associates	Princeton	92	Faculty
Mount Lucas Management Co.	Princeton	20	Alumnus
Nanonex	South Brunswick	13	Faculty
NanoOpto	Somerset	17	Faculty
Panoptic Studios	Hopewell Township	2	Faculty
Primis Technologies	Princeton	4	Alumni
Princeton Consultants, Inc.	Plainsboro	70	Alumnus
Princeton Power Systems	Plainsboro	17	Alumni
RMJM Hillier ⁵	Princeton	140	Alumnus
Signum Biosciences	South Brunswick	22	Faculty
Stan Allen Architecture	Princeton	5	Alumnus (now faculty)
TerraCycle	Trenton	30	Students
Ford 3 Architects	Princeton	7	Alumnus

5. Hillier Architecture merged with London-based RMJM in 2007.

Creation of new businesses by Princeton faculty and alumni

Beyond the formal process of technology transfer, Princeton faculty members and alumni have been actively involved over the years in starting new businesses in the region. Below are a few examples:

- ALK Technologies was founded in 1979 by Alain Kornhauser, a professor of operations research and financial engineering. Today, the firm, which is based in Princeton, is a leading supplier of information systems and services to transportation and logistics companies in the U.S., Europe, and Asia.
- **Princeton Consultants, Inc.** is a Princeton-based information technology and management consulting firm, founded by CEO Steve Sashihara in 1980, shortly after his graduation from the University.
- Mount Lucas Management Company, located in Princeton, was co-founded in 1986 by Frank Vannerson, an economist who earned his Ph.D. from Princeton. The company provides investment alternatives for institutional investors and high-net-worth individuals.
- **Panoptic Studios**, located in Hopewell Township, is a 3-D art and animation firm that provides computer-generated environments, animation, and special effects for games and video. The firm was founded in 1996 by Professor of Architecture Miles Ritter.

- Nanonex was started in 1999 by electrical engineering professor Stephen Chou, a pioneer in the field of nanotechnology. The company, which is located in South Brunswick, provides tools and services used in nanoprinting.
- **Princeton Power Systems (PPS)** was founded in 2001 by two Princeton engineering graduates, Mark Holveck and Eric Limpaecher, who are now the firm's chief technology officer and chief operating officer, respectively. A third Princeton graduate, Darren Hammell, is CEO, and the chairman of the PPS board, Ed Zschau, is a visiting professor of electrical engineering. PPS is engaged in the development of high-efficiency power conversion technology for use in industrial motors, wind turbines, solar power systems, and other applications.

It is noteworthy that these firms were not only born with "Princeton DNA," most of them continue to be involved actively with the University. They are part of a regional entrepreneurial community that retains strong ties to Princeton. Figure 3 shows the location of these firms—and other firms that have licensed technology from Princeton, or are engaged in research partnerships with the University.

- **TerraCycle** was started in 2001 by Princeton students Tom Szaky and Jon Beyer. The company sells organic plant food and fertilizers packaged in used milk, water, and soda bottles donated by volunteers nationwide. The company now operates a 20,000 square foot plant in Trenton, employs more than 30 people, and counts Home Depot among its retail customers.
- **Signum Biosciences**, based in South Brunswick, was co-founded in 2002 by Jeffry Stock, a professor of molecular biology, and Gregory Stock. The company is engaged in the development of innovative ways to treat diseases associated with aging.

Figure 3: Map of New Jersey selected companies with Princeton research partnerships or started by Princeton faculty or alumni


The Forrestal Center: A focal point for economic development

The Princeton Forrestal Center in Plainsboro and South Brunswick—one of the region's most important economic development assets—reflects the University's continuing commitment to the vitality of the Princeton-area economy.

The Forrestal Center was started in the 1970s as a planned development including office and research space, housing, hotels, retail establishments, and more than 600 acres of dedicated open space. Today it is one of the country's most successful university-based research and office parks, with 6.8 million square feet of space and 190 companies that together employ more than 11,000 people. The center has helped attract to the Princeton area major companies such as Bloomberg LP, Bristol Meyers Squibb, Credit Suisse, State Street Elan Pharmaceuticals, and Siemens Corporate Research.

The Forrestal Center is also the home of the Princeton Plasma Physics Laboratory, the Geophysical Fluid Dynamics Laboratory, and ReCAP, the Research Collections and Preservation Consortium—a joint project of the University, Columbia University, and the New York Public Library that can store up to 10 million library items on site.



The Forrestal Center's success in attracting companies (and prompting others to expand their existing operations) is in part due to Princeton's continuing investment in its infrastructure. Since the 1970s, the University has invested more than \$30 million in infrastructure on the Forrestal Campus. In March 2008, when Novo Nordisk announced that it would expand its U.S headquarters on the Forrestal Campus, Princeton's \$6 million investment in Campus Road—and its prospective investment in expanding the road—was instrumental in securing the project. The expansion is expected to bring about 400 new jobs to the area.

Growing new companies on Princeton's Forrestal Campus

While many of the companies at the Forrestal Center are Fortune 500 companies, three University-owned buildings on the Forrestal Campus, totaling approximately 37,000 square feet of space, function as informal incubators. The buildings house 15 small businesses in offices that range from about 150 to 8,500 square feet. Most of the businesses are affiliated with the University in some way—they either were started by alumni or faculty, are based in part on commercializing the University's technology, or operate through collaborations with Princeton faculty and research scientists.

Creating an environment for innovation

Princeton has been successful in transferring innovative ideas and technologies to the marketplace during the past two decades, and the expectation is that the University's ability to foster innovation may be even greater in the future.

Ten years ago, Princeton's "infrastructure" for encouraging and supporting the further development and practical application of innovative ideas was in a nascent stage. Since then, the University has moved on several fronts to encourage innovation and entrepreneurship.





- The University has strengthened its technology transfer function focusing not only on protection of the University's intellectual property, but also on assisting faculty members who are interested in developing new business ventures based on research conducted at Princeton.
- More than 1,000 Princeton students have completed Professor Ed Zschau's course in high-tech entrepreneurship, including the students who started Princeton Power Systems, currently located on the Forrestal Campus in Plainsboro.
- In 2007, Princeton appointed Greg Olsen as its first entrepreneur-inresidence, providing faculty and students with advice from a successful entrepreneur.
- In 2008, Princeton appointed Mike Lang as its first engineer-inresidence, dedicating 50 percent of his time to working with faculty, students, and corporate collaborators on solving engineering problems that could be barriers to product commercialization.

These and other efforts suggest that the University's impact on new business development, in the Princeton area and beyond, is likely to increase in the years ahead.

Princeton develops human capital, creates new knowledge, and supports businesses

Part Four: The Impact of University Spending



By helping to develop the state's human capital, create new knowledge, and support the growth of both new and existing businesses, Princeton University contributes to the ongoing development of the New Jersey economy, and in particular to the economy of the Princeton area. But it also has a significant impact as a major employer, a major buyer of goods and services from New Jersey companies, and a sponsor of construction projects both large and small.

The University generates more than \$1 billion in revenues (endowment earnings, gifts and grants, tuition payments, federal research funds, etc.)—more than 98 percent of which comes from sources outside the Princeton area and most of which is spent within New Jersey on payroll, purchasing, construction, and other University purposes.

This part of the report describes and analyzes the University's impact as an employer, as a buyer of goods and services, and as a sponsor of construction projects. It also estimates the economic impact of off-campus spending by Princeton students and by visitors to Princeton, and discusses the University's impact on local government finance in the Princeton area.

Figure 4: Princeton FY 2007 net revenues (in thousands)



(Sources: Princeton University Report of the Treasurer, 2006–07; Memo to the Chairman of the U.S. Senate Committee on Finance, February 22, 2008)

The University as an employer

During fiscal year 2007, Princeton University employed 5,256 people,⁶ of whom 88 percent worked full time. The University's payroll in 2007 totaled approximately \$358 million, with an additional \$113 million spent on employee benefits.

Princeton is one of the largest private employers in Mercer County. Even in challenging economic times its workforce tends to be stable, or even grow as new academic initiatives are undertaken.

In 2005, Princeton University accounted for more than 16 percent of all private employment⁷ in Princeton Borough and Princeton Township and more than 10 percent of all private employment in Princeton Borough, Princeton Township, Plainsboro, and West Windsor combined. The great majority of Princeton employees work on the University's main campus, although approximately 440 are employed at the Princeton Plasma Physics Laboratory (described in Part Three), which is located at the Forrestal Campus in Plainsboro.



Although Princeton University employed 5,400 employees during FY 2007, this report only includes the 5,256 employees who were non-visiting and benefits-eligible faculty and staff.

7. Calculation is based on municipal level data from the New Jersey Department of Labor and Workforce Development. The most recent year for which data is available is 2006.



Figure 5: Full-time and part-time employment and payroll, by place of residence, FY 2007 (in thousands)

Of the 5,256 people employed by the University in 2007, 39 percent lived within the Princeton-area zip codes. Salaries and wages paid by Princeton to its employees who live in the Princeton-area zip codes totaled \$184 million— 51 percent of the University's total payroll. About 4 percent of all employed residents in the Princeton-area zip codes worked for the University.

Another 1,430 employees lived throughout the rest of Mercer County zip codes—27 percent of the total University workforce. Wages and salaries paid to these employees totaled more than \$75 million—21 percent of the University's total payroll.

Princeton is notable not only for the number of people it employs, but for the quality of University employment. During fiscal year 2007, Princeton spent \$112.6 million on benefits for University employees, such as:

Health, dental, and vision care insurance; Defined-contribution pension plans; Life, disability, and long-term care insurance; Flexible spending accounts for health, dependent care, and transportation needs; Child care assistance; and

Tuition assistance for employees and their children.

In addition to providing child care subsidies, Princeton provides space on its campus for two privately operated child care centers, with a combined capacity of about 200 children. Because of strong demand for child care among its employees, the University is now planning a third center.

Princeton University also owns and manages approximately 600 rental housing units for faculty and staff, ranging in size from efficiency and studio apartments to four- and five-bedroom single-family houses. All rental units are within a reasonable walking distance of campus.

The impact of University purchasing and construction

In addition to employing thousands of Princeton-area residents, the University supports local businesses and jobs in the Princeton area, the rest of Mercer County, and elsewhere in New Jersey through its spending on purchases of goods and services and on construction.

Purchasing goods and services from local vendors

In fiscal year 2007, Princeton University spent \$82 million on purchases of goods and services (other than construction) from New Jersey vendors. More than \$29 million was paid to businesses located within the Princeton-area zip codes, and \$15.3 million to vendors located in the rest of the Mercer County zip codes.

We estimate that in 2007, University spending on goods and services directly supported approximately 210 full-time equivalent jobs (FTEs) with businesses in the Princeton-area zip codes, 185 additional FTEs throughout the rest of the Mercer County zip codes, and another 150 FTEs in the rest of the State of New Jersey.

Local dining services purchasing

As part of Princeton's commitment to ensuring that its operations are environmentally sustainable, University Dining Services continuously reviews food purchases to take advantage of opportunities for local purchasing. For example, when a locally grown product is priced within 5 percent of the same product from other sources, the University will purchase locally. As of fall 2007, the University bought a quarter of all food locally (as measured by dollar value). For certain categories, Princeton purchases more than half of its products locally such as baked goods (93 percent), whole eggs (100 percent), and dairy products (52 percent).

The University also has partnered with The Bent Spoon, a Princeton-based ice cream shop and bakery, as well as small world coffee, to supply outlets on campus. Demand from on-campus sales allowed The Bent Spoon to double its production.



The impact of University construction

Princeton also generates jobs and economic activity through its investments in University facilities. In fiscal year 2007, the University spent \$100 million on capital construction and major maintenance projects with New Jersey contractors and vendors. Major projects completed or under way in 2008 included:

- Sherrerd Hall, a new building for the School of Engineering and Applied Science's Department of Operations Research and Financial Engineering (ORFE). The building will provide critical academic and computer studio space for a growing department.
- Lewis Library, a new 87,000square-foot building, designed by Frank Gehry, that integrates the collections of several science departments. The building provides a focal point for students, faculty, and staff engaged in computerbased research and pedagogy via the instructional activities of the

Educational Technologies Center, the New Media Center, and the research activities of the Princeton Institute for Computational Science and Engineering.

• **Butler College**, a new 112,000square-foot four-year residential complex that will house approximately 290 undergraduate students. Varying in height from two to four stories, the complex will contain communal facilities in the lower-level commons connecting all buildings. These facilities will include a café, study areas, and seminar rooms.

Princeton also supports new development and construction activity in the region by leasing space off campus. An example of this is the development of a 120,000-square-foot building by Boston Properties at 701 Carnegie Center in West Windsor. The University expects to move approximately 250 employees into the building when it opens in late 2009.

Whitman College

In July 2007, Princeton completed the construction of Whitman College, a 281,000-square-foot, \$135 million four-year residential college. The new building includes living space for 500 students, including social, dining, and recreation space, common rooms, a library, a theater, and a digital photo lab.

The design and construction of Whitman College reflects Princeton's commitment to sustainable development. For example, Princeton elected to construct Whitman College from stone for several reasons:

- Aesthetically, it continues the visual continuity of the collegiate gothic architectural vocabulary;
- Stone is an inherently sustainable material in terms of energy used to obtain it, its low maintenance and high longevity, and ultimately in disposal at the end of its useful life, if and when that occurs;
- All of the project's fieldstone and roofing slate was quarried within 500 miles of the site;
- The stone and concrete block walls establish a thermal lag, reducing heat loads in the winter and cooling loads in the summer.

Further, the operable windows are triple-pane glass and maximize the use of sunlight to increase energy efficiency. More than 150 trees were planted to enhance the landscaping around the new college.





University spending on construction and major maintenance projects in 2007 included \$17.6 million paid to contractors from the Princeton-area zip codes. It is estimated that in 2007, University spending on construction and major maintenance generated more than 140 FTEs with contractors located within the Princeton-area zip codes, an additional 80 FTEs throughout the rest of the Mercer County zip codes, and another 585 FTEs with contractors throughout the rest of New Jersey.

The figures cited in the preceding paragraph only take into account the University's direct payments to prime contractors; they do not include work done on campus by local subcontractors who work under nonlocal prime contractors. A February

2008 review of payroll data for two campus projects, Sherrerd Hall and the Butler College project, indicated that 83 percent of the workers employed on these projects by various subcontractors were from New Jersey, and 20 percent lived in Mercer County. (The trades represented on the two projects in February 2008 included masons, carpenters, glaziers, and laborers.) The figures cited in the preceding paragraph thus likely understate the total number of New Jersey and Mercer County residents who were employed on University construction projects.

Princeton's investments in both new and existing University facilities have been a continuing source of business for New Jersey–based architecture and professional service firms. For instance, during 2007, the University engaged 12 such New Jersey–based firms—including three from Princeton.

In the long run, the importance of University construction to the local economy goes well beyond the creation of local contracting opportunities and construction jobs. Investment in the development of new facilities, and in the upgrading of existing facilities, enhances the University's ability to fulfill its mission of education, research, and service to the community—a topic that is addressed further in a later section of this report.

Measuring the multiplier effect

The jobs and economic activity generated by University spending on payroll, purchasing, and construction are not limited to the direct impacts cited above. Some of the money Princeton University pays to its local suppliers and contractors is used to buy goods and services from other local companies, and those companies in turn buy goods and services from still other local businesses.

University employees, and the employees of its suppliers and contractors, similarly use part of their earnings to buy a wide variety of goods and services —housing, utilities, food, personal services, and other household needs—from local businesses; and the employees of *those* businesses do the same.

Using a tool of economic analysis called an input-output model, it is possible to measure these "indirect and induced" (or "multiplier") effects of University spending. We estimate that in the Mercer County and the Princetonarea zip codes located within Mercer County, Princeton's spending on payroll, purchasing, and construction in fiscal year 2007 generated:

- Approximately \$295 million in economic activity;
- 1,740 FTEs throughout the county zip codes, and
- \$75.9 million in employee compensation.

Statewide (including the Mercer County zip codes), Princeton's spending generated:

- Approximately \$465 million in economic activity;
- 2,780 FTEs; and
- \$133.7 million in employee compensation.

Table 3 summarizes the direct, indirect, and induced impacts of Princeton's spending in the Mercer County zip codes and throughout New Jersey. In addition to the 5,256 people it employed directly, University spending directly and indirectly generated 2,352 FTEs with other employers in the Mercer County zip codes, and generated \$367.0 million in economic activity throughout the county.

Table 3: Direct, indirect, and induced impacts of Princeton's spending, FY 2007 (\$ millions)

	Direct University spending		Indirect and induced impact of spending by vendors, contractors, and employees		
	Payroll	Purchasing/ construction	Impact of vendor and contractor spending	Impact of employee spending	Total impact
Mercer County zips	\$357.8 million	\$ 72.0 million	\$ 42.6 million	\$252.3 million	\$724.8 million
	5,256 jobs	616 jobs	323 jobs	1,413 jobs	7,608 jobs
New Jersey	\$357.8 million	\$157.1 million	\$126.4 million	\$338.6 million	\$979.9 million
	5,256 jobs	1,347 jobs	872 jobs	1,905 jobs	9,380 jobs

Student and visitor spending

In addition to the University's own spending, off-campus spending by Princeton University students and by visitors to the University also generates economic activity in the Princeton area.

The impact of student spending

In the fall of 2007, 4,845 undergraduate and 2,380 graduate students were enrolled at Princeton University. The impact of student spending is determined in part by whether students live on campus, in off-campus University housing, or elsewhere in Princeton and the surrounding communities. During the 2006–07 academic year, approximately 97 percent of undergraduate students lived on the Princeton campus. Among graduate students, 21 percent lived on campus, 57 percent lived in off-campus University housing, and 22 percent lived elsewhere in Princeton and the surrounding communities.

Table 4 provides estimates of annual off-campus spending by undergraduate and graduate students in the Mercer County zip codes, based on whether they live on or off campus. These estimates are based on detailed data on student spending that were collected in 2006 through a survey conducted by Economics Research Associates.⁸ We estimate that in 2007, off-campus spending by Princeton students totaled nearly \$34 million, most of which was spent within the Princeton area.

Accommodation	Spending per student	Total spending
Undergraduate		
University housing	\$ 3,418	\$15,445,167
Off-campus housing	10,887	1,652,095
Graduate		
On-campus housing	4,074	1,343,811
Off-campus University housing	8,317	7,317,344
Non-University housing	23,968	8,181,829
Grand total		\$33,940,246

Table 4: Annual off-campus student spending by place of residence, 2007

Using the IMPLAN economic modeling system (a software package and database for estimating local economic impacts), we estimate that this spending directly supported approximately 550 FTEs—most of them in the Princeton-area zip codes. Through the multiplier effect, off-campus student spending generated an additional \$17.5 million in economic activity in Mercer County and 130 FTEs.

^{8.} Student spending calculations are based on the Student Retail Services Survey conducted by Economic Research Associates for Princeton University.

Table 5: Impact of student spending in Mercer County, 2007



	Mercer County				
Employment impacts (FTE)					
Direct	548				
Indirect	58				
Induced	71				
Total	677				
Output					
Direct	\$33,940,000				
Indirect	8,275,000				
Induced	9,200,000				
Total	\$51,415,000				
Employee compensation					
Direct	\$13,789,000				
Indirect	3,142,000				
Induced	3,265,000				

The impact of visitor spending

In addition to drawing faculty members, researchers, and students to the Princeton area, the University also attracts visitors who spend money within the local economy. Princeton University estimates that the number of people visiting its campus in 2006–07—for athletic events, alumni events, Commencement, theater and other performances, academic conferences, and various other purposes—totaled approximately 718,000.

Off-campus spending by these visitors is estimated to have totaled approximately \$37 million during the 2006–07 academic year. Most of this visitor spending consists of payments to restaurants, hotels, and shops within the local Princeton area.

Using IMPLAN, we estimate that visitor spending directly supported 522 FTEs—most of them in the Princeton area. Through the multiplier effect, visitor spending is estimated to have generated an additional \$19.9 million in economic output and 144 FTEs throughout Mercer County.

	Mercer County			
Employment impacts (FTE)				
Direct	522			
Indirect	67			
Induced	77			
Total	666			
Output				
Direct	\$37,30,000			
Indirect	9,988,000			
Induced	9,902,000			
Total	\$57,190,000			
Employee compensation				
Direct	\$14,591,000			
Indirect	3,742,000			
Induced	3,514,000			

Table 6: Impact of visitor spending inMercer County, 2007



State and local taxes, payments, and other support

Despite its tax-exempt status, Princeton's operations generate tax revenues for state and local government in several ways.

Direct and indirect state taxes

At the state level, the most direct impact of Princeton's operations is through the personal income taxes paid by University employees. In 2007, Princeton withheld \$14 million in state income taxes from the wages and salaries paid to its employees. The University also pays energy-related taxes and fees to the state, totaling \$1.35 million in 2007.

Based on the employee compensation figures generated by IMPLAN, we can estimate the taxes paid by the University's vendors, contractors, and their employees, by students and visitors, and through the multiplier effect. We estimate that the University generated about \$36 million in New Jersey taxes in fiscal year 2007. This analysis is summarized in Table 7.

Table 7: Summary of Princeton University tax impacts on the State of New Jersey, 2007

Type of tax	Amount
Princeton University employees' personal income taxes withheld	\$14,000,000
Taxes paid by vendors, contractors, and their employees	13,000,000
Direct taxes generated by student and visitor spending	3,200,000
Energy taxes and fees paid by the University	1,350,000
Taxes generated through the multiplier effect	6,300,000
Total	\$36,100,000

University payments to local governments and school districts

At the local level, the University pays real property taxes on any properties it owns that are not used for tax-exempt purposes, and it also pays a variety of user fees, such as sewer and water fees. In fiscal year 2007, Princeton paid a total of \$10.15 million in taxes and fees to municipalities and school districts in the Princeton area and to Mercer County.

The total tax payment in both Princeton Borough and Princeton Township included taxes on housing for faculty, staff (including the official residence of the University president), and graduate students. Under New Jersey state law, this housing might qualify as tax-exempt. The University nevertheless paid full taxes on these properties voluntarily, in order to ensure that they generate the revenues needed to support the schools and other local government services that might be used by residents of University housing. The University's policy is to remove a building from the tax rolls only when 100 percent of the building is used for educational purposes. This goes beyond what the University is required to do under state law, which exempts colleges and universities from paying taxes on any portion of a building used for academic purposes.

In addition to these taxes and fees, the University makes voluntary payments to several local government entities (primarily to the Borough of Princeton). These payments totaled approximately \$1.145 million in fiscal year 2007.

For the Borough of Princeton, Princeton Township, and Princeton Regional Schools, direct payments by the University in fiscal year 2007 (including taxes, fees, and voluntary payments) accounted for a significant share of all locally raised revenues.

Borough of Princeton—16.4 percent of all revenues raised locally (excluding state aid, federal funding, and other outside funding sources);

Princeton Township—7.6 percent; and

Princeton Regional Schools-6.2 percent.



The University also supports public services in the Princeton area in other ways as well. These include:

- In 2007, Princeton spent about \$53,200 maintaining 2.8 miles of public roads in Princeton Township and about \$19,000 maintaining about one mile of public roads in Princeton Borough.
- In 2007, the University made the second of two \$50,000 contribution payments toward the construction of the Plainsboro Public Library.
- In 2007, Princeton made the first of two \$25,000 contribution payments to the Arts Council of Princeton

for the construction of their new building. This \$50,000 contribution was in addition to an earlier \$100,000 commitment to the project.

- In 2007, the University contributed \$20,000 to the University Medical Center at Princeton.
- In 2007, the University contributed \$20,000 to the Princeton Fire Department.
- The University makes a \$35,000 annual contribution to the Princeton First Aid and Rescue Squad.

- In recent years the University has contributed \$500,000 to the Princeton Public Library; \$500,000 to the Princeton Regional Schools; \$50,000 to the Princeton Charter School; \$325,000 for Monument Drive restoration and landscaping, and lighting of the Princeton Battle Monument; \$150,000 toward the new Albert Hinds Community Plaza; \$40,000 for park improvements; and \$25,000 to the Princeton Recreation Department toward construction of a community skatepark.
- Under a mutual aid agreement with the Plainsboro Fire Department, the Princeton Plasma Physics Laboratory (PPPL) is the first agency called to assist the Plainsboro Fire Department at the Windrows care facility and the Barclay Square Development located across Route One from PPPL. It also provides backup to the Plainsboro

The Forrestal Center: Supporting local communities through property taxes

In addition to its role in attracting private investment to the region, the Princeton Forrestal Center is a major generator of property tax revenues for municipalities and school districts. In 2007, the center generated about \$29.0 million in property taxes, including \$3.2 million to the Township of Plainsboro in the form of local municipal and open space tax. Although it makes up about 27 percent of the Town of Plainsboro's land area, the center accounted for about 37 percent of the town's property tax revenues in 2007. Emergency Medical Services organization and assists the Plainsboro Police in training the township's Community Emergency Response Team (CERT)—a federal disaster preparedness training program.

- PPPL is in the initial stages of drafting a mutual aid agreement with the Princeton Fire Department.
 PPPL responds to most confirmed emergencies in the downtown
 Princeton area and is a resource in responding to areas further away from the center of Princeton.
- Princeton pays the borough and the township for building permits, affordable housing fees, plan reviews, and other fees and licenses. In 2006– 07, the University paid the borough \$264,000 in fees and the township \$726,000 in fees. The University also paid sewer connection fees totaling \$78,000.

In addition to the amounts it pays directly to local governments, school districts, and other public agencies, the University also generates revenues for local government indirectly. Visitors to the University, for example, provide revenues through the payment of hotel occupancy taxes and parking fees.

Princeton's impact on local government finance—adding more than it subtracts

In the Princeton area—as in other cities and towns where colleges and universities are located—the question of whether these nonprofit institutions are shouldering a "fair share" of the cost of local government services has been a subject of long-running debate. Both in Princeton and elsewhere, the issue is not easily resolved. One way to view the issue is by making comparisons to contributions by comparable institutions to comparable communities. Making "apples to apples" comparisons is difficult in Princeton's case because most of its peer institutions are in communities with characteristics quite different from Princeton Borough and Princeton Township, and most communities comparable to the borough and township do not have universities comparable



to Princeton. Nevertheless, a straight comparison between the amounts that Princeton pays to local communities and the amounts paid by several other leading private research universities suggests that Princeton is among the leaders in terms of the total amounts paid to local governments and school districts; and if Princeton's contributions are measured not in absolute terms but as a percentage of local budgets, the comparison is even more favorable.

Another way to view the issue is to ask whether the payments the University makes to local government entities are sufficient to offset the demand for local government services that is attributable to the University. On the basis of the available evidence, the answer to that question appears to be "yes."

For example, in fiscal year 2007 the University paid a total of nearly \$3.42 million in taxes to the Princeton Regional School District. According to data provided by the school district, approximately 85

children who lived in University-owned housing were enrolled in the district's schools during the 2006–07 school year. Based on reported average costs per pupil, it is estimated that it cost the district approximately \$1.357 million to educate these children—far less than the \$3.42 million the University contributed.

Similarly, University properties generated a total of approximately 400 emergency service responses by the Princeton First Aid and Rescue Squad during fiscal year 2007. The approximately 400 responses by the Princeton First Aid and Rescue Squad represented about 15 percent of the squad's 2,679 responses in 2007. Based on Princeton's annual \$35,000 contribution to the Rescue Squad and the addition of direct reimbursement from those who were



transported, the reimbursement for service exceeded the costs incurred by the First Aid and Rescue Squad. In addition, in a given year, about half of the Princeton First Aid and Rescue Squad's volunteers are Princeton University students. The University also has contributed toward the purchase of new vehicles by the First Aid Squad, most recently assisting with a \$155,000 contribution toward the purchase of a new ambulance. Each summer the University provides a housing subsidy so that up to four students can stay on campus and continue volunteering for the Rescue Squad during the summer months.

Similar analyses could be performed on other areas of the municipal budgets. In some areas, the University does not make use of a particular service; one example in the borough would be trash collection, where the borough collects from local residents but the University collects all of its own trash. In other areas, the University does benefit from services (public road maintenance would be an example), but the proportionate benefit may be more than offset by the combination of tax payments, fees, voluntary contributions, and other revenues generated by the University, such as parking fees paid by University visitors.

Local officials and community residents sometimes suggest that universities and other nonprofit institutions should be required to base their contribution to local governments not on the cost of services they use, but on the assessed value of their property.

In concept, this is equivalent to suggesting that these institutions should no longer be tax-exempt. Whether government should continue to encourage the support and development of educational institutions through tax-exemption is a question beyond the scope of this analysis. But what this approach ignores is the impact that universities have on the value of taxable properties in their communities.

In perhaps the most thorough analysis of this issue undertaken to date at a U.S. university, the Anderson Economics Group (AEG) in 2006 analyzed the impact of Michigan State University (MSU) on local property values and tax revenues. The study compared property values and real property taxes in East Lansing, where MSU's campus is located, to those in three Michigan communities that do not have universities, but that in other respects are similar to East Lansing. Even after assuming that without the university, what is now the tax-exempt MSU campus would have been fully developed with taxable uses, AEG found that the total value of taxable property in East Lansing was 109 percent higher *with* the university than it would have been *without* the university.⁹ Depending on local circumstances, higher taxable property values can allow communities to choose between higher levels of municipal services, lower tax rates, or some combination of both.

While there has to date been no similar study of Princeton University's impact on the value of surrounding taxable properties and thus on tax revenues, there is at least some anecdotal evidence suggesting that the presence of the University increases the value of nearby properties. For example, NAI Fennelly, a leading broker of commercial office space in the Princeton area, reports that in December 2006, office rents in Princeton Borough and Princeton Township generally ranged from \$26 to \$40 per square foot, while those in Plainsboro and West Windsor ranged from \$20 to \$33 per square foot; and those in Ewing, Lawrenceville, northern Hamilton, and Hopewell ranged from \$18 to \$30 per square foot.

Further research and analysis would be needed to determine whether as is the case in East Lansing—the total value of taxable property in Princeton Borough and Princeton Township is in fact greater with the University than it would be had the land the University now occupies instead been devoted to taxable residential or commercial uses. But at a minimum, it appears likely that any revenues these communities lose as a result of the University's tax-exempt status are to a significant degree offset by increases in the value of taxable property associated with proximity to the Princeton campus.

Moreover, while alternative uses of the land now occupied by the Princeton campus might generate more in *direct* property tax revenues than the University now pays, they might also generate much greater demand for local government services; and their impact on the economy of the community and the region might be much smaller than the impact of the University (as described in this report). This would especially be the case if what is now University land had instead been developed for residential use.

9. Anderson Economics Group, "Net Fiscal Impact of Michigan State University on the City of East Lansing," June 2006.



Princeton contributes to the educational, cultural, and civic life of the community

Part Five: Community Engagement at Princeton



Princeton University's impacts on communities in the Princeton area are not limited to those that are directly measurable in economic or financial terms, such as the number of local residents employed, purchasing from local companies, or payments to local government. Princeton students, faculty, staff members, and the University itself are engaged in a wide range of activities and programs that contribute to the quality of life in these communities.

This part of the report views the University's engagement with the community from several perspectives and presents selected examples to illustrate this partnership. The topics addressed include:

- The University's role in expanding educational opportunity for area residents and educators;
- The University's role as a cultural resource for Princeton-area residents;
- The services that students provide to the community, either as volunteers or through community-based learning programs; and
- The University's involvement in collaborative efforts aimed at addressing specific community needs.

The University as an educational resource

The opportunities for learning that the University provides to Princeton-area residents extend beyond those available to undergraduate and graduate students. The University also offers a number of programs that provide local elementary and high school students—and their teachers—with opportunities for educational enrichment. For example:

- Since 2001, the **Princeton University Preparatory Program** (PUPP) has provided educational opportunities for high-achieving, economically disadvantaged high school students from Ewing, Princeton, and Trenton public schools. PUPP offers a combination of full-time summer programs, along with enrichment activities during the school year, aimed at enhancing students' chances for admission to, and success in, some of the nation's most selective colleges. Approximately 24 high-school freshmen are selected each year to participate in this three-year program.
- The Program for Exceptional High School Students allows qualified students from area high schools to enroll in classes at the University. In the fall of 2006, 42 students from 23 schools, including the Ewing, Hamilton, Lawrence, Princeton, South Brunswick, Trenton, and West Windsor-Plainsboro school districts, were enrolled in the program. Students took classes in science, world languages, math, and computer science.



- The Woodrow Wilson School annually hosts approximately 175 central New Jersey high school juniors and seniors to a lunch and a lecture on U.S. politics and international relations.
- The **Cotsen Children's Library** has free, year-round public programs for children of all age groups including interactive book readings, discussions, and book review writing.
- Art for Families is a program for children aged five through nine hosted by the Princeton University Art Museum each Saturday that includes a gallery talk and a related art project. The program draws more than 1,000 children and their parents annually.
- Nearly 1,000 students from 11 school districts attended the University's Science and Engineering Expo (SEE) in 2007. Now in its fourth year, the expo provides middle school students with hands-on science and engineering activities and demonstrations. Each year, approximately 100 University professors, students, and volunteers participate in the program.
- The **Princeton University Materials Academy (PUMA)**, in an effort to improve science education for underrepresented high school students in Trenton, Hamilton, and Lawrence, brings 30 to 50 students to PUMA for two to three weeks every summer to study science and engineering.
- Princeton Engineering Education for Kids (PEEK) provides outreach to local elementary schools. Classroom visits help to educate youth about engineering and put special emphasis on encouraging children (especially girls) to explore the fun of engineering.

- Each year, the **Princeton Plasma Physics Laboratory (PPPL)** offers a limited number of research internships for students from central New Jersey high schools. PPPL also hosts **Science on Saturdays**, which presents lectures by specialists on diverse scientific topics such as geophysics, scientific computing, and the science and application of global positioning systems.
- The **Plasma Academy**, sponsored by PPPL, is an intensive summer

program for high school students that focuses on plasma, fusion, and energy.

• The **Princeton University Art Museum** annually hosts four thirdgrade classes from the Trenton school district, with each class making eight visits to the museum. The participating students (about 100 each year) then create artwork in their school studios for an exhibit at the Trenton Board of Education at the end of the school year.



The University also provides opportunities for educational enrichment to adults living in the community.

- Through its Community Auditing Program, the University allows community residents to sit in on selected courses. In 2006–07, 1,212 people took non-credit courses at Princeton, of whom 578 were residents of Princeton Borough or Princeton Township.
- Through its **Program in Continuing Education**, the University admits residents of the community into its undergraduate and graduate courses for credit on a selective basis. During 2006–07, 53 students were enrolled in the program.

Princeton also offers professional development programs for teachers at New Jersey elementary and high schools.

• **QUEST**, a professional development institute for elementary and middle school teachers, focuses on laboratory experiments and field experiences in science, math, and technology. For nearly 20 years, participants have enrolled in a two-week summer session and workshops throughout the year with Princeton University faculty and staff. In 2006, 50 teachers participated in the program.

• In 2006, 30 teachers participated in **CONNECT-ED**, a program in partnership with Rider University that brings K-12 teachers of science and math to Princeton's campus for two weeks in the summer.

- PPPL's **Plasma Camp**, a full-time, five-day summer program, provides an opportunity for high school physics teachers to learn about current topics in plasma physics and fusion research, conduct their own experiments, and develop lesson plans for use in their own classes. PPPL also provides equipment and software to participating teachers for use in their classes.
- In partnership with 13 school districts and several private schools, including the Princeton Regional School District, the **Teachers as Scholars** program holds seminars for teachers that are taught by University faculty and staff.
- The James Madison Seminars, sponsored by the University's James Madison Program in American Ideals and Institutions, include six two-week seminars for middle and high school teachers of American history primarily from New Jersey public schools. Some 250 teachers participate in the seminars each

summer for three years, covering a range of topics on American constitutional history in sessions led by scholars from numerous institutions.

- Cotsen in the Classroom is a free educational program in which Cotsen staff members visit K-5 classrooms within a 10-mile radius of the University campus and share materials from the collection of the Cotsen Children's Library.
- The University's **Program in Teacher Preparation** prepares undergraduates, graduates, and alumni to become certified teachers in elementary and secondary education. There are 12 school districts in the Teacher Prep network, including the Princeton and the Trenton regional school districts. Approximately 60 percent of last year's cohort in the Program in Teacher Preparation went on to teach in New Jersey primary and secondary schools.

In addition to these elementary and high-school-level programs, the **Mid-Career Fellowship Program** brings selected faculty from participating New Jersey community colleges to the University. Participants enroll in Princeton classes and are able to consult with scholars in a variety of fields.

Princeton as a cultural and recreational resource

The University also helps make Princeton and the surrounding communities more attractive places to live and work through the cultural resources that are available to area residents.

• The McCarter Theatre Center, which includes a 1,100-seat main theater (Matthews) and a smaller, 360-seat performance space (Berlind), is one of New Jersey's leading performing arts centers. McCarter offers more than 200 performances each year of theater, dance, music concerts, and other special events. In 2007, approximately 180,000 people attended performances at McCarter and Berlind.

- Richardson Auditorium and Taplin Auditorium are open to the community; attendance at such venues in fiscal year 2007 totaled approximately 80,000.
- **Theatre Intime** is a student-run theater group that has been entertaining the student body and the

surrounding community for more than 85 years. Students are solely responsible for every aspect of the theater—from acting and directing to fundraising and administration. Students also offer a summer Intime program.

- The **Cotsen Children's Library** is a specialized library within the Princeton University Library. Its international research collection of illustrated children's books, manuscripts, original artwork, prints, and educational toys from the 15th century to the present day serves as a resource for children, families, and educators in the greater Princeton area. It offers a variety of children's programs that are open to the public and free of charge.
- The Lewis Center for the Arts at 185 Nassau Street offers public events year-round, including student visual arts exhibitions at the Lucas Gallery, dance performances in the Patricia and Ward Hagan '48 Dance Studio, theatrical productions in the Marie and Edward Matthews '53 Acting Studio, and film screenings, lectures, and a creative writing reading series in the James M. Stewart '32 Theater.
- The **Princeton University Art Museum** is one of New Jersey's leading museums. The museum is free and open to the public. In 2007, attendance totaled about 85,000.



The Princeton University Department of Athletics oversees 38 varsity intercollegiate athletic teams, which offer many opportunities for campus visitors to watch NCAA Division I competition at low or moderate cost. The department partners with community organizations, allowing student athletes to volunteer in events such as:

• The annual National Girls and Women in Sports Day, which features an interactive sports fair offering participants a chance to learn about different sports and practice a variety of athletic techniques. Princeton's female student-athletes demonstrate and coach participants on the fundamentals of a variety of sports, including lacrosse, crew, softball, soccer, and cheerleading.

• The New Jersey Race for the Cure, a 5K race sponsored by the Susan G. Komen Breast Cancer Foundation.



In addition, the University's sports and athletic facilities, including the Dillon and Jadwin gymnasiums, Baker Rink, and West Windsor fields, give members of the Princeton community an opportunity to participate in sports and recreational activity.

- For nearly 40 years, Princeton University has collaborated with the Princeton Borough and Princeton Township's joint recreation department in a youth basketball league held in Dillon Gymnasium. University undergraduates serve as volunteer coaches, and in 2007, approximately 90 students coached nearly 400 children from the local community between the ages of 9 and 15.
- Nine public and independent Princeton-area high schools used Princeton University athletic facilities in 2007 for more than 750 hours of sports team use. Local high schools rented University swimming pools throughout the year while other

local high school teams used Baker Rink, Dillon Gymnasium squash courts, and the indoor track at Jadwin Gymnasium.

- An additional 28 Princeton-area community recreation groups used University athletic facilities in 2007 for nearly 1,500 hours of practice and competitions. Fifteen different swim teams used University pools, and other groups practiced and played ice hockey at Baker Rink, soccer on the West Windsor fields, and wrestling and squash at Jadwin Gymnasium throughout the year.
- Many area youngsters participate in summer sports camps on the Princeton campus.

These and other resources available to the public enhance the quality of life that residents of the Princeton area enjoy. In making the region a more attractive place to live, they also make it a more attractive place to work, invest, and do business—and thus strengthen its economy.



Students in the community

Princeton students are involved in a broad range of community service activities, both as volunteers and through their participation in communitybased learning programs. During the 2006–07 academic year, 34 percent of Princeton students reported that they participated on a weekly basis in some form of community service, representing more than 106,000 service hours over the course of the academic year. Princeton students participate in a number of ways:

- The Student Volunteers Council (SVC) sponsors more than 40 community projects that operate under its auspices in Princeton, Trenton, and the surrounding area, including six tutoring programs, six health services programs, and nine social action and emergency service programs. More than 650 students participate as regular weekly volunteers. SVC also sponsors Community Action, a week-long pre-orientation program that introduces incoming freshmen to volunteer opportunities in Princetonarea communities. More than 150 students participate in this program, which also introduces more than 40 faculty and staff to local nonprofit organizations.
- Princeton's Community House works directly with the Princeton Regional School District and other local nonprofit organizations to address educational achievement gaps. More than 100 students work throughout the school year to provide academic enrichment and cultural and social opportunities to low-income and minority children in Princeton schools. In addition, Community House sponsors two summer programs for underserved youth: an academic enrichment and computerfocused program for 40 middle-school students; and a multicultural camp for 50 grade school-aged students.
- Princeton students provide support to critical emergency service

organizations in the community as volunteers with the local **Fire Department** and **First Aid and Rescue Squad**. It is estimated that more than half of the volunteers at the Princeton First Aid and Rescue Squad are University students.

- Ivy Athletes Charity Team (IACT) is an organization through which all of Princeton's athletic teams work to raise money for a Community House summer camp that serves economically disadvantaged youth, ages 10 to 14, in the Princeton and Trenton areas, providing them the academic and technical skills they need in order to get ahead by the time they return to school in the fall.
- The Community-Based Learning Initiative (CBLI), a collaboration of students, faculty, administration, and community-based organizations, encourages Princeton students to combine classroom learning with related work in the community. In 2006–07, 499 students enrolled in 16 CBLI courses, working with more than 50 community organizations in New Jersey.

For example, in Professor Jessica Trounstine's "The American City" spring 2006 class, Princeton CBLI students Benjamin Tagoe and Lauren Barnett researched two communities adjacent to distressed areas in New Jersey. The students developed profiles of Hamilton and Pennsauken by using demographic information and news articles, visiting the towns, and interviewing area residents. This research provided New Jersey Community Capital, a leading community development organization, with detailed information about the communities so that it could explore new opportunities and continue developing appropriate products and services to assist potentially at-risk communities throughout the state.



Other service learning opportunities for Princeton students include:

• The Engineering Projects in Community Service (EPICS) program gives students an opportunity to earn academic credit by participating in multidisciplinary design teams that solve technologybased problems for local governments and nonprofit organizations. For example:

> A team of Princeton students worked with the Trenton-based **Isles** community development organization and **Princeton Young Achievers**, an after-school program for elementary students from low-income households, to repair and restore a tower clock

in an abandoned factory being redeveloped by Isles. The team also designed a hands-on curriculum to teach engineering concepts to the Princeton Young Achievers.

A team of 12 EPICS students worked with the Pennington-based **Stony Brook-Millstone Watershed Association** throughout the year to help turn the organization's 30year-old nature center into a model "green" building. The interdisciplinary group also developed an academic module based on their efforts that will teach elementary students about sustainability.

Princeton as a community partner

The University continues to partner with the community on a variety of programs and initiatives such as:

 Princeton University was a founding member of Princeton Community Housing in 1967. Today, Princeton Community Housing provides affordable housing to residents of five developments with a total 463 units. Since 1990, the University has contributed \$1.5 million in cash and land to local affordable housing initiatives. The University is currently covering the full cost of a \$2.5 million reconstruction project in the Borough of Princeton that will result in five new units of affordable housing for the community.

• The **Princeton-Blairstown Center**, in partnership with the University, operates year-round for schools and community agencies as an outdoor adventure and experiential education facility. The center also provides Princeton students with an outlet for community service; since the center's founding, an estimated 2,000 undergraduates and young alumni have served on the Blairstown staff.

- The University operates a **Campus Transit System** to serve faculty, staff, students, and visitors to campus and the local community. The shuttle is available free of charge to both University-affiliated and other riders. Since it began in 2003, the system has expanded to incorporate several off-campus stops—including the Dinky station and NJ Transit bus stops. As the service has grown, ridership has increased, reaching a total of 722,000 rides in 2007. The University plans to expand and enhance the system in 2008.
- In April 2008, initial funding from the University helped the local community start a free jitney bus service. The new service—the "Free B"—is free to all riders and loops around Princeton Borough on weekdays during peak commuting hours. The jitney service schedule is coordinated with the NJ Transit Dinky train schedule and shares common stops along Nassau Street with the University shuttle routes.

- In 2000, the University, at the request of local officials, invested more than \$2 million in renovation of the **Garden Theatre**, the only firstrun movie theater in Princeton. The University's investment was critical to keeping the theater in operation, and thus helped maintain the vitality of the downtown area.
- For nearly 10 years, the University has provided Internet access to public schools and the Princeton Public Library.
- The Greening Princeton Farmers' Market was established in fall 2007 by University students on Princeton's campus to support local farmers, promote local agriculture, and educate students and community residents about sustainable food. The market opens for six-week periods in the spring and fall and includes numerous local vendors.
- In 2007, the University facilitated the opening of two new businesses in downtown Princeton. Independent bookseller Labyrinth Books opened a 10,000-square-foot store (its largest operation) to serve the University's and the community's bookstore needs. The Princeton University Store (the "U-Store") expanded from an on-campus location to an additional location on Nassau Street.

Through these and other initiatives, the University has long been committed to enhancing the quality of life for Princeton-area residents—culturally, socially, and economically. That commitment is, if anything, likely to grow in the years ahead—a topic that is addressed in the final part of this report.



Princeton's commitment to sustainability ensures sensitive growth

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Part Six: Growth and Sustainability



As this report has documented, Princeton University is a significant contributor to the economic vitality of the Princeton area, Mercer County, and the State of New Jersey. Over the next five to 10 years, the University's role in the local economy is likely to increase. This part of the report highlights several of the most significant factors that will drive the growth of Princeton's economic impact. It also briefly discusses how the University's commitment to sustainability can help ensure that this growth occurs in an environmentally sensitive way.

Enrollment growth

The University estimates that by 2012, undergraduate enrollment will increase to 5,200—an increase of 7.3 percent over the 4,845 undergraduates enrolled at Princeton in 2007. Graduate enrollment is projected to increase by an average of 1 percent annually, to approximately 2,600 by fall 2016.

The projected increase in enrollment represents an increase in the number of talented students that will be attracted to Princeton each year from all over the U.S. and the world—and thus an increase in the talent pool that is potentially available to support the continued growth of the region's economy.

In a more immediate way, the projected 8 percent increase in total enrollment will translate into an increase in the University's operating expenditures, and an increase in student spending in the Princeton area.

Growth in the University's research enterprise

Just as the University's enrollment is expected to grow, so is its research enterprise. Increased University spending on research will translate into increased employment at the University itself, and an increase in business activity and jobs elsewhere in the region.

Even more important in the long run than a projected increase in total research spending, however, will be the continued development of the University's strengths in several areas that could provide a foundation for future economic growth, including energy research, neuroscience, and genomics.

New development: Princeton's campus plan

Through 2016, Princeton is planning to add approximately 2 million square feet to its physical plant. Planned new construction will include:

- New buildings for the arts, including performance spaces, a satellite location of the Princeton University Art Museum, and an experimental media studio;
- New buildings for neuroscience and chemistry, and a new center for energy and the environment;
- New housing for graduate students, faculty, and staff.

This new construction—in combination with ongoing investment in existing facilities—will provide contracting and subcontracting opportunities for New Jersey companies, and employ hundreds of people each year in construction and related industries. It will also provide the facilities needed to support the continued growth of the University's teaching and research enterprise. This growth will not only require more space—it will require different kinds of space to support new approaches to teaching and to collaborative research in fields such as genomics, neuroscience, and environmental science.



Arts and Transit: A new gateway to Princeton

The proposed Arts and Transit Neighborhood, located at the western edge of the Princeton University campus, is designed to strengthen an area that already plays a vital role in the daily life of both the University and the community. The proposed plan for this area builds on the strengths of its two existing anchors: the McCarter Theatre Center and NJ Transit's Dinky railroad station. Elements of the plan for the area currently include:

- A new building for the Princeton University Art Museum, complementing the McCarter and Berlind theatres with galleries for contemporary and rotating exhibits, teaching spaces, and a museum café and shop;
- New studio and performance spaces for the Lewis Center for the Arts;
- An experimental media studio;
- A new Dinky station building, with improved amenities for commuters as well as a relocated 24-hour Wawa store;
- A "Transit Plaza" adjacent to the new station, providing convenient pick-up and drop-off as well as connections to, taxis, buses, a community jitney, campus shuttles, bicycles, and the future bus rapid transit service proposed by NJ Transit;
- Reconfiguration of the roadway network in the area, with a roundabout to reduce traffic congestion and a driveway into an existing University parking garage to improve traffic circulation, increase visitor usage, and reduce vehicle miles traveled;
- Restaurants, cafés, an attractive public plaza, and other amenities that will serve visitors to the area's cultural facilities, transit riders, University faculty, staff, and students, and those who live or work nearby.

The planned improvements are expected to reduce peakhour traffic in the area by replacing administrative offices with cultural uses, and by strengthening transit connections. When completed, this neighborhood promises to be a more lively and attractive gateway to the Township and Borough of Princeton, and to the University.



A more sustainable Princeton

Released in 2008, the Princeton University Sustainability Plan has three major components: greenhouse gas reduction; resource conservation; and research, education, and civic engagement. While many of these initiatives are aimed at much broader environmental objectives—such as reducing Princeton's carbon emissions to 1990 levels by 2020—some will directly benefit the local community.

For example, the plan calls for a comprehensive transportation demand management initiative that will include increasing transit options and encouraging telecommuting, vanpools, walking, and commuting by bicycle. As a result of these steps, the University expects to reduce the number of cars commuting to campus by 500 by 2020—a reduction of about 10 percent below 2008 levels.

The University's plans for storm water management will similarly ensure that the planned 2-million-square-foot increase in total building space, and the projected growth of enrollment and employment, does not increase the runoff into local streams and the lake. Princeton is installing rainwater capture and reuse systems for irrigation on its Butler College project and for flushing toilets on its neuroscience and chemistry building projects. The University is employing rain gardens, bioswales, and vegetated storm water management techniques to minimize rain water runoff and provide bio-filtering of the water.

Initiatives that will help meet the new Sustainability Plan's goals of research, education, and civic engagement will be funded in part by a gift from the High Meadows Foundation. Initiatives include an engineering course that evaluates energy usage in local homes and provides green retrofitting guidance, paid internships to investigate strategies to mitigate projected water levels resulting from climate change, and support for local bicycle and pedestrian programs.

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's cogeneration system typically runs at about 78 percent efficiency compared to the local power grid efficiency of about 30 percent.





Princeton installed a 150-well geothermal system in 2003 to serve 207 units at Lawrence Apartments, located adjacent to campus. On the main campus, 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 reduces carbon dioxide emissions by an estimated 18,000 metric tons per year, according to the Environmental Protection Agency. Energy efficiency initiatives have also been a part of standard operations for many years, including lighting retrofits, window upgrades, improved insulation, HVAC replacements, and Energy Star appliance use.

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.

A foundation for the future

As it has been for many years, Princeton University today is a significant contributor to the economic and cultural vitality of the Princeton area, the surrounding region, and the State of New Jersey.

The University is of course a major enterprise in its own right. It is one of Mercer County's largest private employers—a major investor in the development of new facilities, a buyer of goods and services from local companies, and a magnet for visitors. Even more important in the long run, however, is Princeton's role in creating a foundation for sustained prosperity that will continue for many years into the future.



The University's strengths in critical areas of research ensure that it will continue to be involved at the forefront of developing the ideas and innovations that will drive economic growth during the next several decades, in fields as diverse as genomics, neuroscience, new materials, and new energy and environmental technologies. In a world that is year by year becoming more and more integrated, and in which "human capital" is widely recognized as the single most important source of competitive advantage, Princeton's strengths in both undergraduate and graduate education will ensure that its students will be well prepared to become leaders in the global economy.

Economic growth, however, requires more than great ideas and talented people—it requires the effective use of those resources to create new products and services, new businesses, and new jobs. Here too, Princeton is contributing to the development of the region's and the state's economy. It does so through:

- Research partnerships with both established New Jersey companies and with new ventures;
- Businesses created by University faculty, students, and alumni.
- Agreements under which technologies developed at the University are made available for commercial use; and

In addition, the educational and cultural resources and activities that Princeton makes available to the community will continue to make the Princeton area an attractive place to live, work, and do business; and this in turn helps make not just the University, but the entire community, a magnet for talent.

Finally, the new development that Princeton has planned will further strengthen its ability to contribute to the vitality of the local economy—by providing the facilities needed to support a growing (and changing) research enterprise and to attract the most talented faculty, researchers, and students; and by enhancing the cultural vitality of both the University and the community.

For all of these reasons, the investments Princeton is making today are helping lay a strong foundation for continuing prosperity in the Princeton area, Mercer County, and the State of New Jersey.
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