
Table of Contents

Executive Summary	2
Introduction	8
I. The Regional Economic Context	11
II: Rensselaer Polytechnic Institute: An Overview	15
III. Building the Region’s Human Capital	18
IV. Research: Building the Region’s Intellectual Capital	25
V. Rensselaer’s Role in New Business Development	35
VI. Rensselaer as an Employer	47
VII. Purchasing and Construction	51
VIII. Regional Economic Impact of Rensselaer’s Spending	55
IX. Rensselaer and the Community	59
X. Looking to the Future	68

Executive Summary

Growing a Major Regional Enterprise

Among its many roles in the community, Rensselaer is itself a major — and growing — regional enterprise. During fiscal year 2001, the most recent year data was available at the time of the study, Rensselaer's revenues totaled \$278 million. Between 1998 and 2001, total revenues grew by an average of 8 percent annually.

Much of this revenue stays within the region. Payroll for faculty and staff working at Rensselaer's Troy campus totaled \$108 million, of which \$96 million was paid to residents of the Capital Region. Payments to Capital Region businesses for purchases of goods and services totaled an additional \$26 million.

With 1,956 full- and part-time employees (excluding students), Rensselaer is the 14th-largest non-governmental employer in the Capital Region and the 2nd-largest in Troy. The annual earnings of full-time employees at Rensselaer averaged more than \$55,500 — about 28 percent higher than the average for full-time workers in the Capital Region.

Rensselaer also contributes to the local economy through its sponsorship of major construction projects. Between 2003 and 2006, Rensselaer plans to spend approximately \$65 million on construction each year. In addition to providing business opportunities for local contractors and approximately 450 full-time-equivalent construction jobs each year, Rensselaer's construction program is building state-of-the-art facilities that will keep the Capital Region at the forefront of new developments in the life sciences, nanotechnology, experimental media, and other disciplines that will shape the 21st century economy.

Rensselaer's impact on the economy of the Capital Region is not limited to its local spending on payroll, purchasing, and construction. In communities throughout the region, Rensselaer's employees spend their salaries on things such as housing, food, child-care, transportation, and entertainment. Companies in the region from which Rensselaer buys goods and services also spend money locally to pay their own employees and suppliers. Through this recycling of Rensselaer's spending, more than \$119 million in economic activity and approximately 1,150 jobs at other businesses in the Capital Region were indirectly supported by Rensselaer.

The impact of local spending by students on everything from the rental of off-campus apartments to purchases of food and personal items to entertainment is also significant. Off-campus local spending by Rensselaer students is estimated to have totaled \$23 million, over and above the amounts spent locally by Rensselaer itself. Taking into account the multiplier effect, the total impact of student spending was \$30.6 million in the Capital Region and \$31.6 million in New York State as a whole.

New Knowledge for a New Century

Total research funding exceeded \$50 million for the first time in 2001 and was more than \$58.5 million in 2002 - making Rensselaer the Capital Region's leading academic research center, with strengths in such critically important areas as integrated electronics, polymer science, nanotechnology, and biotechnology. Rensselaer's research activities help in several ways to strengthen the region's economy.

- In 2001, total research spending was \$44.9 million. About 83 percent of this — about \$38 million — was financed from federal and corporate grants and contracts — money that Rensselaer brought in from outside sources and then spent within the Capital Region.

- The opportunity to participate in cutting-edge research in fields such as integrated electronics, polymer science, nanotechnology, and biotechnology greatly enriches the education of both graduate and undergraduate students — and greatly enhances the value they bring to Capital Region employers.
- Research partnerships with Rensselaer have helped Capital Region companies stay on top of the latest developments in science, solve applied research problems, and gain an edge in recruiting talented students.

The impact of Rensselaer's research enterprise on the region's economy is likely to be even greater during the next several years. The Rensselaer Plan — the strategic plan adopted by Rensselaer's trustees — sets a goal of increasing total research funding to \$100 million by 2008. This will mean more federal and corporate funding brought into the region, more corporate partnerships, more research opportunities for students, and more new-businesses based on innovations and ideas first developed at Rensselaer.

More than 7,000 undergraduate and graduate students come to Rensselaer's Troy, N.Y. campus every year to pursue degrees in engineering, science, information technology, architecture, management, and the humanities and social sciences. About 1,650 of these students are residents of the Capital Region; the others come to Troy from communities throughout New York State, the other 49 states, and 80 foreign countries.

The more than 2,100 undergraduate and graduate students who earn Rensselaer degrees each year provide a steady stream of well-educated workers to companies throughout the region. Nearly 7,900 Capital Region residents were graduates of Rensselaer.

Translating New Ideas Into New Business

For the past 25 years, Rensselaer has actively encouraged the translation of cutting-edge academic research into new products and new businesses. Rensselaer's Incubator Center — one of the first university-based facilities of its kind in the United States — has since its founding in 1980 provided low-cost, flexible space and a wide range of business development services to more than 150 start-up companies. Of 120 companies that graduated from the Incubator between 1984 and 2000, 80 percent are still in business, with 75 percent of them located in the Capital Region.

The 1,250-acre Rensselaer Technology Park, located in North Greenbush, N.Y. provides room to grow for graduates of the Incubator and other young Capital Region companies. It also provides an attractive location for larger, more established firms. Today the Tech Park includes 1,000,000 square feet of industrial, office, and research space. It is home to approximately 50 companies employing more than 2,200 people, with an annual payroll of more than \$100 million.

Rensselaer also contributes to new business development in the Capital Region by helping its students prepare for careers as entrepreneurs. Through courses in entrepreneurship, part-time employment or internships with start-up companies, and the annual Tech Valley Collegiate Business Plan Competition, students have multiple opportunities to get hands-on training in starting and running a business. Through its IdeaLab program, Rensselaer also provides on-campus space and support services to students who want to begin working on new ventures while still in school.

Partnering for Success in an Ever-Changing Economy

The economy of the 21st century will provide an ever-expanding array of opportunities for the communities of the Capital Region and for their residents. To take full advantage of these opportunities, the people of the Capital Region will have to be equipped with the higher-level skills that the new economy demands. And the region's communities will have to ensure that they are attractive places for the most talented people to live, work, and do business.

In partnership with the City of Troy and other nearby communities, Rensselaer is working to ensure that its neighbors are prepared to take advantage of the opportunities the new economy offers. Each year, for example, the Rensselaer Alliance to Increase Student Excellence (RAISE) offers after-school, weekend, and summer classes and research experience in mathematics, chemistry, and physics to 900 middle and high school students. Similarly, Rensselaer's Technology Integration Initiative is working with elementary and middle school teachers in five local school districts to integrate information technology more effectively into everyday classroom activity.

Rensselaer is also an active partner in the physical and economic revitalization of the City of Troy. In 1995 Rensselaer, Russell Sage College, the Emma Willard School, Northeast Health, and Seton Health agreed to create and fund the Troy Redevelopment Foundation, which to date has contributed \$3.2 million to projects such as the establishment of a small business revolving loan fund, the creation of a business improvement district and a visitors' center in downtown Troy, and a study of the Hoosick Street commercial corridor.

Rensselaer has partnered with the City of Troy in the revitalization of its downtown, by moving several research centers and administrative departments into the downtown area, by managing the renovation and reuse of the historic Rice Building, and by working with the city on the development of a high-speed broadband network in the area.

For nearly two centuries, Rensselaer has been a vital contributor to the success of New York's Capital Region. Through its teaching, research, business development, and community-building efforts, Rensselaer is contributing directly to the economy, attracting and retaining talent, discovering new knowledge and translating it into new businesses, fostering economic growth, and partnering with the local communities to grow the regional area.

Introduction

Since the 1980s, communities throughout the United States have become increasingly aware of the role that universities play in urban and regional economic development. Many universities are major enterprises in themselves – frequently among the largest employers in their communities, the leading purchasers of goods and services, and the leading sponsors of construction projects. Even more important, in an era when the health of a city or region’s economy more than ever depends on the quality of its human and intellectual capital, universities attract talented people, help communities develop their human resources, create new knowledge, and help turn new ideas into new businesses.

For more than twenty years, Rensselaer Polytechnic Institute has been an active participant in the process of economic development in New York’s Capital Region. Rensselaer created one of the nation’s first on-campus incubators for technology-based businesses, developed one of the first university-sponsored industrial and office parks, and has been a pioneer in forging partnerships between academic and corporate researchers. Today it is educating students, conducting research and helping move new knowledge from the lab to the market place in emerging fields such as advanced materials, biotechnology and nanotechnology. And it is actively engaged in grass-roots efforts to revitalize the economy of its home community, the city of Troy, New York.

In order to understand more fully the scope and magnitude of its contribution to economic development in the communities it serves, Rensselaer in 2002 asked Appleseed – a New York City-based economic development consulting firm that has had extensive experience working with universities – to prepare a comprehensive

assessment of its economic impact in New York State, the Capital Region and the City of Troy. This report presents the results of Appleseed's assessment.

Organization of the Report

Part I of the report begins with a brief overview of the economy of the Capital Region. Part II provides a brief overall description of Rensselaer Polytechnic Institute. Part III focuses on Rensselaer's role in attracting talent and developing human resources; Part IV on its strength as a major research center; and Part V on its contribution to the development of new businesses.

Part VI of the report describes Rensselaer's impact as a major employer in itself, and Part VII on its impact as a purchaser of goods and services and a sponsor of construction projects. Part VIII estimates the "multiplier effect" of Rensselaer's spending on payroll, purchasing and construction. Part IX describes Rensselaer's extensive involvement in efforts to help Troy and other communities adapt to the demands of a changing economy, and take advantage of the opportunities it offers. Finally, Part X offers some concluding observations about Rensselaer's future contribution to the growth of the Capital Region's economy.

Acknowledgments

This report could not have been completed without the active assistance and continued cooperation of many members of the Rensselaer community. We would especially like to thank Allison Newman, Director of Community Relations, for her support and assistance throughout the course of the project. Others who during the past several months have provided information and insight into Rensselaer's economic impact include Simon Balint, David Bohan, Chet Burzynski, John Bradley, Frances Bronet, Kenneth Gertz, Eddie Jackson, Jeanne Jenkins, Oliver Holmes, Ann LoPonto, John MacEnroe, Jack Mahoney, Dorothy Matsikas, Branda Miller, Paul Murphy, Barbara Nelson, Mary Alice O'Brien, Cindy Price, Charles Rancourt, Lester Rubinfeld, Arthur Sanderson, Colleen Serror, William Shumway, Cynthia Smith, Larry Snavley, Peter Snyder, Jeanne Stefanik, Paul Stryjek, Diane Veros, and Michael Wacholder.

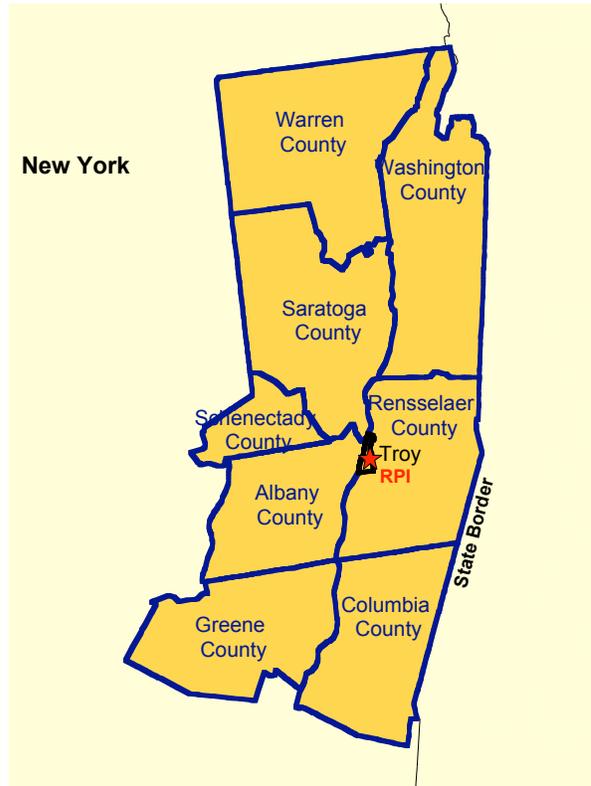
I. The Regional Economic Context

The main campus of Rensselaer Polytechnic Institute is located in Troy, New York, just a few miles from the state capital in Albany. Along with nearby Schenectady, Albany and Troy make up the urban core of a broader eight-county area that is often referred to as New York's Capital Region.¹ In addition to its three principal cities, this highly diverse region includes several smaller cities, attractive suburbs, rural villages and farmlands, the mountain forests of the Adirondacks and the scenic Hudson Valley.

In 2000, the population of the eight counties totaled just over one million people – an increase of 2.6 percent since 1990. The region's adult population is fairly well educated; only 15 percent of those age 25 or older lack high school diplomas, and 26 percent have at least a four-year college degree. Overall, the region's population is solidly working- class and middle-class. With only 9 percent of its population in 1999 living in households with incomes below the poverty level, the Capital Region poverty rate is significantly lower than New York State's poverty rate of 15 percent, and the nation's 12 percent poverty rate.

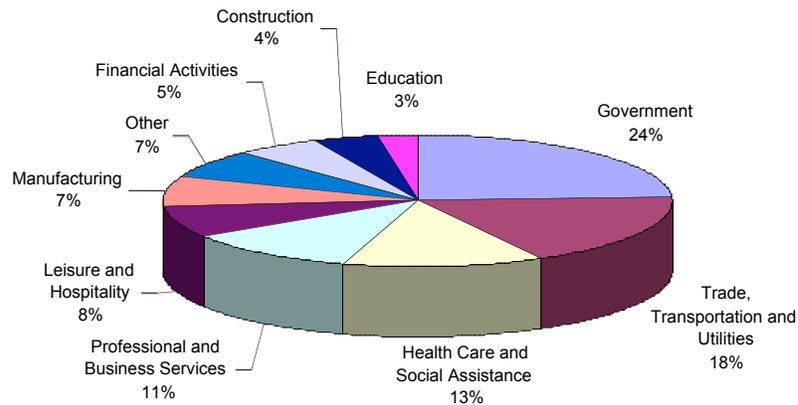
¹ The eight counties are Albany, Columbia, Greene, Rensselaer, Saratoga, Schenectady, Warren and Washington.

Figure 1
Capital Region



In 2001, the New York State Department of Labor reports that more than 494,000 people were employed in wage and salary jobs in the Capital Region – an increase of 11.2 percent since 1988. During that same time period, employment grew only by 4 percent in New York State as a whole. Since 2001, however, the region – like other parts of New York State – has felt the impact of a nationwide recession.

As its name suggests, government is one of the Capital Region's leading industries. In 2000, federal, state and local government agencies accounted for 24 percent of all payroll employment in the area – more than 118,000 jobs. As Figure 2 shows, however, the Capital Region is home to many other industries as well, with major concentrations in manufacturing, health care, finance and business services.

Figure 2**Employment in the Capital Region**

Source: New York State Department of Labor

While the Capital Region, like other areas in the Northeast, has experienced a steady decline in manufacturing employment, it has also registered strong gains in business services, engineering and management consulting services, health care, and social services.

Higher education has long been among the region's strongest industries. In 2001, Capital Region colleges, universities and professional schools employed more than 14,500 people. The region's fifteen colleges and universities, listed in Table 1, enrolled a total of 82,100 students.

Table 1
Capital Region Colleges and Universities

Schools:
Albany College of Pharmacy
Albany Law School
Albany Medical College
College of Saint Rose
Empire State College, SUNY
Excelsior College
Hudson Valley Community College
Maria College
Rensselaer Polytechnic Institute
Sage Colleges
Schenectady County Community College
Siena College
Skidmore College
Union College
The University at Albany, SUNY

Since the 1980s, the region has also experienced significant growth in a number of technology-based industries, including software, microelectronics, energy systems and biomedical technology. This ongoing evolution reached a new milestone in July 2002 with the announcement that Sematech, a consortium of leading United States semiconductor manufacturers, would locate a new research and development center in Albany. In November 2002, Tokyo Electron Ltd., a maker of tools for microchip manufacturing, followed Sematech's lead by announcing the opening of an R&D center in Albany in 2003.

II: Rensselaer Polytechnic Institute: An Overview

Founded in 1824 by Stephen Van Rensselaer, scion of a family that traced its heritage back to the Dutch Colonial era, and Amos Eaton, Rensselaer Polytechnic Institute is the oldest technology degree-granting institution in the United States. Van Rensselaer and Eaton described the Institute's purpose as "instructing persons who may choose to apply themselves in the application of science to the common purposes of life." With its emphasis on learning by doing, Rensselaer during the nineteenth century pioneered the use of laboratories for teaching science, and was a major contributor to the development of the engineering profession in the United States. Its graduates helped make Troy one of the leading centers of America's industrial revolution.

Today, Rensselaer is still committed to the mission defined by its founders. The Institute offers 140 bachelors, masters and doctoral degree programs through five schools located on its main campus:

- Architecture;
- Engineering;
- Humanities and Social Sciences;
- The Lally School of Management and Technology; and
- Science.

Degrees are also granted through the interdisciplinary Faculty of Information Technology, which draws on the resources of all five schools.

Rensselaer's 260-acre main campus is located in Troy, New York. Rensselaer also operates a branch campus in Hartford, Connecticut, which offers graduate degrees and continuing education courses, as well as specialized corporate training programs.

(This report focuses primarily on Rensselaer's Troy campus; a separate report will analyze the impact of Rensselaer at Hartford.)

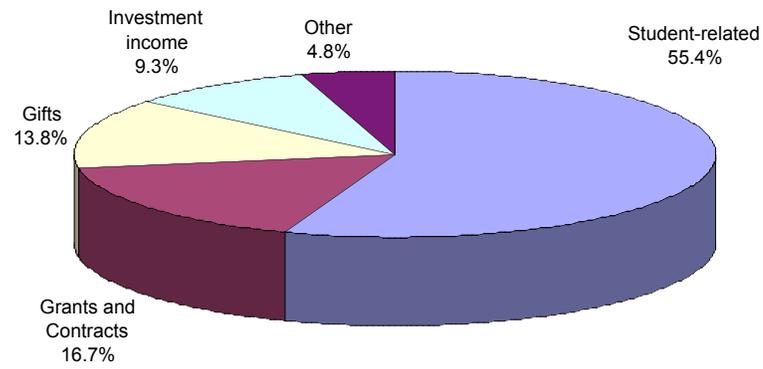
During the fall 2002 semester, 9,369 students were enrolled in degree programs at Rensselaer – 5,185 undergraduates, 3,501 on-campus graduate students, and 683 participants in Rensselaer's Troy-based distance learning program. Graduate enrollment included 1,862 students on the Troy campus and 1,639 in Hartford. The Institute's students are drawn from communities throughout New York State, all 49 of the other states and 80 foreign countries.

Rensselaer has consistently been ranked by *U.S. News & World Report* among the top fifty national universities. Its undergraduate engineering program is ranked fifteenth in the nation, and its graduate program nineteenth. The Institute is also known for its research strengths in microelectronics, industrial automation, advanced materials, information technology, lighting and biomedical engineering.

During its fiscal year 2002, Rensselaer's operating revenues totaled more than \$296.6 million up from \$283.8 million in fiscal year 2001. Between 1998 and 2000, the Institute's operating revenues grew at an average annual rate of 8 percent.

As Figure 3 shows, net student-related revenues (tuition, fees, room and board) accounted for 55 percent of total revenue in fiscal year 2001. Grants and contracts (primarily federal and corporate research funds) accounted for 17 percent; gifts for 14 percent; and investment income for 9 percent.

Figure 3
Operating Revenues by Source, FY 2001



III. Building the Region's Human Capital

Human capital – the knowledge and skills that workers accumulate through education and experience – is one of the most important factors affecting the growth of urban and regional economies. Between 1960 and 1990, population and income growth in United States cities was closely correlated with levels of human capital endowment, as measured by the percentage of the cities' residents who were college graduates in 1960. The relationship between human capital and economic growth persisted through the 1990s.²

Higher education doesn't just benefit the people who earn degrees; it has important spillover effects as well. James Rauch of the University of California has found that increasing the average level of education in a metropolitan area by one grade increases "total factor productivity" by 2.8 percent. (Total factor productivity is a measure of the increase in a nation's or a region's output that results not from increasing the total volume of human labor, or total investment in plant and equipment, but from "working smarter.")³

² Edward Glaeser, Jose Scheinkman and Andrei Schleifer, "Economic Growth in a Cross-Section of Cities," *Journal of Monetary Economics* (1995) pp. 117-143; Glaeser and Jesse Shapiro, "Is There a New Urbanism? The Growth of U.S. Cities in the 1990's" (Cambridge: National Bureau of Economic Research

Working Paper, July 2001) p. 2.

³ James Rauch, "Productivity Gains from Geographic Concentrations of Human Capital: Evidence from the Cities," *Journal of Urban Economics*, vol. 34, pp. 398-99.

The critical importance of human capital means that universities are major participants in the process of regional economic development. As Richard Florida has noted:

The most critical contribution of the university to economic development is talent. Talent is the key resource of the knowledge economy...Smart people do not necessarily respond to monetary incentives alone, they want to be around other smart people...The fact is that good people attract other good people, and places with lots of good people attract other good people, and places with lots of good people attract firms that want access to talent, creating a self-reinforcing cycle of growth.⁴

Because highly talented people are especially mobile, cities and regions that want to prosper in today's economy must constantly replenish their supply of talent. Colleges and universities play a central role in this process. As Irwin Feller of Penn State has observed:

Industrial representatives have repeatedly stated that universities' primary contribution to technological innovation lies in the training of students... Students are a means by which new scientific findings and technologically relevant knowledge are transferred from campus to firm.⁵

⁴ Richard Florida and Wesley Cohen, "Engine or Infrastructure? The University's Role in Economic Development," in Branscomb, Kodama and Florida, op. cit., pp. 605-606.

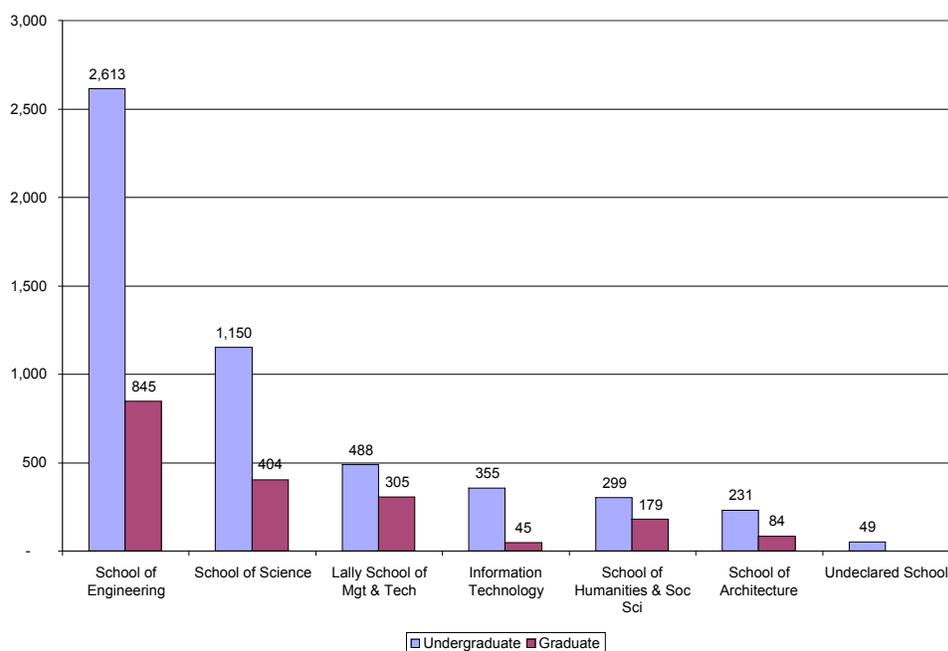
⁵ Irwin Feller, "The American University as a Performer of Basic and Applied Research," in Branscomb, Kodama and Florida, op. cit., pp. 82-84.

Students and Alumni

Universities help communities and regions enrich their human resources by attracting, developing and helping to retain talent. Rensselaer contributes in all three of these ways to the strength of the Capital Region's economy.

During the fall 2001 semester, 5,185 students were enrolled in undergraduate degree programs at the Troy campus. As Figure 4 shows, more than half of all undergraduates were enrolled in the School of Engineering; another 22 percent were enrolled in the School of Science. An additional 1,862 students were enrolled in graduate degree programs at the Troy campus; about 45 percent were engineering students, and 22 percent were enrolled in the School of Science.

Figure 4
Undergraduate and Graduate Enrollment, by School
Fall 2001

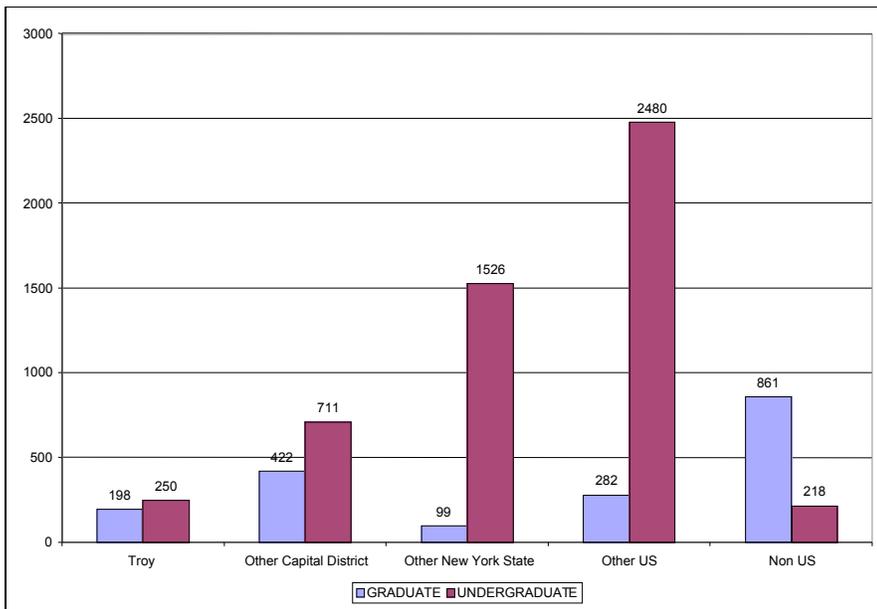


The Institute attracts students from communities throughout New York State, all 49 other states and 80 foreign countries. In 2001, 19 percent of all undergraduates came to Rensselaer from communities within the Capital Region, 32 percent from elsewhere in New York State, 45 percent from other states in the United States, and 4 percent from other countries. (Figure 5)

At the graduate level, 35 percent of all students on the Troy campus are from the Capital Region, 10 percent from elsewhere in New York State, and 14 percent from elsewhere in the United States. About 41 percent of all graduate students, and 52

percent of all engineering graduate students, came to Rensselaer from other countries – a pattern seen at many technological universities in the United States.

Figure 5
Origin of Undergraduate and Graduate Students, Fall 2001



Some of those who graduate from Rensselaer each year stay in the Capital Region. Of the 78,486 living Rensselaer alumni for whom addresses were known in 2002, 7,876 – just over 10 percent – resided in the Capital Region. An additional 9,105 graduates – 11.6 percent of all Rensselaer alumni – lived elsewhere in New York State.

Keeping Graduates in the Region

While Rensselaer graduates thus represent a significant share of the region's college-educated population, it is important to note that the percentage of current students who *come from* the Capital Region is higher than the percentage of alumni who have

stayed in the region. This highlights an important challenge for the region – while it provides excellent educational opportunities for the region’s residents, it has historically had some difficulty in retaining graduates. The Center for Economic Growth – a public-private partnership dedicated to strengthening the Capital Region’s economy – has recently identified this as one of the region’s most pressing problems. As CEG has starkly put it:

Many of our key business assets leave town every year. Each year, more than 14,000 students graduate from our colleges, some of the nation’s leading institutions in business, technology and the arts, yet many leave the area upon graduation. Through collaboration with our universities and companies, CEG is working to stop the “brain drain” and keep more of our talented graduates in the Region.

Rensselaer is one of several institutions collaborating with CEG on a program called Beanstalk. Operating under the slogan “Stay Close, Grow Far,” Beanstalk provides an on-line service that connects students to internship opportunities at Capital Region companies, and to opportunities for employment after graduation. Beanstalk also sponsors monthly networking events, provides information about cultural, entertainment and recreational activities in the area, and markets the Capital Region as an attractive place for young college graduates to live and work.

Continuing Education

In an economy in which the skills and knowledge required for success are constantly and rapidly evolving, workers cannot afford to view higher education as a process that ends at graduation. Once a buzzword, “lifelong learning” is now a virtual necessity. As a result, continuing education has steadily been moving from the periphery to the center of the nation’s higher education enterprise.

At the Troy campus, continuing education is offered through RSVP, Rensselaer's distance education program. In 1999-2000 the program had 27 corporate partners at 62 locations and was providing instruction for more than 1,000 professionals per semester. RSVP also currently offers 17 certificate programs for individual students in fields such as bioinformatics, computer graphics, manufacturing systems engineering and software engineering. To earn certificates in these areas, students are typically required to complete four graduate-level courses. During the Fall 2001 semester, 142 students were enrolled in these non-degree programs.

To further serve the community, the Lally School offers an Executive MBA Program that was established in 1987. It is designed and taught by senior faculty from Rensselaer's School of Management. The program provides a learning-intensive setting in which diverse academic theories are blended with each participant's work experiences. Executive MBA participants gain strong fundamental management skills, a global perspective, and the diversity and depth necessary to recognize and cope with new challenges. Executive MBA classes are held Friday and Saturday of alternate weekends for two academic years (September to May) to allow participants to continue in their careers while earning their degrees.

More continuing education courses are offered at the Hartford campus and through the Rensselaer Learning Institute. Those programs will be discussed in a separate report on the economic impact of Rensselaer at Hartford.

IV. Research: Building the Region's Intellectual Capital

For the past half-century, basic research has played a central role in the growth and development of the United States economy. In 1999, the Committee for Economic Development reported that:

Basic research in science and engineering has made a major contribution to the growth of the United States economy. Economic returns on investments in basic research are very high. In addition, the returns to the nation from basic research investments are substantially higher than the returns to private firms, since advances in fundamental knowledge tend to be widely dispersed and exploited in innovations that deliver substantial economic benefits over a lengthy period.

Without question, the most important institution in American basic research is the research university. The research university system has become the nation's largest basic research enterprise.

CED also found that:

Basic research performed in major universities (and in other public and private labs) often has a large indirect impact on the economy of the regions where the universities are located.⁶

⁶ Committee for Economic Development, *America's Basic Research: Prosperity through Discovery* (New York, 1999), pp. 2. 11. 19.

University research contributes to regional economic growth in several ways.

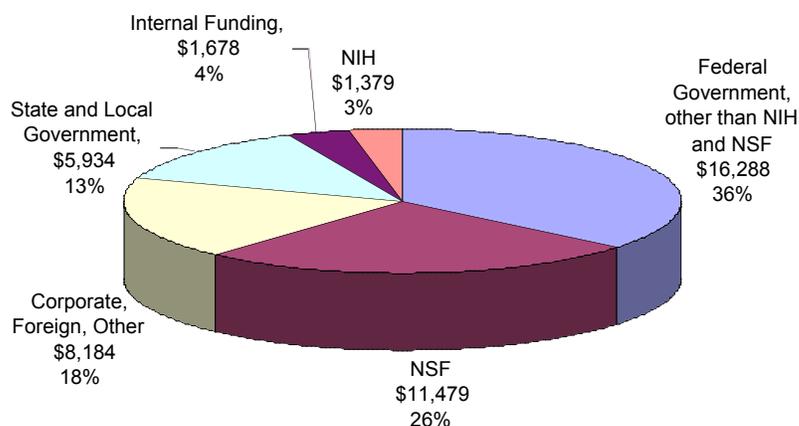
- Each year, research universities attract millions of dollars in federal and corporate research funds – money that is spent locally on salaries, supplies, equipment and overhead costs.
- The opportunity to work side by side with faculty researchers can greatly enhance the quality of both undergraduate and graduate students' education. This experience can in turn enhance the skills and knowledge that university graduates can offer to the region's employers.
- Contracting or collaborating with university researchers can be an efficient way for companies to acquire new knowledge, solve applied research problems and recruit new employees.
- Strong university research programs can help make the region an attractive location for corporate research and development facilities.
- University research sometimes leads directly to the development of new products and the creation of new businesses.

All of these effects are evident at Rensselaer.

Research Spending at Rensselaer

Total research funding exceeded \$50 million in 2001 and was more than \$58.5 million in 2002. In fiscal year 2001, when the total of research spending was \$44.9 million, Federal grants and contracts accounted for 65 percent of this total. Corporate, foundation and other sources accounted for an additional 18 percent. State and local funding accounted for 13 percent, and internally generated Institute funds for 4 percent. (Figure 6) Thus, at least 83 cents of every dollar that Rensselaer spends on research is brought in from sources outside the region.

Figure 6
Research Spending by Source, FY 2001
 (in \$000s)



Between 1997 and 2001, externally funded research spending at Rensselaer grew by 17.2 percent – an average of 4 percent annually.

Industry Research Partnerships

Rensselaer Polytechnic Institute was a pioneer in the development of collaborative relationships between academic and corporate researchers. Today, such partnerships are a common feature of research work at Rensselaer. The Institute's corporate partners include a number of leading companies in the Capital Region and throughout New York State.

University research partnerships benefit Capital Region and other New York State companies in several ways. They provide a window into new developments in a wide range of sciences. They provide a cost-effective way to supplement their own research

and development activities; this is especially true in rapidly-developing fields such as nanotechnology, in which it could be enormously expensive for companies to develop in-house a critical mass of research activity, or the infrastructure required to sustain it. University partnerships can also provide a low-cost way to identify and recruit talented graduates.

The following examples illustrate the breadth of Rensselaer's research partnerships.

The Center for Integrated Electronics, Electronics Manufacturing and Electronic Media is an umbrella organization that houses several multidisciplinary microelectronics research programs, with particular emphasis on chip design and manufacturing, on-chip and off-chip interconnection technologies, and the development and use of electronic media. More than 50 faculty members, 15 full-time research staff and 100 graduate students currently participate in the Center's work, which is funded by more than 100 public agencies and private corporations. Major corporate sponsors include IBM, General Electric and Eastman Kodak.

The Lighting Research Center, founded in 1988 with support from the New York State Energy Research and Development Authority, is the world's largest university research center focusing on lighting technology. The Center's researchers are continually seeking ways to improve the efficiency of lighting systems, and have been active in the development of solid-state lighting. The Center conducts more than \$4 million in research activity each year.

Through its Partners Program, the Center brings together leading researchers from the academic world, major companies and government to solve problems related to lighting technology. Major corporate partners include GE Lighting, Philips Lighting and Sylvania.

The New York State Center for Polymer Synthesis, established in 1998, builds on 30 years of polymer research at Rensselaer. The Center describes its role as providing “bridges for companies to work with Rensselaer faculty and students in designing, producing and testing novel polymers that can change the way we live and work.” Eighteen faculty members and 75 graduate students participate in the Center’s work. Corporate partners include IBM, General Electric, Plug Power, Inc. of Latham, BioFine, Inc., of South Glens Falls and Polyset Chemical Company of Mechanicville.

The Rensselaer Nanotechnology Center is the focal point for one of Rensselaer’s newest research initiatives. Nanoscience and technology – understanding the properties and behavior of matter, and manipulating it for practical purposes, at scales as small as one millionth of a meter – are expected to be a major source of innovation and growth during the next several decades. Rensselaer’s work in this critical area was recognized in September 2001, when the National Science Foundation designated Rensselaer as one of just six university-based centers funded under the NSF’s Nanoscale Science and Engineering Initiative. The NSF is providing \$10 million over five years to support a program of research at Rensselaer and two collaborating institutions – the University of Illinois and Los Alamos National laboratory. NSF-supported research is focused on techniques for the controlled assembly of atoms and molecules into more complex structures.

Two years before receiving this federal designation, the Institute had already established the Rensselaer-Industry Partnership in Nanotechnology. This collaborative program currently involves five corporate partners, each of whom contributes substantial funding each year. Four of the five – Albany International, Eastman-Kodak, IBM and Philip Morris – are based in New York; the fifth is ABB, based in Norwalk, Connecticut.

The Nanotechnology Center's partners participate in exchanges of corporate and Institute researchers, share information and engage in collaborative research projects. As a result of such collaborative efforts, the Institute has recently filed joint applications for United States patents with two of its industry partners. Three companies have also provided six-month internships for Rensselaer students.

Taking into account funding from federal, state, corporate and Institute sources, Center Associate Director Paul Stryjek estimates that over the next five years, total funding for research conducted at the Rensselaer Nanotechnology Center will double.

Sharing the Costs – and Rewards – of Research

The collaboration between Rensselaer's Center for Polymer Synthesis and Polyset is an example of how partnerships among universities, companies and public agencies can benefit all three participants. Polyset, located in Mechanicville, N.Y., agreed in 2001 to match a \$300,000 grant awarded to Rensselaer under New York State's NYSTAR (New York State Science, Technology and Academic Research) program. With this combined funding, Polyset and Rensselaer are collaborating on the development of a resin-like insulator for use in semiconductors and telecommunications equipment. The project is helping a local company develop a new product; and provides faculty and students with an opportunity to participate in practical, real-world R & D. In addition, the Institute will share in Polyset's revenues if and when the product reaches the market.

Student Participation in Research

University research also contributes to the strength of the regional economy by enriching the education of both undergraduate and graduate students. Working side by side with senior faculty members on research projects is, of course, a standard feature of graduate education in the United States; it is, in fact, one of the distinguishing strengths of the American approach to graduate education. Participation in cutting-edge research doesn't just enhance graduate students' educational experience – it turns them into instruments of technology transfer.

Students are a means by which new scientific findings and technologically relevant knowledge are transferred from the campus to the firm. Indeed, as new technologically

relevant research findings become embedded in the tacit know-how of students...their importance of technology transfer agents is likely to increase.⁷

While graduate student involvement in research may be a common feature of the American university system, one of the great advantages that New York State and the Capital Region derive from Rensselaer's strength as a research university is the opportunity it creates for undergraduates as well to participate in major research projects.

Rensselaer's Undergraduate Research Program offers students opportunities to work with faculty members on major research projects, either for academic credit or for a cash stipend. Recent projects in which undergraduates have participated include studies of the impact of the September 11 World Trade Center attack on Lower Manhattan's infrastructure and the development of new technologies for subsurface imaging of highways and bridges.

More than a quarter of all undergraduates participate in at least one major research project during their years at Rensselaer, and some students work on several. Involvement in major research projects helps students learn about particular fields in greater depth than they typically could in the classroom, gives them experience in working as part of a team, and allows them to develop contacts with corporate sponsors. From the perspective of future employers, the Undergraduate Research Program helps create a pool of potential future recruits who bring with them first-hand knowledge of the latest research, and practical experience that is directly relevant to corporate R & D.

⁷ Irwin Fellner, *op. cit.*, p. 84.

A Magnet for Corporate Investment

Growing synergies between university and corporate research mean that communities and regions with strong concentrations of academic research are most likely to be successful in attracting corporate investment in R & D. In most cases, it is not the strength of a single institution that attracts such investment. Rather, it is a combination of strengths across several institutions that together create a regional setting that corporate researchers and decision-makers find most attractive.

Thus, for example, the combined strengths of Rensselaer and the State University at Albany have helped make the Capital Region a leading center for research on integrated electronics and nanotechnology. This combined strength, along with a strong commitment from New York State, helped persuade International Sematech – a consortium of major semiconductor manufacturers, based in Austin, Texas – to locate a major new research and development center in Albany. Sematech’s presence will in turn reinforce the region’s ability to attract other corporate investments in research and development. This process is already under way; in the fall of 2002, Tokyo Electron Ltd., a major manufacturer of semiconductor manufacturing equipment, announced that it will open an R&D facility in Albany in 2003.

As noted above, university research can also lead directly to the creation of new products and businesses. The next section of this report discusses Rensselaer’s role in new business development.

A Growing Research Enterprise

During the next several years, the contribution that Rensselaer’s research enterprise makes to the economy of the Capital Region and the Empire State is likely to increase. This is so for several reasons.

First, research at Rensselaer is a growing enterprise. The Rensselaer Plan – the strategic plan adopted by the Institute in 2000 – is calling for aggressive growth in this area and sets a goal of reaching \$100 million annually in research activity by 2008. With research at Rensselaer more than doubling during the next five years, its multiple impacts are likely to grow commensurately – more local spending on salaries and supplies, more partnerships with New York businesses, more students participating in research projects.

Second, Rensselaer is particularly strong in several areas that could over the next decade emerge as major sources of innovation and economic growth, such as integrated electronics, biomedical technology and nanotechnology.

Finally, the Institute's continuing focus on promoting and supporting entrepreneurship means that the Rensselaer community has year by year become more and more proficient at translating the results of academic research into new products and new businesses. This means that over time, the long-term economic impact of every dollar invested in research is likely to increase.

The next section of this report takes a closer look at Rensselaer's commitment to new business development.

V. Rensselaer's Role in New Business Development

Helping to generate and grow new businesses is one of the most commonly cited ways in which universities contribute to regional economic growth. Rensselaer has been active in this area for more than twenty years. It has contributed to new business development through the support provided to start-up companies housed in its incubator, through the development of Rensselaer Technology Park, through its entrepreneurial education program, through the creation of new businesses by Rensselaer graduates and faculty members, and through the assistance it provides to other new and growing companies in the region.

Incubating New Companies

Rensselaer's Incubator Center provides low-cost space and a wide range of support services for new technology-based companies. First established in 1980 in 3,500 square feet of space in the H Building, Rensselaer's facility was among the first university-sponsored incubators in the United States. In 1982 the Incubator expanded into 42,000 square feet of renovated space in the J Building (1223 Peoples Avenue). Renovations were financed by the Troy Industrial Development Agency and the New York State Urban Development Corporation. In 1992, the Incubator expanded again, taking over a 52,000 square-foot former lab facility in Watervliet, New York.

Finally, in 2000 Rensselaer in partnership with Troy Savings Bank, the Troy Architectural Program, and New York State renovated the 25,000 square-foot Rice Building in downtown Troy. The Rice Building serves in effect as the Incubator's "halfway house," serving companies that have outgrown their space in the Peoples Avenue facility.

The Incubator Center offers companies moderately priced, flexible space on a month-to-month basis. It also offers shared space and equipment, such as conference rooms and computer facilities, and low-cost Internet and phone service through Rensselaer's campus network. The Incubator also provides access to a variety of business services. Its professional staff, who have extensive experience in business development, are available for informal consultation on topics such as business planning and pricing strategies. In addition, attorneys, accountants and other business service professionals regularly conduct presentations and discussions on topics such as patent and trademark law, and the comparative advantages of organizing as an S corporation or a limited liability company.

The strength of their roots in science and technology, and the services the Incubator provides, help make many tenant companies attractive prospects for investors. Acting director Simon Balint estimates that resident companies have attracted approximately \$80 million in early-stage equity investment.

One of the greatest advantages the Incubator offers to young companies is access to students. Rensselaer students constitute a pool of well-educated workers, available for work as interns or part-time employees. As of October 2002, 100 Rensselaer students were working on projects with twenty Incubator companies.

The Incubator also sponsors a monthly enterprise forum, the Venture Bplan series, at which two companies present their business plans to an audience that includes local business leaders and entrepreneurs, venture capitalists and other investors. Of the 60 companies that have made presentations since the forum was launched, twenty have as a result secured outside equity investment.

The benefits the Incubator provides are not limited to tenants. Affiliate companies, many of which are home-based businesses located in Troy and surrounding communities, have access to the same services as tenant companies. The Incubator currently has 14 affiliate companies.

As of the fall of 2002, the Incubator Center's three facilities housed 35 companies – 25 on campus, 7 in Watervliet and 3 in the Rice Building – that together employ approximately 200 people. Tenant companies included 11 firms founded by Rensselaer faculty members, and 8 by students or graduates; the rest were started by other local entrepreneurs. Notable examples include:

- **Applied Biophysics, Inc.**, founded in 1991 by Dr. Ivar Giaever, a Nobel Prize-winning faculty member, and Charles Keese, develops biophysical technologies for use in cell research and drug discovery.
- **Evident Technologies, Inc.**, founded by adjunct professor Clinton Ballinger, is engaged in the development and manufacture of semiconductor nanocrystals, in sizes as small as two nanometers. The firm is currently located in the Rice Building. In September, Evident announced plans to establish new facilities in Troy, and to increase total employment to nearly 200.
- **Molecular Optoelectronics Corporation**, located in Rensselaer's Watervliet facility, was formed to commercialize optoelectronics technology first developed at General Electric's Global Research Center in Niskayuna.
- **Tiercent Corporation**, founded in 2001 by three Rensselaer graduate students, has developed wireless technology that can be used to track the movements of firefighters and other emergency personnel within buildings, and to locate them when incapacitated. As of late 2002, Tiercent had twelve employees.

How long companies stay in the Incubator can vary considerably, depending on the nature of their business, how quickly they are able to obtain outside investment, and other factors. Information technology start-ups, for example, are typically ready to move out more quickly than firms working in fields such as advanced materials or biotechnology. Overall, the median length-of-stay for tenant companies has been just under three years.

Between 1984 and 2000, approximately 120 companies that started as tenants in Rensselaer's Incubator moved out. Of this total:

- 70 percent were still in business;
- 10 percent had merged with or been acquired by or merged with other companies;
- 18 percent were no longer in business; and
- 2 percent could not be located.

Thus, 80 percent of all former incubator tenants were still in business in 2000, either as independent ventures or as part of larger companies. Moreover, three-quarters of those still in business were located in the Capital Region. These firms include some of the area's most dynamic technology-based companies; several notable examples are listed in Table 2.

Table 2
Selected Incubator Graduates

Company Name	Location	Employment in Capital Region
Albany Molecular Research	Albany	438
Intermagnetics General Corp	Latham	365
GlobalSpec.com	Troy	125
AutheniDate Holding Corp	Schenectady	100
Flow Management Technologies	Clifton Park	100
Vicarious Visions	Troy	40
Integrated Liner Technologies	Albany	35
Precision Valve & Automation Inc	Halfmoon	35
Simmetrix	Clifton Park	20
Coresense	Saratoga Springs	15
Advanced Innovative Technologies	Troy	10
Fulfillnet Solutions	Troy	10

Moreover, the totals cited above do not include the Incubator's former affiliate companies. Former affiliates include what is one of Rensselaer's most successful start-ups of the past twenty years, MapInfo, which is described below.

The Rensselaer Incubator Center's most recent initiative, the Accelerator program, goes one step beyond traditional incubator services. The program will identify three to five tenant companies with particularly strong growth potential, and provide intensive services aimed at helping them reach the take-off stage more quickly. The Incubator will assemble a team of advisors for each Accelerator company, and will provide ten hours of business services per week.

Growing a New Venture at Rensselaer

As high school students in Rochester, New York, Guha and Karthik Bala got interested in designing computer and video games. What started as a hobby formally became a business in 1994 when Karthik, by then an undergraduate student at Rensselaer, started Vicarious Visions. After initially working out of his dorm room, Bala moved the company into the Rensselaer Incubator. Vicarious Visions soon began winning awards for its game designs, and in December 1998 the fast-growing company began renting space in the Rensselaer Technology Park.

Today, with Karthik as CEO and Guha as President, Vicarious Visions employs 40 people – including several Rensselaer graduates. And their game designs are still winning awards.

The Rensselaer Technology Park

As a logical next step after the creation of the Incubator, the Institute launched the Rensselaer Technology Park in 1982. The Park is located on a 1,250-acre Institute-owned site in North Greenbush, about five miles south of the Troy campus. From the beginning, the Park was envisioned as both a site that would accommodate the growth of companies “graduating” from the Rensselaer Incubator, and as a location that could attract other companies to the Capital Region.

The Institute prepared the original master plan for the site, which includes several elements: the 450-acre Technology Park, 150 acres zoned for future residential development, an additional 150 acres along the Hudson River zoned for future commercial development, and 500 acres permanently set aside as open space.

Rensselaer also obtained the necessary approvals, and financed the development of the Park's basic infrastructure.

Over the past twenty years, a total of 875,000 square feet of space in 21 buildings has been developed at the Tech Park. Its facilities include 13 multi-tenant buildings totaling 425,000 square feet, and 8 buildings developed for individual companies. All of the multi-tenant buildings were financed by Rensselaer using a combination of industrial revenue bonds and conventional financing.

The Tech Park today is home to 50 companies, twelve of which are graduates of the Rensselaer Incubator. Together they employ more than 2,200 people, with an estimated payroll of more than \$100 million. Some of the Park's more notable tenants include:

- **Vicarious Visions** (described above).
- **MapInfo** (described below).
- **Met Life**, which has its software development center and national disaster recovery facility in the Park.
- **Verizon**, which has back office operations in the Park.
- **GlobalSpec**, a former Incubator tenant, founded in 1996, which developed and maintains an on-line, searchable catalog of engineering and technical products.
- **WMHT**, the region's public television station, which is moving production and broadcast facilities to the Park.

From Troy to the World – And Back Again

MapInfo provides a particularly striking example of how support for new business development can translate into jobs and economic growth for the Capital Region. Founded in 1986 by four Rensselaer students, MapInfo was a pioneer in the development of geographic information systems (GIS) software for personal computers; it was also one of the Rensselaer Incubator's first affiliate companies.

MapInfo's rapid growth led in 1993 to the construction of a new headquarters building in the Rensselaer Tech Park. By 2002, MapInfo had become one of the region's largest information technology enterprises, one of its largest publicly owned companies, and one of its largest exporters. The company employed 438 people in the Capital Region in 2002.

The process of entrepreneurial development that produced MapInfo has since come full circle. During the past few years, its founders have invested in three other start-up companies housed in the Rensselaer Incubator.

Entrepreneurial Education

Education at Rensselaer goes beyond acquiring substantive knowledge and learning how to do research. Students at Rensselaer also have the opportunity to learn how to turn ideas and discoveries into new businesses. The Lally School of Management and Technology offered the Institute's first course on entrepreneurship in 1985. Today, the Lally School offers a concentration that includes three core courses on entrepreneurship and six electives on related topics, such as the management of technological innovation. A similar sequence of courses is available to undergraduates, and to non-business graduate students.

The Severino Center for Technological Entrepreneurship, housed in the Lally School, provides a platform for entrepreneurial education at Rensselaer. Founded in 1988, the Center offers a variety of programs designed to help Rensselaer students, staff, faculty and community residents understand the nature of entrepreneurship, and to help them become entrepreneurs. The Center's programs include:

- **The Tech Valley Collegiate Business Plan Competition**, an annual program open to full-time graduates and undergraduates at colleges and universities in the Hudson Valley. During the course of the program, students can participate in business planning workshops, and get help in preparing their plans. Student teams that submit the best plans receive cash awards, “prime-the-pump” investments, and professional services aimed at helping them launch their proposed ventures.
- **The Rensselaer Entrepreneurial Internship Program**, funded by the Kauffman Foundation, annually places 8 to 10 Rensselaer students as interns in entrepreneurial companies. Participating Capital Region firms have included Plug Power, MTI, GlobalSpec, MapInfo and Flow Management Technologies.
- **The Entrepreneurship Club**, a 40-member student organization for Rensselaer students interested in developing their own businesses.
- **Women in Entrepreneurship**, an annual seminar series, launched in 2002, aimed at interesting women at Rensselaer and elsewhere in the community in careers as entrepreneurs.

Developing Bright Ideas at Rensselaer

Support for students interested in entrepreneurship goes beyond the classroom. In 2001 the Rensselaer Incubator Center created the RPIdeaLab, which provides workspace and supportive services for students who want to explore the creation of their own businesses. The IdeaLab provides:

- Opportunities for students to discuss their business ideas with incubator staff and owners of incubator companies;
- Assistance in preparing business plans;
- Regular sessions with outside business professionals such as attorneys, accountants, marketing specialists and venture capitalists; and
- Periodic dinners at which student entrepreneurs can share ideas and experiences.

By October 2002, student participation in the IdeaLab had already resulted in the creation of three full-fledged Incubator companies.

The Center also provides a focal point for continued development of Rensselaer's entrepreneurship curriculum. For example, the development of entrepreneurship courses in the School of Engineering and of an introductory course to be required for all Rensselaer undergraduates.

Technology Transfer

As Rensselaer's research enterprise grows, the formal process of patenting the products of that research, and licensing them for further development and commercial use, plays an increasingly important role in the translation of new knowledge into new products and businesses. The Institute's Office of Technology Commercialization (OTC) is responsible for the management of this process.

Since 1996, Rensselaer has become more active in seeking patent protection for the fruits of its research, and licensing discoveries and inventions that are judged to have some commercial potential. OTC's post-1996 approach to managing Rensselaer's intellectual property has been characterized as "protect appropriately, market aggressively." Prior to 1996, the Institute held a total of 40 patents; today it holds 80, and has 120 additional patent applications pending.

In fiscal year 2002, the OTC filed 64 patent applications, received seven United States patents, and entered into 6 new licensing agreements with companies that are developing commercial applications of Rensselaer technologies. OTC licensees include both established companies and new ventures created specifically to bring to market the products of Rensselaer's research. They currently include ten local start-up companies, seven of which are Rensselaer Incubator tenants. Under the terms of its licensing agreements, the Institute has taken an equity position in five of these firms. (Table 3)

Table 3
Capital Region Start-Up Companies
With Technology Licensed from Rensselaer

Company name	Location	Rensselaer Equity?
Applied Biophysics	Troy	N
AutoQuant	Troy	N
Crystal IS	Troy	Y
ImagenAR	Troy	N
Martial Arts Innovation	Slingerlands	N
ReserX	Schenectady	Y
shareDesign	Troy	N
Starfire	Watervliet	Y
Ve-design	Troy	Y
Xylos	Troy	Y

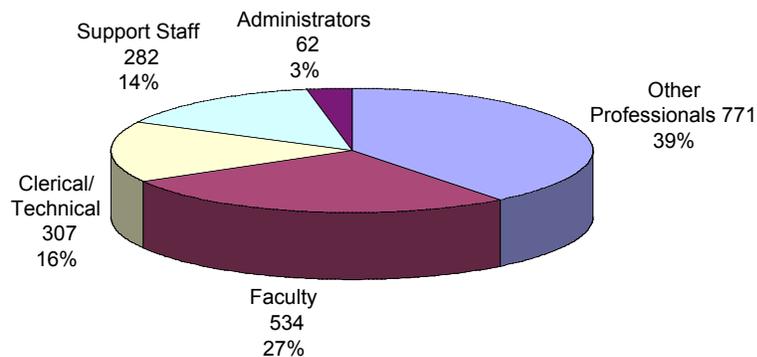
VI. Rensselaer as an Employer

In addition to contributing to the economy of the Capital Region and New York State through its role in developing human resources, creating new knowledge and supporting new business development, Rensselaer is itself a major regional employer. In October 2001, the Institute had 1,679 full-time employees, and 3,160 part-time workers at its Troy campus. (More than 90 percent of all part-timers were students.)

In 2002 Rensselaer ranked as the Capital Region's fourteenth-largest non-governmental employer, according to the *Capital District Business Review*. The same source lists the Institute as Troy's second largest private-sector employer.

As Figure 7 shows, faculty members account for 27 percent of the Institute's non-student employees, other professionals for 39 percent and clerical, technical and support staff for 30 percent.

Figure 7
Employment by Occupation, October 2001



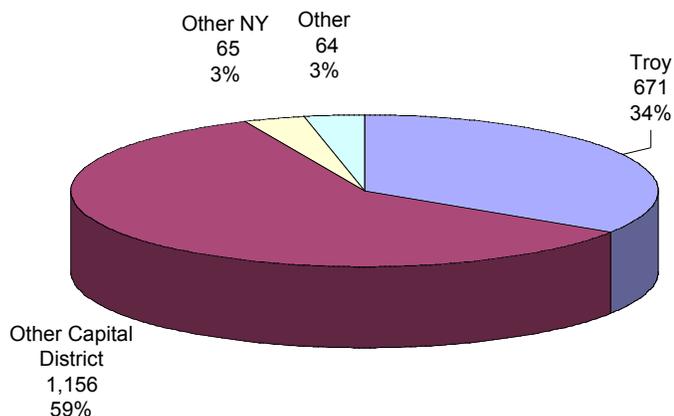
The total gross payroll for the Troy campus in calendar year 2001 was \$108.5 million.

Where Rensselaer Employees Live

More than 34 percent of Rensselaer's non-student employees in 2001 – 671 out of 1,956 – were residents of Troy. Not surprisingly, most of the remainder – 59 percent of all non-student employees – were residents of other Capital Region communities (Figure 8).

Wages and salaries paid to Troy residents in 2001 totaled \$33.3 million – 31 percent of the total. Payments to other residents of the Capital Region totaled \$62.7 million – 58 percent of the total. These payments to Rensselaer employees translate into expenditures for housing, groceries, other retail purchases, personal services, local property taxes and other purposes – in Troy and in communities throughout the region.

Figure 8
Employee Place of Residence, October 2001



The Quality of Employment at Rensselaer

Rensselaer is notable not only for the number of Capital Region residents it employs, but also for the quality of the jobs it offers. The quality of employment can be gauged both by the wages employees earn and by the opportunities for education and training available to them.

In 2001, the gross earnings of full-time employees at the Troy campus averaged more than \$55,500, significantly higher than the \$43,200 wage of the average Capital Region full-time worker in 1999.⁸ Faculty members at the Troy campus averaged more than \$92,200. Other full-time professionals (non-faculty researchers, librarians, etc.)

⁸ From the U.S. Bureau of Census. Adjusted for inflation.

earned an average of \$45,100; support staff, \$29,950, and clerical and technical workers, \$26,300. These salary levels generally compare favorably with those paid by other Capital Region employers.

Rensselaer also provides extensive opportunities for education and training. Rensselaer provides tuition to eligible employees and their spouses for up to two courses per semester at Rensselaer. Alternatively, the Institute may reimburse employees for tuition paid to other approved colleges and universities, for as many as two job-related courses per semester. During 2001-02, 241 employees took advantage of the Institute's tuition remission program.

Full-time employees with at least three years' continuous service are also eligible for full tuition benefits for up to eight undergraduate semesters for their children who attend Rensselaer. Alternatively, they are eligible for up to \$1,500 per semester in tuition reimbursement for children who attend other colleges and universities.

Rensselaer also provides in-house training programs, on topics as varied as workplace communication skills, managing teams, customer service, and workplace health and safety.

By investing in the skills of its employees, Rensselaer is not just enhancing the quality of its own services and the productivity of its own operations. In the long run, it is also helping to strengthen the overall quality of the region's workforce.

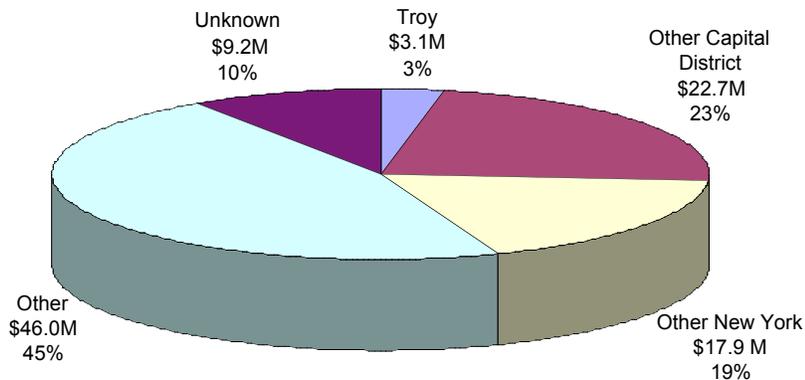
VII. Purchasing and Construction

Rensselaer also contributes to the region's economy through its purchases of goods and services, and through its investments in construction and renovation of its physical facilities.

In fiscal year 2001, Rensselaer spent a total of \$98.8 million on purchases of goods and services (including construction). Purchases of goods and services from companies located in New York State accounted for 44 percent of this total, or \$43.6 million.

Purchases from businesses located in the Capital Region in 2001 totaled \$25.8 million. Major categories of expenditure included construction, printing, publishing, marketing services, food, and furniture. Of the \$25.8 million paid to Capital Region businesses, purchases from businesses located in Troy accounted for \$3.1 million. (Figure 9)

Figure 9
Purchasing on goods and services,
by location of vendor



Construction at Rensselaer

University construction contributes to the continued development of the regional economy in two ways. It generates business for local construction firms and jobs for workers in construction and related industries. At the same time – and probably more important in the long run – it enhances the university’s ability to support the continued development of the regional economy through education, research, the generation of new businesses and community service.

Students = Spending

When students come to Rensselaer from around the nation and the world, they don't just bring their talents and aspirations. They also bring spending money. Funds that students spend off-campus – for housing, food, entertainment and various other items – represent an additional contribution to the local economy over and above the money paid to the Institute for tuition, fees, room and board.

During the Fall 2001 semester, 46 percent of Rensselaer undergraduate students and virtually all graduate students lived off-campus. In addition, both students living on- and off-campus spent money at Capital Region businesses. Using data from a national survey sponsored by The College Stores Research and Educational Foundation⁹, we estimate that Rensselaer's students spent \$23 million in the Capital Region, excluding the money paid to the Institute and its auxiliaries.

Construction spending at Rensselaer's Troy campus in 2001 totaled \$16 million. Small renovation and modernization accounted for virtually all of this spending. In 2002, construction spending rose to \$23 million.

Beginning in 2003, spending is expected to increase sharply, averaging \$65 million annually between 2003 and 2006. During this period, Rensselaer's program will directly generate approximately 450 full-time-equivalent jobs each year in construction and related industries.

⁹ College Stores Research and Educational Foundation. *Student Watch: Understanding College Student Consumer Behavior II*. (2000)

The growth of the Institute's construction program is primarily a function of the South Campus Development Project. The Project includes two major new facilities:

- **The Biotechnology and Interdisciplinary Studies Research Center**, an \$80 million, 218,000 square-foot complex combining laboratories, offices, seminar rooms and support space. Work done at the Center will focus on the application of expertise in engineering, information technology and the physical sciences to issues and problems in the life sciences. Funding for this project includes an investment of \$22.5 million under New York State's Gen*NY*Sis program.
- **The Experimental Media and Performing Arts Center (EMPAC)**, a 160,000 square-foot facility that will include a 1,200-seat theater, a 400-seat recital hall, several smaller performance spaces, studio and practice space, offices and support space. EMPAC will provide a focal point for Rensselaer's fast-growing electronic arts programs.

In addition to these major new facilities, the South Campus Development Project will include a 500-car parking garage, new boiler and chiller plants, a new electrical substation, open space improvements and a new campus entrance on College Avenue.

As noted above, the Institute's construction program will in the coming years do more than generate business and jobs for local contractors and construction workers. It is essential to Rensselaer's continuing effort to attract talented scholars and students, to double the size of its research enterprise, and contribute to the continuing growth of the regional economy.

VIII. Regional Economic Impact of Rensselaer's Spending

As a major regional enterprise in itself, Rensselaer Polytechnic Institute has an impact on the economy of the Capital Region – and more broadly, on the economy of New York State – that goes beyond its expenditures on payroll, purchasing and construction. In order to gauge the full extent of its economic impact, we need to take into account the “multiplier effect” of Rensselaer’s local spending.

Impact on the Capital Region's Economy

As noted in Parts VI and VII, a large share of Rensselaer’s annual revenues is spent within the eight-county Capital Region. In 2001, Rensselaer paid \$96 million in salaries and wages to employees who resided in the Capital Region. More than \$29 million was spent on purchases of goods and services (including construction) from Capital Region businesses.

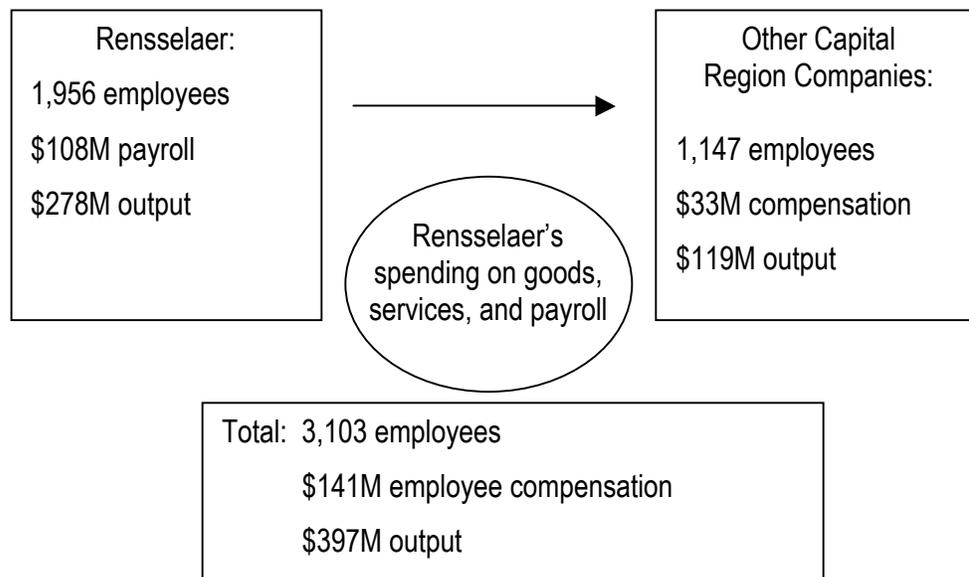
Part of the money that Rensselaer’s employees earn is also spent locally – for housing, food, utilities, day care, entertainment, etc. The Capital Region businesses from which Rensselaer buys goods and services similarly spend money locally – on purchases of goods and services from *their* local suppliers, and on wages and salaries for their employees. Taking into account this “multiplier effect,” Rensselaer’s local spending on goods, services, and payroll in 2001 was responsible for a total of \$119 million in economic activity in the Capital Region. This translates into an estimated 1,147 full-time equivalent jobs in other Capital Region businesses, accounting for \$33

million in employee compensation.¹⁰ When these indirect impacts are added to Rensselaer's \$278 million operation, with 1,956 employees in Troy, the total regional impact in the Capital Region comes to \$397 million in economic output and 3,103 jobs. (Figure 10)

This estimate of Rensselaer's overall economic impact does not include the impact of spending by students and by visitors. Students spend their money on everything from the rental of off-campus apartments to purchases of food and personal items to entertainment. Using data from Rensselaer on where its students live, and national research on how university students spend their money, Appleseed estimates that off-campus spending by Rensselaer students in 2002 totaled an additional \$23 million. When the multiplier effect is taken into account, the total impact of student spending in 2001 was \$30.6 million in economic output, and 283 jobs.

¹⁰ To quantify the economic impact of local spending, we used the input-output modeling system IMPLAN.

Figure 10
Rensselaer's Impact on the Capital Region Economy



Parents, prospective students, alumni and conference attendees also bring money into the Capital Region when they visit the area. However, because there is little hard information available on the number of visitors, their origin, and their off-campus spending, we have not tried to quantify this impact.

It should be noted that the estimate of regional economic impact presented in Figure 10 is based solely on Rensselaer's own operations and its indirect impact. It does not include the economic output and jobs associated with companies created at Rensselaer's Incubator Center, or tenants at the Rensselaer Technology Park, or the indirect impact that these companies generate.

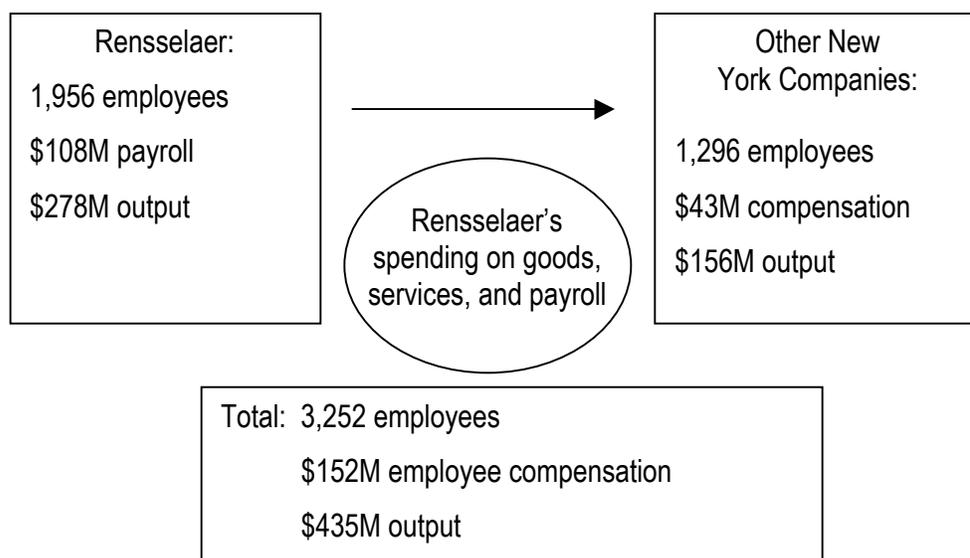
Impact on the New York State Economy

The economic impact of Rensselaer's spending on payroll, purchasing and construction extends beyond the Capital Region. In 2001 Rensselaer spent \$18 million on purchases of goods and services (including construction) from businesses located elsewhere in New York. Rensselaer also spent \$5 million on payroll for employees who live in New York but not in the Capital Region. Purchases made at businesses from other New York regions include computers, banking services, and laboratory equipment.

Taking into account the multiplier effect, Rensselaer's spending in New York State as a whole was responsible for \$156 million of economic activity, 1,296 full-time equivalent jobs, and \$43 million employee compensation in other businesses in the state. Together with the Institute's own operations, Rensselaer generated \$435 million in economic activity in New York and created 3,252 jobs, which together account for \$152 million in employee compensation. (Figure 11)

The impact of student spending on the state's economy adds an additional \$31.6 million in output and 292 jobs.

Figure 11
Rensselaer's Impact on the New York Economy



IX. Rensselaer and the Community

By attracting and developing talent, creating new knowledge and supporting the creation and growth of new businesses, Rensselaer is helping to ensure that the Capital Region is prepared to compete successfully in the twenty-first century's global economy. It is nevertheless important to recognize that not all of the region's residents, nor all of its communities, are equally well equipped to respond to the opportunities that this new economy can offer.

Because of their historic, 175-year-long relationship, Rensselaer has a particularly strong incentive for ensuring that the City of Troy is well-positioned and prepared to prosper in the new economy. And because of its special concentration of scientific, educational and technical resources, Rensselaer can help ensure that other communities in the region are similarly well-prepared.

There are two areas in particular in which Rensselaer is helping its neighbors prepare to compete more effectively in this rapidly changing economy:

- By helping to ensure that graduates of local schools are prepared for the opportunities that the new economy offers; and
- By helping the City of Troy and its communities create and maintain a stimulating environment in which to live, work, invest and do business.

Strengthening Schools, Expanding Educational Opportunity

Working in partnership with local schools and teachers, Rensselaer faculty, students and staff are helping to improve the quality of elementary and secondary education in neighboring communities. Here we will cite just a few examples of Rensselaer's involvement in such efforts.

- The **Technology Integration Initiative** managed by Rensselaer's Center for Initiatives in Pre-College Education (CIPCE) has for the past several years been working with elementary and middle schools in five area school districts to integrate new technologies more effectively into day-to-day classroom activities. The program operates through a team of technology mentors who work on-site with teachers at each participating school, one or two days each week.
- CIPCE is also working with a team including representatives from Rensselaer, Union College, and the Schenectady school district on a pilot project that integrates robotics into seventh-grade science and technology education.
- **The Rensselaer Alliance to Increase Student Excellence (RAISE)** offers after-school, weekend and summer classroom and research experience to an average of 900 middle- and high-school students from low-income neighborhoods in Troy and other nearby communities each year. Participating students regularly come to the Rensselaer campus for advanced classes in mathematics, chemistry and physics. The program also includes a mentoring component and financial counseling for prospective college students.
- **The New Visions Program**, a collaboration between Rensselaer and the local Board of Cooperative Educational Services, seeks to stimulate high school seniors' interest in mathematics, science, engineering and information technology. Participating students spend five mornings each week during the school year at Rensselaer, where they are exposed to both classroom and lab work in physics, computer science and engineering. The program also includes periodic visits to local technology-based companies.
- **The Capital Region Science and Technology Entry Program (STEP)**, funded by Rensselaer and the State Education Department, is designed to improve disadvantaged students' access to scientific, technical, engineering and health professions. The program offers after-school enrichment and summer programs,

and research experience, both on campus and with local companies, to 150 middle- and high school students.

- The Severino Center for Technological Entrepreneurship sponsors **EntrePrep**, a year-long entrepreneurial training and internship program for area high school students.
- **Tutor-Time**, started in 2001 by Rensselaer students, provides reading and math tutoring at the Lansingburgh Library for students from kindergarten through the ninth grade. A similar tutoring program is provided in association with America Reads and America Counts. In FY 2001 the programs ran for 30 weeks and involved 70 Rensselaer students who together donated 7000 hours of work.
- Rensselaer faculty and students have partnered with Rensselaer County and the Ark, first a downtown Troy after-school program and now a charter school, to provide after-school instruction in new communications technologies, aimed at preparing them both for further education and for future job opportunities in computer technology and electronic media. Graduate and undergraduate students have helped young neighborhood residents develop skills in areas such as web design, desktop publishing and video production.

Building Strong Communities

To flourish in today's economy, communities need more than good schools and access to educational opportunity. They need to create an environment that enables them to attract and retain talented people, and in which businesses can thrive and grow. Successful communities today are those that offer attractive places to live, work, invest and do business.

Rensselaer faculty and administrators have in recent years worked closely with city officials and community leaders to ensure that Troy is well-positioned and prepared to

participate in the growth of the Capital region's technology-based economy. In 1999, President Shirley Ann Jackson coined the term "communiversity" to reflect the deepening partnership between the university and the community that has been its home for more than 175 years.

Rensselaer's involvement in the revitalization of the City of Troy has taken several forms: direct involvement in downtown redevelopment; support for a wide range of economic development projects through the Troy Redevelopment Foundation; assisting in the development of the information infrastructure that the City will need to participate fully in the new economy; and collaborating with community groups to revitalize the neighborhoods adjacent to the Rensselaer campus.

Downtown Redevelopment

Rensselaer has been an active participant in efforts to revitalize downtown Troy. The Institute is managing the historic Rice Building, which was renovated in 2000 through a collaborative effort among Troy Savings Bank, the Troy Architectural Program (described below), and Rensselaer. Renovation work was financed with a \$2.3 million state grant secured by State Senator Joseph Bruno. As noted previously, the building has provided offices for companies that have outgrown their space at Rensselaer's on-campus Incubator.

Rensselaer has also contributed to downtown revitalization by moving its Lighting Research Center into 25,000 square feet of renovated space in the landmark Gurley Building. The building is also the home of Gurley Precision Instruments, one of the region's oldest companies, founded more than 150 years ago by Rensselaer alumnus William Gurley.

Rensselaer has reinforced its commitment to the City of Troy by moving faculty and staff off campus into downtown office space. Eighty-seven employees of Institute Advancement are based in the Hedley Building. The Lighting Research Center's 40 faculty and staff members work in the Gurley Building, and Rensselaer's Finance Department has 37 employees working out of the Rice Building.

The Troy Redevelopment Foundation

The Troy Redevelopment Fund, a non-profit partnership of Rensselaer, Russell Sage College, the Emma Willard School, Northeast Health and Seton Health, was established in 1995. Each year, the five member institutions commit a total of \$400,000 to support economic development projects in Troy. Half of each year's total is allocated to projects selected by the Mayor of Troy, and half to projects approved by a board consisting of the presidents of the five institutions.

Since 1995, the Foundation has contributed \$3.2 million to various projects including the establishment of a small business revolving loan fund, the opening of the RiverSpark Visitors Center, a study of the Hoosick Street Corridor, and the creation of a downtown business improvement district.

Public Service Internship Program

One way that Rensselaer students contribute to the community is through the Public Service Internship Program. A mandatory course for Human and Social Science students and an elective course for all other students, this program yearly attracts 150 students and each student performs 80 hours of community service. The PSI Program partners with local community organizations to develop focused projects that benefit the community and then assigns a team of students to help the organization complete the project. Current and past partners include the YWCA, the Ark Community Charter School, Troy Gateway Initiative, Capital District Community Gardens, and the South Troy Health Center. Examples of team-based student projects are the creation of CD-

ROM to promote homeownership in South Troy and the installation of a computer network system for the Sally Catlin Resource Center at the YWCA.

Community Networking

In 1997, faculty, staff and students at Rensselaer launched the Troy Community Networking Project, aimed at using the Internet as a resource for economic and social development in Troy and Rensselaer County. The project includes several elements.

- Faculty member and students have worked with the city to create and maintain TroyNet, a community web site. TroyNet includes a community events calendar, home pages for city government and the Historic Arts District, an interactive map, and virtual tours of Troy.
- Rensselaer administrators are working with city government to explore the development of a “municipal area network,” a subscriber-owned high-speed broadband network that would be available to public agencies, non-profit institutions and businesses in Troy. The network would provide higher-quality Internet connections than are currently available to most users in the city, at lower cost. A task force of Rensselaer administrators, city officials and representatives of the local business community are now working to determine whether there is sufficient interest among potential subscribers to support issuance of a request for proposals from service providers.
- Rensselaer faculty and students are also working with local officials to establish a Community Media Center in downtown Troy, which would give Troy residents and community organizations access to electronic media and communications technology.
- Rensselaer faculty and students are working with several community organizations on the development of community-oriented software – for example, a database and web interface that supports the City’s sale of tax-foreclosed properties; and an

online database called Connected Kids, which allows sharing of information among agencies and organizations serving children and youth.

Neighborhood Revitalization

In many cities throughout the United States, traditional “town-gown” conflicts have in recent years been moderated by a growing recognition that colleges and universities and the neighborhoods that surround them have many interests in common.

Rensselaer has over the years undertaken a number of initiatives aimed at helping to revitalize adjacent neighborhoods, and at strengthening its relationships with those neighborhoods. The Troy Architectural Program, for example, which was founded in 1969 by faculty and students at Rensselaer’s School of Architecture, is an independent non-profit organization that provides design and development services to neighborhood organizations – not just in Troy, but throughout the Capital Region. In 1996, Rensselaer joined with the city and with neighborhood groups – with support from Rensselaer County and a private foundation – to renovate The Approach, a turn of the century landmark stairway that links the Institute’s campus to downtown Troy.

Building on these and other efforts, Rensselaer in 2000 launched the Neighborhood Revitalization Initiative, a collaborative effort aimed at enhancing both the physical environment of the neighborhoods adjoining the Institute’s campus, and the quality of neighborhood life.

Overall direction for the Neighborhood Revitalization Initiative is provided by a forty-member Neighborhood Task Force, co-chaired by the City’s deputy mayor and the vice president for administration at Rensselaer. Other Task Force members include neighborhood residents, representatives of community institutions and neighborhood associations, faculty members and students. This year Rensselaer has committed

\$500,000 in direct support for the Initiative; the Task Force also draws on other Institute resources, and works to obtain support from other sources as well.

The Task Force has focused its efforts in three areas: community planning and infrastructure, economic development, and housing and livability. Specific projects undertaken to date have included:

- A Homebuyers Incentive Program, which provides grants of \$5,000 to qualified buyers who purchase a home in the neighborhoods immediately north and south of the Rensselaer campus. Participants need not be affiliated with Rensselaer; they must, however, commit to using the home as their primary residence for at least five years.
- Purchase and rehabilitation of blighted properties.
- Streetscape improvements.
- Hiring a consultant to develop a strategy for revitalizing the Hoosick Street retail area.

Supporting Community Partnerships

Recognizing Rensselaer's track record in working with its neighbors, and its commitment to building on that record, the federal Department of Housing and Urban Development in 2001 awarded a grant of \$400,000 to the Institute under its Community Outreach Partnership program. Rensselaer's Community Outreach Partnership Center (COPC) has been a major participant in several of the Institute's recent initiatives. It provides a home for the Neighborhood Revitalization Task Force, and supports its work. It also supports Rensselaer's involvement in the development of the proposed Community Media Center.

X. Looking to the Future

For more than 175 years, Rensselaer has been a partner with companies and communities in the ongoing development of the economy of New York's Capital Region. As this report has documented, this partnership has probably never been stronger – and the Institute's contribution to the region's economic growth never greater – than it has been during the past twenty years.

Nevertheless, Rensselaer's contribution to the development of the region's economy could well be greater during the next decade than it has been in the recent past. This is so for several reasons.

Perhaps the most fundamental reason is the continued growth of Rensselaer's research enterprise. As noted previously, the Rensselaer Plan has committed the Institute to the goal of increasing its research spending to \$100 million; and it is currently on track to reach that goal. Rensselaer is especially strong in several areas that are likely to be among the major drivers of economic growth during the next twenty years, including integrated electronics, biotechnology, nanotechnology and advanced materials. As Rensselaer's research enterprise expands, so will opportunities for collaboration with companies in the Capital Region and elsewhere in New York State.

Moreover, Rensselaer's continually-growing proficiency in translating new knowledge and new businesses means that over time, every dollar invested in research is likely to yield a greater return in new investment, business and jobs. Over the next decade, the roster of Rensselaer-related start-up companies that take root and grow in the Capital Region is thus likely to expand.

Finally, the continued growth of the region's technology-based economy will make it more enticing for Rensselaer graduates to remain in the Capital Region to live, work and create new businesses. Rensselaer's collaboration with the Center for Economic Growth and other institutions in the Beanstalk program, and other efforts to retain recent graduates, will help the region capitalize on its increased vitality.

By continuing to work closely with government, companies and communities in the Capital Region, Rensselaer can once again – as it has since its founding – help ensure that the future happens here.