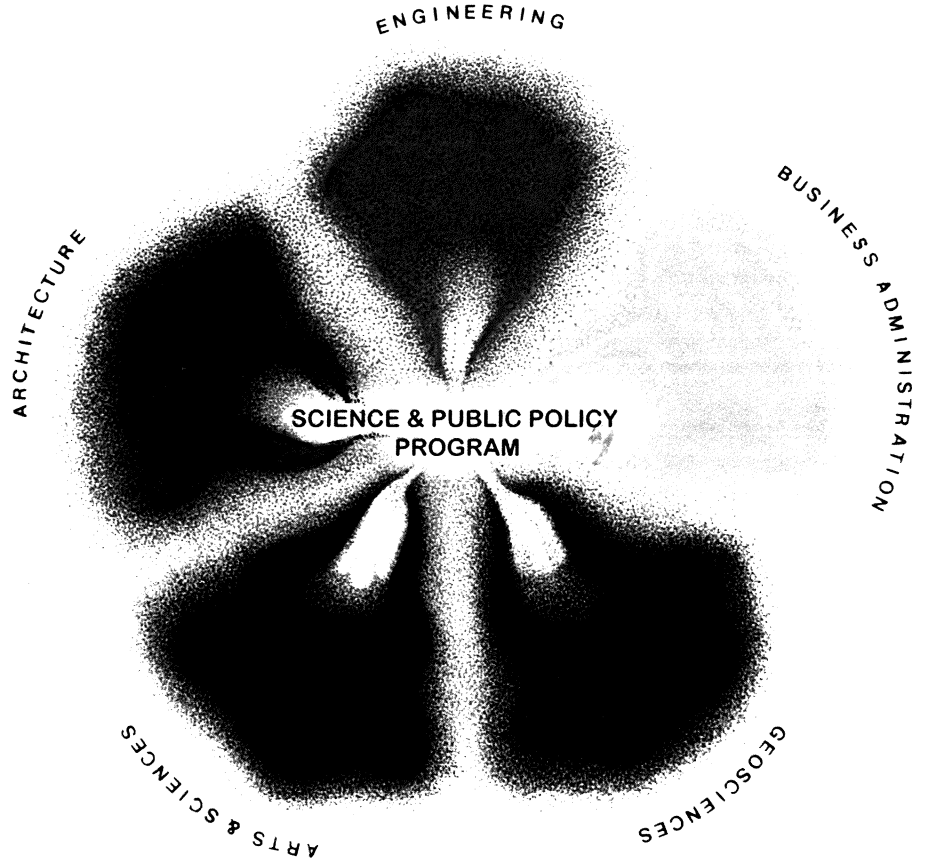


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# Science and Public Policy Program University of Oklahoma

Annual Report 1998



The **Science and Public Policy Program (S&PP)** is an interdisciplinary academic research unit at the University of Oklahoma. It conducts applied policy studies on important topics characterized by the complex interactions between science and technology. The Program was created in 1970 when science and technology were recognized as major forces driving social and environmental change, and as essential sources of knowledge for improving public policy. The goals of S&PP are to serve society by enhancing its problem-solving capabilities, and to advance the intellectual, educational, and public service missions of the University.

S&PP supports an interdisciplinary core faculty whose members approach their research by building task-specific teams designed to build upon individual and collective expertise. The core faculty members in S&PP hold joint appointments as Research Fellows in Science and Public Policy and as professors in academic departments. S&PP Faculty Associates, in contrast, do not hold their primary appointments in S&PP, but collaborate closely with core faculty in the design, development, and implementation of research projects that encompass mutual scholarly interests.

This annual report describes the Program's continuing and new research projects, with specific attention to the sources of extramural funds, the interdisciplinary character of S&PP's research and teaching, the faculty members involved in the Program's projects, and the previous year's accomplishments.

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## Credits

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Cover graphic: The graphic illustrates the cross-disciplinary relationship between S&PP's research activities and the five OU Norman campus colleges whose faculty and students collaborate with the unit. The cover graphic was created by Mary Morrison (copyright M. Morrison).

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## Report from the Director

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In 1998, the **Science and Public Policy Program** was fully engaged in policy research and teaching with faculty and students from *five* different colleges on the University of Oklahoma Norman campus. As the cover of this year's annual report dramatically illustrates, these are the College of Architecture, the College of Arts and Sciences, the Michael F. Price College of Business, the College of Engineering, and the College of Geosciences. Blending knowledge to further our shared understanding, however, is not as straightforward, nor as colorful, as it might appear.

To be successful, the integration of knowledge must be responsive to society's growing need for cross-disciplinary investigation of policy-related issues, the human and financial resources to support it, and the intellectual capability to provide it. As environmental, energy, and technology concerns have become better understood as fundamental to the nation's standard of living, sponsored research agencies have become more supportive of multidisciplinary activities that address them.

Agencies such as the Environmental Protection Agency, the National Science Foundation, and the National Oceanic and Atmospheric Administration, for example, have become more committed to helping universities nurture their ability to address society's complex policy problems. As one might expect, prominent problems such as achieving *sustainable development* are also among the most difficult to solve. Frequently this is the case because today's challenges often cut across public and private sector activities and involve a varied menu of environmental or technological elements and human values.

It is this inherent requirement to integrate scientific and technical knowledge, as well as the key stakeholders that create or utilize such knowledge, that motivates research development in the Science and Public Policy Program. In general, S&PP faculty follow several discrete steps in the course of conceptualizing and analyzing contemporary problems. In the initial *issue identification* step, the faculty familiarize themselves with those aspects of a policy-oriented problem which have already been studied and those which have not.

This discovery phase typically involves a review of the current research literature and considerable interactive exchanges with knowledgeable individuals from different professional fields and occupations. A good example of this process is reflected in S&PP's current research in *industrial ecology* and *life-cycle assessment*.

Next, the faculty engage in *team-building* exercises in which a good fit is sought between the best academic expertise and specific aspects of the research problem under study. It is not unusual, however, to find that those team-building tasks in which faculty colleagues' views are actively solicited often lead to a sharper and more coherent definition of the research problem, which improves the overall chances of success. Once the team is organized, *proposal writing* follows. For many researchers, writing a good proposal takes time, and multidisciplinary proposals are no exception. While there are some instances in which a proposal might get funded after its first submittal, the general experience for S&PP has been for the team to submit, revise, and re-submit a proposal, sometimes up to three times.

For S&PP, the execution of these steps with academic colleagues is a continuous process that helps to strengthen the Program's relationships with its campus collaborators, and improve the overall competitiveness of the University's faculty in multidisciplinary research. Readers interested in learning more about multidisciplinary university programs may wish to look at the American Association for the Advancement of Science web site at [www.aaas.org/spp/dspp/sepp/index.htm](http://www.aaas.org/spp/dspp/sepp/index.htm). Descriptions of many of S&PP's peer programs, including those at Carnegie-Mellon, George Washington, Indiana, MIT, Princeton, and Cal Berkeley, are located here.

Since the intellectual framework of any multidisciplinary effort in the University is built upon the disciplinary strengths of the individual colleges, it is gratifying to acknowledge and thank the academic talent that has made the past year so successful. As a participant from the College of Architecture, former OU professor **Jim Sipes** has been using his nationally-recognized skills with computer animation and design to render complex environmental phenomena into easily-visualized imagery

as part of a joint OU-OSU research effort directed at improving conservation management in the Illinois River basin.

In this same project, Prof. **Baxter Vieux** of the School of Civil Engineering and Environmental Science in the College of Engineering has been directing the development of numerical hydrologic models that characterize the flow of plant nutrients, such as phosphorus, over the variable topography of the Illinois River watershed. Also, Prof. Emeritus **Rex Ellington**, School of Chemical Engineering and Materials Science, has been working on two S&PP projects with Prof. **Mark Sharfman**, a management expert in the Michael F. Price College of Business. Both projects are directed toward improving our understanding of the organizational dynamics and mechanics of environmentally-friendly technological innovation.

In collaboration with Profs. **Scott Greene** and **Mark Morrissey** in the College of Geosciences, S&PP investigators have been examining how information about extreme climatic events, such as drought, can be transferred to and understood more easily by natural resource and emergency management professionals. In a related project, Profs. **Susan Postawko** and **Morrissey** have been collaborating with S&PP on a GLOBE project that examines climate variability in the South Pacific Island region. Profs. **Ed Sankowski** and **Zev Trachtenberg** of the Philosophy Department in the College of Arts and Sciences have been investigating the ethical dimensions associated with the management of the Illinois River. Prof. Trachtenberg is also collaborating with Profs. **Gregg Mitman** of the History of Science Department, **Linda Wallace** of the Botany-Microbiology Department, and S&PP Research Fellow **Rajeev Gowda** in the popular College of Arts and Sciences undergraduate degree minor, *Interdisciplinary Perspectives on the Environment* (IPE).

Beyond the brick gates of the Norman campus, the Program's faculty has been building research links with Profs. **Robert Lynch** and **Dan Boatright** in the Department of Occupational and Environmental Health, located in the College of Public Health at the OU Health Sciences Center. Both professors have been working on the Illinois River project along with three faculty members from Oklahoma State University: **Will Focht** in the Department of Political Science, **Keith Willett** in the Department of Economics, and **Lowell Caneday** in the College of Education.

In addition to academics, the Program's activities have also benefited from the creation of collaborative links with the private and public sectors. In recent years the number of companies, agencies, and municipal governments that have participated in S&PP's research activities has steadily grown. Among the key ones are **Conoco**, **DuPont**, **General Electric**, **Oklahoma Gas and Electric**, the **City of Tulsa**, the **Oklahoma Scenic Rivers Commission**, and the **Pacific Northwest National Laboratory**.

Taken together, these academic, corporate, and bureaucratic links provide the Science and Public Policy Program with a continuous stream of intellectual vigor and the vital relationships needed to test policy research in the turbulent worlds of business and government. In addition, they also provide a steady flow of University students from many of the colleges on campus, who are recruited to work on funded research projects while completing their undergraduate or graduate degree requirements. While many S&PP-supported students graduate to take private and public sector positions, some are fortunate enough to win academic positions. Two recent OU graduates, **Rick Farmer** and **Jeff Fox**, have both secured faculty positions in Ohio and North Carolina, respectively.

As the University responds to the growing societal expectation for its faculty and graduates to be better able to address today's complex problems in a collaborative manner, the Science and Public Policy Program is prepared to do its part. As time and space have continued to shrink, S&PP has responded by enlarging its research vistas to encompass state, national, and international issues. Recently, for example, two of the Program's three core faculty, Profs. **Rajeev Gowda** and **Mark Meo**, were recruited to serve on a campus task force to develop a Global and Regional Environmental Studies program in the International Programs Center. The third, Prof. **Rob Anex**, recently won a prestigious National Research Council Young Investigator award to study energy policy and its environmental impacts in Armenia.

Please read our annual report, and if you wish to know more about the Program, contact Ms. **Catherine Blaha** at 405/325-2554 or via e-mail at [cblaha@ou.edu](mailto:cblaha@ou.edu). Thank you.

**Mark Meo**, Director

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## The Science and Public Policy Program

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Last year marked the twenty-eighth anniversary of the Science and Public Policy Program at the University of Oklahoma, making it one of the oldest academic interdisciplinary research programs in the nation. From its inception in 1970, Science and Public Policy has carried out interdisciplinary research in areas that paralleled growing public concern about the influence of science and technology on the environment and the economy. Early studies by S&PP conducted in collaboration with other OU faculty have made important contributions to evolving national policies on energy and environmental quality. Upon its publication in 1973, *Energy Under the Oceans*<sup>1</sup> focused national attention on the University's unique multidisciplinary research team, its approach to technology assessment, and its contribution to resolving the nation's *energy crisis*, a situation that endures today. In the same vein, the Program published *Energy from the West*<sup>2</sup> in 1981 to elucidate the range of energy production alternatives under consideration within eight resource-rich western states. By 1987, when S&PP published *Cogeneration and Decentralized Electricity Production*<sup>3</sup>, national interest in environmental quality had expanded significantly to include global concerns resulting from energy use. By the end of the decade, S&PP had published *Symposium on Climate Change in the Southern United States*<sup>4</sup>, had contributed to the U.S.

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<sup>1</sup>*Energy Under the Oceans: A Technology Assessment of Outer Continental Shelf Oil and Gas Operations*, by Don E. Kash and Irvin L. White, with Karl H. Bergey, Michael A. Chartock, Michael D. Devine, R. Leon Leonard, Stephen N. Salomon, and Harold W. Young. University of Oklahoma Press: Norman OK, 1973.

<sup>2</sup>*Energy from the West: A Technology Assessment of Western Energy Resource Development*, by Michael D. Devine, Steven C. Ballard, Irvin L. White, Michael A. Chartock, Allyn R. Brosz, Frank J. Calzonetti, Mark S. Eckert, Timothy A. Hall, R. Leon Leonard, Edward J. Malecki, Gary D. Miller, Edward B. Rappaport, and Robert W. Rycroft. University of Oklahoma Press: Norman OK, 1981.

<sup>3</sup>*Cogeneration and Decentralized Electricity Production: Technology, Economics, and Policy*, by Michael D. Devine, Michael A. Chartock, David A. Huettner, Elizabeth M. Gunn, Steven C. Ballard, and Thomas E. James, Jr. Westview Press: Boulder CO, 1987.

<sup>4</sup>*Symposium on Climate Change in the Southern United States: Future Impacts and Present Policy Issues* (New Orleans, LA: May 28-29, 1987). Proceedings edited by Mark Meo. Science and Public Policy Program: Norman OK, 1987.

EPA's Report to Congress on the national impacts of global climate change, and had participated in an international study of Integrated Energy Systems, which are advanced electric power production systems designed to reduce environmental impacts and create multiple products from energy conversion processes.

As topics of national policy concern changed over time, the Program's emphasis has changed as well. This responsiveness is necessary for two reasons. First, it is essential to maintaining the unit's academic competitiveness for securing external research sponsorship, especially from federal agencies such as the National Science Foundation (NSF), the U.S. Department of Energy (DOE), and the U.S. Environmental Protection Agency (EPA). Second, it enables the Science and Public Policy Program to maintain an influential role in the national policy dialogue on current topics and issues. For example, in response to the growing influence of Pacific Rim countries in the international market for manufactured goods, Science and Public Policy, with the support of the NSF, undertook a study of the United States' competitiveness, with particular attention to the role of publicly-funded basic and applied research. The results of this study, published as *Innovation Through Technical and Scientific Information*<sup>5</sup>, highlighted the growing importance of technical and scientific information to the long-term viability of the U.S. economy in an electronic era. The report documented the growing importance of public-private partnerships in the institutionally complex areas of research, development, and demonstration, and recommended policies for augmenting the strategic use of technical and scientific information to enhance America's international competitiveness.

While the Science and Public Policy Program has continued to address emerging national energy, environmental, and technology issues, it also has made substantial contributions to Oklahoma's applied policy areas. In the last decade, for example, S&PP has

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<sup>5</sup>*Innovation Through Technical and Scientific Information: Government and Industry Cooperation*, by Steven C. Ballard, Thomas E. James, Timothy Adams, Michael Devine, Lani Malysa, and Mark Meo. Quorum Books: Westport CT, 1989.

conducted state-wide analyses of the potential for solid waste reduction through recycling and resource recovery; of the implications of alternative transportation fuels, particularly natural gas, to the state's economy; and of the issues surrounding Oklahoma's response to federal environmental regulations for confined animal feeding operations (CAFOs). In addition, numerous other studies ranging from public works infrastructure to drug use have been carried out by S&PP faculty to inform the continuing dialogue on state policy directions.

In recent years, the globalization of energy and environmental policy in conjunction with the challenge to incorporate environmental criteria more effectively into private-sector decision making has led to the emergence of sustainability as an integrating concept for both public and business policy. Corporate environmental management and the management of natural and technological risks are among two of the most pressing issues confronting today's planners and managers. As a consequence, these research areas have become central to building the Program's current policy research agenda.

As one of the oldest academic interdisciplinary policy research programs in the nation, S&PP has long relied on the contributions and involvement of OU's strongest academic departments. Initially structured as an organized research unit, S&PP does not offer academic

degrees, but participates in departmental teaching through its core faculty's joint appointments. Students are recruited into the Program's research activities primarily through classroom contact with S&PP faculty. In addition, the core faculty members have expanded the scope of their teaching obligations to include interdisciplinary courses, using this venue to share the results of their research and to make new connections among other faculty and students on campus. Though just a few of the University's academic departments have been linked directly to the Program's leadership, faculty and students from all around the campus have been actively involved in S&PP projects. Research associates and graduate students have been drawn from aerospace and mechanical engineering, anthropology, civil engineering and environmental science, economics, geography, industrial engineering, law, library science, political science, regional and city planning, and zoology.

The Program's administrative office is situated on the second floor of the Sarkeys Energy Center in room S202, and the faculty offices are located on the S corridor as well. S&PP's library, which houses periodicals, books, and a variety of newsletters pertaining to energy and environmental policy, can be found in room P118A, on the first floor adjacent to the East Atrium.

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## Faculty and Staff

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The faculty members in the Science and Public Policy Program are committed to active scholarly inquiry into interdisciplinary topics. At present, there are three core faculty members in the Program who lead thematic research areas. Their research interests are complemented by those of other campus departmental faculty. A recent change in titles should be noted here. As a result of their records of scholarly research, teaching, and service, Prof. **Rajeev Gowda** was promoted to the rank of Associate Professor with tenure, and S&PP Director **Mark Meo** was promoted from Associate Professor to Professor, effective July 1, 1999.

Faculty Associates strengthen the academic expertise of the core faculty and considerably enhance S&PP's capability to compete for extramural research awards. Last year, the Program benefited from the contributions of four faculty associates: Profs. **Rex Ellington** (Chemical Engineering and Materials Science); **Teresa Shaft** (Management Information Systems); **Mark Sharfman** (Management); and **Zev Trachtenberg** (Philosophy). The Program would like to acknowledge and thank Profs. Trachtenberg and **Mark Morrissey** (Geosciences) for their service on the Science and Public Policy Program Committee A during the past year.

### Core Faculty

#### **Mark Meo**

Director, Science and Public Policy Program & Professor, Civil Engineering and Environmental Science

Ph.D. 1983, University of California, Davis

Interests: Global environmental change policy; Policy innovation and social learning; Environmental planning and management; Use of scientific and technical information; Clean fuels and technological innovation; Sustainable development.

#### **Robert P. Anex**

Research Fellow, Science and Public Policy Program & Assistant Professor, Aerospace and Mechanical Engineering

Ph.D. 1995, University of California, Davis

Interests: Environmental engineering; Pollution prevention; Waste management; Design for environment; Dynamic system modeling and control; Decision making under conditions of uncertainty; Energy markets.

#### **M. V. Rajeev Gowda**

Research Fellow, Science and Public Policy Program & Associate Professor, Political Science

Ph.D. 1992, Wharton School, University of Pennsylvania

Interests: Prospect theory; Decision and risk analysis; Environmental policy; Cross-cultural risk studies; Native American health and environment; Political economy; Rational choice; Law and economics; Experimental economics.

### Faculty Associates

#### **Rex T. Ellington**

Professor Emeritus, Chemical Engineering

Ph.D. 1953, Illinois Institute of Technology

Interests: Total systems; Total life-cycle analysis; Management for economic, energy, and environmental sustainability; Human, technical, and environmental systems interactions; System analysis for effects after shutdown; Project management.

#### **Teresa M. Shaft**

Assistant Professor, Management Information Systems

Ph.D. 1992, Pennsylvania State University

Interests: The development and maintenance of environmental information systems, particularly those which support life-cycle oriented environmental management; The validation and verification of expert systems; The cognitive processes of programmers.



**Mark P. Sharfman**

Associate Professor, Strategic Management

Ph.D. 1985, University of Arizona

Interests: Organization's relationship with the business environment; Effect of the business environment on the natural environment; Strategic choice.

**Zev M. Trachtenberg**

Associate Professor, Department of Philosophy

Ph.D. 1988, Columbia University

Interests: Analysis of environmental regulation as taking of private property; Ethical dimensions of Industrial Ecology.

## **Staff**

**Catherine Blaha**

Assistant to the Director

**Linda Hulse**

Secretary I

**Mary Morrison**

Information Resource Manager and Librarian

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## Research

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The Science and Public Policy research agenda addresses the increasingly critical roles that science, technology, and values play in the global search for sustainable development. The Program's research strategy is to identify and respond to key issues of national and international concern to which the combined core and associated S&PP faculty can make significant intellectual contributions. Support for S&PP's research program is achieved through faculty competition for research funds available at the national, state, and local levels. A summary of the Program's research effort and awards is presented in Tables 1 and 2 on pages 13-15.

In 1998 the research emphasis of the Science and Public Policy Program continued to focus on the energy and environmental aspects of sustainable development, and the role of decision analysis in public policy. In the **energy** area, Program faculty continued their research on Life Cycle Assessment in an examination of the technological innovation of clean energy systems. In particular, the team completed the second year of a three-year study of the historical development of energy-efficient combined-cycle natural gas turbines, and the relationship of radical and incremental innovations to the lifetime performance of the technology. This research complements S&PP's almost-completed research project with DuPont and Conoco (formerly DuPont-Conoco) on the influence of government regulation on the pace of corporate innovation in energy and environmental technology markets.

In the **environmental** area, S&PP completed the second year of a three-year, multi-campus research project to determine how the environmental integrity of the Illinois River basin in northeastern Oklahoma might be better protected. The joint University of Oklahoma and Oklahoma State University project, which involves ten faculty from seven different colleges, integrates disciplinary expertise in environmental science, engineering, and landscape architecture with that in the social sciences and humanities. The research focus of this team is to address current land use and water quality conflicts in the watershed. This project is both exploratory and applied in the sense that the team's findings are expected to be transferred directly to

national, state, and local decision makers and natural resource managers.

Two additional projects with an environmental focus were continued in 1998. The influence of risk on the use of scientific information for responding to extreme weather events, such as drought, is the subject of a two-year project funded by NOAA that S&PP is conducting with researchers in the Oklahoma Climatological Survey and the College of Geosciences. This project, which examines state policy responses to the 1996 and 1998 Southwestern droughts, will provide valuable insights into the different ways risk perception about the droughts and their impacts shaped human behavior and institutional responses. S&PP also continued its investigation into the strategies by which the City of Tulsa has received national acclaim for its policy innovations in flash-flood hazard mitigation, regional municipal solid waste recycling, and air quality management.

In the **decision analysis** area, S&PP has continued its involvement in the interdisciplinary and intercollege GLOBE program that bridges environmental and energy topics. In addition, S&PP faculty and graduate students have been actively involved in developing a book on the implications of heuristics and biases in decision analysis for public policy.

## Energy & Sustainability

Energy issues continue to play an important role in public and private affairs. Because of the essential role that energy plays in international, national, and subnational activities, the Science and Public Policy Program has maintained an active interest in energy policy since its founding in 1970. In the past several years, S&PP faculty researchers have focused their attention on those energy issues that provide a basis for linking public- and private-sector concerns.

As an example of this orientation, S&PP faculty have begun to study Life-Cycle Assessment (LCA), which has become central to international, national, and state agencies concerned about developing and using tools that advance sustainability. In addition, LCA has

become an important management technique for corporations interested in adopting and applying the ISO 14000 environmental quality standards. Thus, the Program's focus on LCA as a bridging technique between business and government also enables the faculty to address current and emerging issues in energy and energy-related topics, such as global climate change policy.

### *Innovation and the Transformation of Clean Technologies*

In a project funded in 1997 by the National Science Foundation, an S&PP team is examining the degree to which LCA can be used as a tool for guiding environmental, or *green*, technological innovation. This three-year project is being carried out by a research team comprised of Profs. Meo, Anex, Ellington, and Sharfman. The OU team has partnered with General Electric Company's R&D program in power systems and Oklahoma Gas and Electric (OG&E) to examine the historical development of GE's natural-gas-fired combined-cycle turbine, one of the cleanest electric power generation technologies in existence.

By carrying out a retrospective analysis of the developmental path of this energy technology, the research team has developed several after-the-fact LCAs at specific points in the turbine's evolutionary history that document the environmental aspects associated with the innovation process. The research team has begun its exploration of the implications of LCA for technological innovation by examining the spinoff case of biomass-fired combined-cycle power plants. This application of advanced gas-turbine technology is currently of interest, since a growing number of regions in the developing world, rich in biomass resources, also seek to generate electric power in an energy-efficient and clean manner. Moreover, the project should elicit better understanding of the best way to match public-sector support with private-sector innovation, particularly for green technologies.

As part of this project, the S&PP team began a collaboration with researchers at the Pacific Northwest National Laboratory to evaluate the lab's innovative LCA software (*LCAD*) by applying it to the different turbine configurations under study. In addition, the team began an informal collaboration with the U.S. Department of Energy's Advanced Turbine Systems program, which is a multi-million dollar partnership with industry and academe to design and build the next

generation turbine. Additional work has involved personal interviews, administering a survey, and evaluating technical documents and archival materials.

### *Regulation and Green Technological Innovation at DuPont-Conoco*

Profs. Sharfman, Ellington, and Meo have been collaborating on a continuing project that seeks to understand the influence of governmental regulation on the pace of green technological innovation. With the support of the U.S. Environmental Protection Agency's Environmental Technology Initiative, the S&PP team, under the direction of Prof. Sharfman, has prepared a set of four case studies on technological innovations that have taken place within DuPont and its former subsidiary Conoco. With the help of Archie Dunham, the president and CEO of Conoco and a member of OU's Sarkeys Energy Center Board of Directors, the team has identified two product and two process innovations that illustrate the range of environmental, business, and organizational issues that are central to the decision to become greener. The four cases being examined include Conoco's development of biodegradable lubricants; Conoco's advances in vapor recovery from natural gas production operations; DuPont's introduction of post-consumer recycle content into its Tyvek manufacturing process; and the unique technology, the SmartBox, that DuPont co-developed to deliver a potent organophosphate pesticide into the soil without exposing the farmer/applicator to any health risk. The team recently synthesized its findings and conducted a questionnaire survey of several hundred businesses to determine the key factors that either inhibit or facilitate the development and adoption of green technologies.

### *Energy Policy in Armenia*

During the summer of 1999, Prof. Rob Anex will be part of a small team of U.S. researchers traveling to Armenia. The trip, sponsored by the National Research Council with support from the U.S. Department of State's Research and Training Program for Eastern Europe, will focus on the political, economic, and environmental aspects of Armenia's options for long-term energy security.

Armenia is slowly recovering from an armed conflict with Azerbaijan that lasted from 1988 until May, 1994,

claiming over 25,000 lives and creating more than one million refugees. The fighting centered on Nagorno-Karabakh, an ethnic Armenian enclave in Azerbaijan. An energy blockade by Azerbaijan and Turkey and political instability in Georgia has left Armenia, which has no fossil fuel resources of its own, in a severe energy crisis. This crisis has led to deforestation; the draining of lakes for hydropower, which threatens drinking water supplies and destroys important natural habitat; and the restart of Unit 2 of the Medzamor nuclear power plant, which lacks fundamental safety features such as containment and an adequate core-cooling system.

The interdisciplinary U.S. team will consider environmental concerns with current energy sources as well as problems and benefits associated with increasing energy supplies, including the use of renewables and the potential impact of new oil and gas pipelines planned for the region. They also will examine options for demand-side management in residential and industrial sectors. The team members were chosen to provide expertise in energy planning, energy economics, political science, and environmental management. Prof. Anex's expertise in energy system life-cycle assessment, as well as environmental policy, economics, and engineering, will make him a versatile team member.

## **Environment & Sustainability**

The social goal of achieving sustainable development has obligated academics to develop new approaches to their research endeavors. As a result of the interdepartmental structure by which S&PP faculty are appointed and evaluated, an interdisciplinary perspective in conducting research has long been a characteristic specialty of the Program's scholarly activities. By actively seeking to study the interaction of environmental science, technology, and values in its policy research, S&PP has developed an intellectually stimulating portfolio of projects that well illustrate the essential role interdisciplinary engagement plays in meeting the challenge of building a more sustainable society.

## ***Ecological Risks, Stakeholder Values, and River Basins***

In late 1997, a team of researchers from the University of Oklahoma and Oklahoma State University began a three-year interdisciplinary project on the Illinois River watershed after winning a competitive research award from the joint EPA and NSF Partnership for Environmental Research in water and watersheds. The team, which is led by Prof. Mark Meo of S&PP, includes OU professors Baxter Vieux, Civil Engineering and Environmental Science; James Sipes, former head of the Division of Landscape Architecture; Edward Sankowski and Zev Trachtenberg, both in the Department of Philosophy; and Robert Lynch and Dan Boatright, both in the Department of Occupational and Environmental Health at the OU Health Sciences Center. Participating from OSU are Profs. Will Focht, Department of Political Science; Keith Willett, Department of Economics; and Lowell Caneday, Associate Dean of the College of Education. The goal of the project is to demonstrate how different environmental and social values held by river basin stakeholders can be identified and compared so that more effective environmental protection strategies can be adopted by local land and water use interests and agencies.

The research team has begun to develop and test an integrated impact assessment management protocol for the Illinois River watershed. The protocol links the ecological, economic, hydrological, social, and political aspects of the watershed in an interdisciplinary approach that provides a more realistic framework for calculating, communicating, and negotiating environmental risks and competing social values. In the first two years of the project, the research team: (1) has identified stakeholder views on the Illinois River basin; (2) is determining the economic effects of alternative land and water uses for several study sites in the river basin; (3) has calculated the ecological risks associated with different intensities of resource use; (4) is developing hydrologic models using Geographic Information Systems (GIS) that incorporate water quality aspects of alternative land use practices; and (5) is creating computer-generated imagery of each site that will enable stakeholders to visualize more easily the implications of different management options for the river basin's resources.

Last year members of the research team investigated stakeholders' perspectives of natural, economic, and

socio-political impacts through personal interviews. These groups included technical experts, lay stakeholders, and policy makers. Background data has been drawn from prior agency and university studies of the Illinois River watershed, its carrying capacity, and existing land use plans.

**Ed Fite**, Administrator of the Oklahoma Scenic Rivers Commission, has been of great assistance to the team by making research materials, published reports, and key contacts available. Recently, he guided several team members on a helicopter flight to photograph the diverse set of environmental problems found in the watershed.

In the final year of the project, stakeholder groups will be engaged in a policy dialogue and a test of the effectiveness of integrated computer models and imagery to facilitate the risk communication of complex environmental management issues. Visual simulations developed from GIS-based hydrologic models and related information will be presented to stakeholders in conjunction with focus group sessions to ascertain management preferences and the overall legitimacy of negotiated agreements. Negotiation workshops will be held to develop a consensus about land use practices that afford an adequate level of protection to the basin. The entire process will be tested to determine the degree to which the process is viewed by experts and lay stakeholders as efficient, effective, and legitimate, and therefore acceptable.

### *Drought, Information, and Policy Response*

Profs. Meo and Gowda began a project in 1997 that examines the role of risk perception in decision making about drought. In collaboration with the Environmental Verification and Analysis Center located in the College of Geosciences, the S&PP faculty have teamed with Profs. Mark Morrissey and Scott Greene to examine how climate information was used in decision making during the Southwestern drought that devastated sections of several states, including Oklahoma, in 1996 and more recently in 1998. The two-year project is sponsored by the Human and Economic Dimensions section of the Office of Global Programs in the National Oceanic and Atmospheric Administration (NOAA).

Under the direction of Prof. Meo, the team has conducted a number of personal interviews with key

resource managers and decision makers throughout Oklahoma to determine how climate and weather information was acquired, used, and communicated in response to the onset and evolution of severe drought conditions. To recreate the drought conditions, the team is using the extensive database collected by the University's unique Mesonet system. The Mesonet is a joint OU/OSU effort that collects meteorological information at five-minute intervals from an array of 114 automated measurement stations that cover the state. The Oklahoma Climatological Survey manages the Mesonet at OU. **Howard Johnson**, Associate Climatologist for Service, and Dr. **Robert Dauffenbach**, Director of the Center for Economic and Management Research in the College of Business Administration, are assisting the research team. Findings from this project should help improve weather-related risk communication in general and provide a better base of information for Oklahoma's Drought Management Task Force, of which Howard Johnson is a member.

### *Strategic Policy Innovation and Social Learning*

The City of Tulsa, Oklahoma, widely recognized as a national leader in urban environmental policy, is the subject of a two-year research project funded by the National Science Foundation. Mark Meo, S&PP Director, is investigating Tulsa's emergence as a policy leader, with the intention of helping other cities move more readily toward the national goal of sustainability. The timeliness of the project is underscored by the Federal Emergency Management Agency's launching last year of *Project Impact*, in which Tulsa won recognition as a leading example of natural disaster risk management and mitigation. This leadership has been underscored by President Clinton's appointment of Tulsa Mayor **Susan Savage** to the President's Council on Sustainable Development, the only mayor on the council.

The strategy by which environmental policies can be successfully developed and implemented is often difficult to put into practice. While scientists and engineers recognize that a paradigm shift toward environmentally-benign programs can provide greater benefits to society in the long term, less well understood is how the policy process can facilitate that shift when and where physical or social circumstances warrant. Significant policy changes typically are

marked by recurring disputes between political interests, those that support a more integrated approach to environmental management versus those that do not. In this respect, Tulsa has a remarkable history of environmental policy innovations. Of particular interest to the project, Tulsa has received national attention for its innovative programs in flash-flood hazard mitigation in the Mingo Creek area, in municipal solid waste recycling under the authority of the Metropolitan Environmental Trust (the M.e.t.), and in air quality management of urban ozone levels (the *Ozone Alert!* program).

Understanding the dynamics of policy innovations is key to understanding how society can foster sustainable development. Tulsa's policy innovations have been strategic in the sense that, while these changes took place over a fairly lengthy time period and were the subject of numerous scientific and technical arguments, they also were guided by entrepreneurial individuals who were quite knowledgeable about emerging policy issues and the political process. During the two-year project, Prof. Meo and his student team have been investigating alternative conceptual models that integrate the role of scientific and technical information in environmental policy innovation, the influence of competing advocacy coalitions, the effect of social learning, and the role of policy entrepreneurs in creating opportunities for policy change to take place.

As a result of this and related projects, the Science and Public Policy Program was recruited in 1998 to become a partner in Tulsa's *Project Impact* program.

### ***GLOBE Project***

Global climate change caused by unsustainable human actions is a major concern for scientists and policy makers alike. The Global Learning and Observations to Benefit the Environment (GLOBE) program is one of the initiatives responding to this problem. Conceived by Vice President Al Gore, this NSF-administered program aims to inculcate environmentally sustainable activities in people through participation in educational exercises. GLOBE involves students in a series of earth-related research activities, such as environmental measurement and monitoring, that enable them both to learn about the environment and to contribute to the scientific enterprise. Through GLOBE research, students around the world are linked with scientists and other students through the Internet to create a global

learning community oriented toward environmentally sustainable action.

Prof. Gowda has participated in the GLOBE program for the last four years. The research team at OU, including Principal Investigator and Prof. Susan Postawko of Meteorology, Prof. Mark Morrissey of the Oklahoma Climatological Survey and the Department of Geosciences, Prof. Gowda of S&PP, and Andrew Wood of the Oklahoma Climatological Survey, received an additional four-year GLOBE grant in 1998. As part of this project, Gowda will continue working on the fundamental question of what students know about climate change and how they err. Gowda, along with former graduate student Jeffrey Fox, has conducted questionnaire surveys of high school students in order to understand their knowledge of and attitudes toward climate change. In future work, Gowda will help to develop innovative educational exercises which draw on the various GLOBE projects to enhance students' understanding of complex issues such as climate change.

## **Decision Analysis & Public Policy**

The policy sciences constantly witness debates over policy failures, paradoxes, and inefficiencies arising from people's "irrational" behavior. A fundamental reason for this may lie in the assumptions, approaches, and methods of economics that policy analysts bring to their work. Recent research in the field of behavioral decision theory offers an alternative perspective on rationality, with a more descriptively accurate account of how humans arrive at judgments and choices, especially under conditions of risk and uncertainty.

Prof. Rajeev Gowda has been working on a research initiative which attempts to bring behavioral decision theoretic insights to bear on public policy controversies. He has been applying this perspective on issues involving the regulation of health and environmental risks in the United States. Former graduate research assistants Jeffrey Fox and Rick Farmer have extended applications of this approach to political contexts, such as whether voters can make informed choices given the nature of political advertising.

As a result of having organized a series of well-received panels at a 1997 professional conference, Prof.

Gowda and Jeffrey Fox have been engaged in a project to edit a book entitled *Judgments, Decisions and Public Policy*. This book will bring together leading scholars to showcase diverse applications of behavioral decision theory in public policy. Such a book will leave policy analysts and practitioners with a clearer understanding of the complexities of human judgment and choice, and with an idea of how to integrate behavioral decision theoretic insights into more realistic and effective policies.

## Student Research

Students are involved in several aspects of S&PP's research and teaching activities. While the Program does not offer a formal degree, students from different academic units participate in a variety of ways: they help to write proposals, conduct research, explore new topics, and prepare teaching materials. In this way, students get day-to-day experience in interdisciplinary research that directly benefits their career development. Working with S&PP faculty, student researchers can satisfy thesis and dissertation requirements and improve their prospects for professional employment.

**Eileen Chiam** is an industrial engineer pursuing a Masters of Business Administration in the Michael F. Price College of Business. Eileen is assisting Prof. Anex on several projects, including the examination of technological innovation in gas turbine engines, the economics of recycling, and decision making under uncertainty.

**David Hergenrether** is an undergraduate mechanical engineering student from Lawton, Oklahoma. David is working with Prof. Anex under an NSF *Research Experiences for Undergraduates* (REU) supplemental grant to research the history of the technological development of gas turbine engines since the second world war. David has written a draft report that summarizes the major technological innovations in gas turbines over the past fifty years and correlates these developments with the government policies, research and development expenditures, and market forces that may have influenced the technological development trajectory. His work was presented in a poster recently at the Oklahoma State Capitol during Research Day.

**Tanya Haviland** is an undergraduate environmental science student in the School of Civil Engineering and Environmental Science. Tanya worked on the Tulsa project with Prof. Meo and was supported by an NSF REU award.

**Carlie Lawson** is a graduate student in Regional and City Planning who spent the past year working on the NOAA-funded drought project with Profs. Meo and Gowda. Carlie is writing her master's thesis on organizational learning associated with the Oklahoma droughts of 1996 and 1998.

**Rezaul Mahmood** is a doctoral candidate in the Department of Geography who works with Prof. Meo on the NOAA drought project. Rezaul's dissertation work focuses on monsoonal rainfall variability and rainfed rice productivity in Bangladesh, and Prof. Meo is co-chair of his doctoral committee.

In 1998 Rezaul had several papers published and helped co-author a paper with Meo for presentation at the 1999 annual American Meteorological Society meeting in Dallas.

**Karl Pepple** was a master's student in environmental science, and worked with Prof. Meo on the NSF-sponsored Tulsa project. Karl's thesis research addresses the role of policy entrepreneurs in policy innovations associated with the Mingo Creek flood mitigation project. Karl graduated in 1999 and is presently attending law school at the University of Houston.

**Terri Stubblefield** is an undergraduate student in the College of Liberal Studies who worked on the Tulsa project with Prof. Meo. Terri was supported by an NSF REU award and also won an Undergraduate Research Opportunities Program (UROP) award to conduct a study of Tulsa's ozone prediction model. Terri presented her findings at the University's Undergraduate Research Day in April, 1999.

**Sasidhar Velnati** is an Aerospace and Mechanical Engineering master's-level student who worked with Prof. Robert Anex on the NSF-funded turbine project. Under the guidance and supervision of Prof. Anex, Sasidhar conducted his thesis research on the Life Cycle Assessment of biomass-based, integrated gasification, combine-cycle power systems, with a third-world-country perspective. Sasidhar graduated in 1999.

**Becky Ziebro** is a doctoral candidate in environmental science working with Prof. Meo on the NSF-sponsored Tulsa project. Becky's dissertation research investigates aspects of social learning, natural hazard mitigation, and environmental policy innovation.

**Table 1. Research Proposals Submitted and Grants Awarded in CY 1998**

Agency	Title/Document Number	Participants	Amount	Funded?
NSF	Conference on Judgments, Decisions, and Public Policy SPP-PR-01-98	Principal Investigator: <b>Rajeev Gowda</b> Co-PI: <b>Jeffrey Fox</b>	\$34,959 S&PP's share is \$34,959	No
OU College of Arts and Sciences	Judgments, Decisions, and Public Policy SPP-PR-02-98	Principal Investigator: <b>Rajeev Gowda</b>	\$6,000 S&PP's share is \$6,000	No
NSF	Values in Industrial Ecology: A Comparison of Paradigms SPP-PR-03-98	Principal Investigator: <b>Robert P. Anex</b> Co-PI: <b>Zev Trachtenberg</b>	\$166,478 S&PP's share is \$99,887	No
NSF	Integrating Suppliers and Customers into Environmental Quality Management Efforts: A Cross-National Investigation SPP-PR-04-98	Principal Investigator: <b>Mark Sharfman</b> Co-PIs: <b>Robert P. Anex, Rex T. Ellington</b>	\$299,994 S&PP's share is \$74,999	No
NSF	Participation in the GLOBE Atmospheric Science Experiments SPP-PR-05-98	Principal Investigator: <b>Susan Postawko</b> Co-PIs: <b>Andrew Wood, Rajeev Gowda, Mark Morrissey</b>	\$640,000 S&PP's share is \$160,000	Yes
IPEC	Environmental Training Initiative on the Impact of Global Climate Change on Domestic Petroleum Industry SPP-PR-06-98	Principal Investigator: <b>Zev Trachtenberg</b> Co-PI: <b>Rajeev Gowda</b>	\$17,640 S&PP's share is \$8,820	No
NSF	Shared Vision: Industrial Ecology, Sustainability, and the Learning Organization SPP-PR-07-98	Principal Investigator: <b>Robert P. Anex</b> Co-PI: <b>Zev Trachtenberg</b>	\$99,994 S&PP's share is \$59,996	No
NSF	Life Cycle-Based Design for Electroplating SPP-PR-08-98	Principal Investigator: <b>Robert P. Anex</b>	\$56,723 S&PP's share is \$56,723	No
NSF	REU Supplement: MOTI: Innovation and the Transformation of Clean Technologies: A Life-Cycle Approach to the Management of Gas Turbine Systems SPP-PR-09-98	Principal Investigator: <b>Mark Meo</b> Co-PIs: <b>Robert P. Anex, Rex Ellington, and Mark Sharfman</b>	\$5,000 S&PP's share is \$3,350	Yes

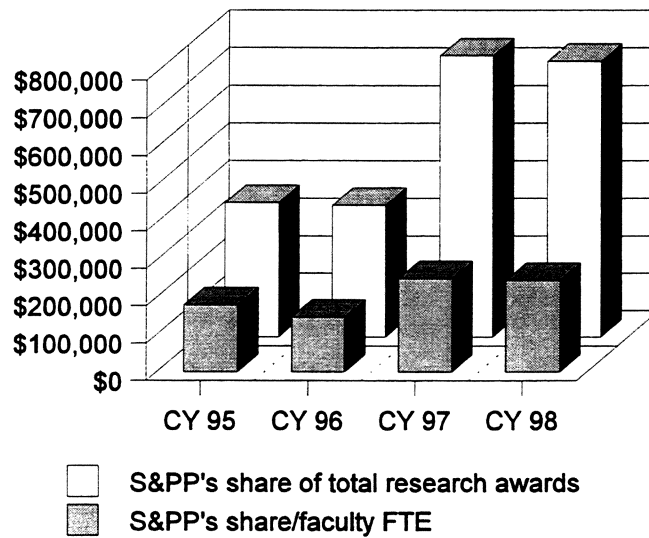


Agency	Title/Document Number	Participants	Amount	Funded?
NSF	IGERT Preproposal: Environmental Professionals for the 21 <sup>st</sup> Century SPP-PR-10-98	Principal Investigator: Robert Knox Co-PIs: Mark Meo, Joseph Sufita, Rajeev Gowda, Robert Nairn, Zev Trachtenberg, David Sabatini, Michael McInerney, Mark Nanny, Keith Strevett, Larry Canter, Deborah Nelson, Jeffrey Harwell, Baxter Vieux, Kelvin Droegemeier, Randall Kolar, and Linda Wallace	\$2,085,076 S&PP's share is \$125,105	No
U.S. Dept. of Justice, National Institute of Justice	Information, Technology, and Risk Management in Community Policing: The Utility and Effect of Sex Offender Notification under Megan's Law SPP-PR-11-98	Principal Investigator: Rajeev Gowda Co-PI: Jeffery Fox	\$194,307 S&PP's share is \$194,307	No
Oklahoma Regents for Higher Education	Oklahoma Center for Aging Systems and Infrastructure SPP-PR-12-98	Principal Investigator: James Baldwin Co-PIs: Melissa Rieger, Edgar O'Rear, and Robert P. Anex	\$1,630,342 S&PP's share is \$244,551	No
NOAA	Incorporating Early-Warning Climate Forecast Information into Energy Industry Decision Making SPP-PR-13-98	Principal Investigator: Dennis O'Brien Co-PIs: Rajeev Gowda, David Montroy, Peter Lamb, Kenneth Nixon	\$450,000 S&PP's share is \$112,500	No

**Table 2. New and Continuing Research Awards in CY 1998**

Agency	Title/Project Period	Participants	Amount
NSF	Participation in the GLOBE Atmospheric Science Experiments 08/01/1998 - 07/31/1999	Principal Investigator: Susan Postawko Co-PIs: Andrew Wood, <b>Rajeev Gowda</b> , Mark Morrissey	Total: \$155,000 (first-year funding) S&PP's share: \$38,750
U.S. Dept. of Education, GANN	Chemicals in the Environment: Doctoral Fellowships in Environmental Engineering 08/15/1998 - 08/14/2001	Principal Investigator: Robert Knox Co-PIs: <b>Mark Meo</b> , Jess Everett, Robert Nairn, Md Zaman, David Sabatini, Leslie Fink, Mark Nanny, Keith Strevett, Larry Canter, Deborah Nelson, Baxter Vieux, Randall Kolar, Anant Kukreti, Kanthasamy Muraleetharan	Total: \$250,510 S&PP's share: \$12,526
NSF	REU Supplement: MOTI: Innovation and the Transformation of Clean Technologies: A Life-Cycle Approach to the Management of Gas Turbine Systems 07/01/1998 - 06/31/1999	Principal Investigator: <b>Mark Meo</b> Co-PIs: <b>Robert P. Anex</b> , <b>Rex Ellington</b> , and <b>Mark Sharfman</b>	Total: \$5,000 S&PP's share: \$3,350
NSF	REU Supplement: Strategic Policy Innovation and Social Learning: Flood Hazard Mitigation, Recycling, and Air Quality in Tulsa, OK 04/01/1998 - 02/28/1999	Principal Investigator: <b>Mark Meo</b>	Total: \$12,065 S&PP's share: \$12,065
EPA	Ecological Risks, Stakeholder Values and River Basins: Testing Management Alternatives for the Illinois River 10/01/1997 - 9/30/2000	Principal Investigator: <b>Mark Meo</b> Co-PIs: Edward Sankowski, James Sipes, and Baxter Vieux  OU Health Sciences Center subcontract: Co-PI: Robert Lynch  Oklahoma State University subcontract: Co-PIs: Lowell Caneday, Will Focht, and Keith Willett	Total: \$260,658 (first- and second-year funding)  S&PP's share: \$78,197
NSF	Innovation and the Transformation of Clean Technologies: A Life-Cycle Approach to the Management of Gas Turbine Engines 07/01/1997 - 06/30/2000	Principal Investigator: <b>Mark Meo</b> Co-PIs: <b>Robert P. Anex</b> , <b>Rex Ellington</b> , and <b>Mark Sharfman</b>	Total: \$293,938 (first- and second-year funding)  S&PP's share: \$196,938 (first- and second-year funding)
NOAA	Climate Prediction, Information and Policy Response: A Retrospective Assessment of Drought Management in Oklahoma 05/01/1997 - 04/30/2000	Principal Investigator: <b>Mark Meo</b> Co-PIs: <b>Rajeev Gowda</b> , Mark Morrissey, and J. Scott Greene	Total: \$103,899 S&PP's share: \$72,729
NSF	Strategic Policy Innovation and Social Learning: Flood Hazard Mitigation, Recycling, and Air Quality in Tulsa, OK 03/01/1997 - 02/29/2000	Principal Investigator: <b>Mark Meo</b>	Total: \$147,395 S&PP's share: \$147,395
EPA	Regulation, Business, and Sustainable Development: The Management of Environmentally Conscious Technological Innovation Under Alternative Market Conditions 10/01/1995 - 03/31/1999	Principal Investigator: <b>Mark Sharfman</b> Co-PIs: <b>Mark Meo</b> , <b>Rex Ellington</b>	Total: \$244,955 S&PP's share: \$122,478
NSF	Participation in the GLOBE Atmospheric Science Experiment 05/15/1995 - 04/30/1998	Principal Investigator: Susan Postawko Mark Morrissey, Kenneth Crawford, Renee McPherson, <b>Rajeev Gowda</b>	Total: \$500,888 S&PP's share: \$50,089

Figure 1. Research Trends, 1995–1998  
(Research Obligations per FTE)



	CY 95	CY 96	CY 97	CY 98
S&PP's share	\$358,580	\$352,205	\$748,915	\$734,517
Total faculty FTE	2.0	2.4	3.0	3.0
Share/FTE	\$179,290	\$146,752	\$249,638	\$244,839

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## Teaching

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As part of their joint appointments in academic units, S&PP core faculty members teach at least two courses per year. While some of these courses touch on interdisciplinary themes, Profs. Anex, Gowda, and Meo also offer courses through other venues, courses that are interdisciplinary in nature and targeted at the wider on- and off-campus community.

Prof. Anex taught two courses in the School of Aerospace and Mechanical Engineering in 1998. In the fall, Prof. Anex taught a graduate course in Advanced Engineering Dynamics. In the spring, he taught Dynamic Analysis of Mechanical Systems in AME, an undergraduate course with an enrollment of 108. Also during 1998, Dr. Anex guided the work of undergraduate research assistant, David Hergenrether. David has been developing a history of the technological development of gas turbines since the second world war. In addition, Prof. Anex chaired two master's committees and served on six Ph.D. committees in AME and Political Science.

During 1998 Prof. Gowda taught two new courses as part of his involvement with the Interdisciplinary Perspectives on the Environment Program (IPE). In "People, Planet Problems: Introduction to IPE," he was joined by Prof. Zev Trachtenberg of the Department of Philosophy and Prof. Scott Greene of the Department of Geography and the Environmental Verification and Analysis Center. He also co-taught the IPE practicum class focusing on the environmental management in the university with Prof. Trachtenberg and Prof. Jess Everett of the School of Civil Engineering and Environmental Science. His mentoring of students

through research resulted in a publication with Political Science graduate student Paula Owsley Long and research proposals and a book prospectus with Political Science graduate student Jeffrey Fox. He also supervised the Undergraduate Research Opportunities Program projects of Gretchen Gordon and Paul Irby, both Political Science students. He serves as Chair of one Ph.D. and one Master's committee and is a member of nine other graduate student committees.

Prof. Meo teaches two courses in the School of Civil Engineering and Environmental Science: one in the fall about public works infrastructure planning and management; and another in the spring that covers environmental evaluation and management. These courses address interdisciplinary topics and offer both undergraduate and graduate credit. For example, while the fall infrastructure course is taught as a technical elective for graduate students, it is cross-listed with Regional and City Planning and covers both national and international infrastructure issues. The spring course is part of the core requirement for undergraduate environmental science majors, but it also is offered for graduate credit.

In 1998 Prof. Meo taught 28 students in his undergraduate and graduate classes, and served on the doctoral committees of six students from several departments, including Civil Engineering and Environmental Science, Geography, Zoology, and the School of Public Health. He also chaired a master's thesis on the use of scientific knowledge in toxic tort litigation and served on two special topics master's degree committees in Environmental Science.

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## Service

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In 1998, Science and Public Policy Program faculty members provided service to the University, the community, and the profession as part of their faculty duties.

**Robert Anex** served on a number of University committees during the year and reviewed manuscripts for five journals. Prof. Anex served on the Campus Environmental Concerns Committee, the Graduate Committee in the School of Aerospace and Mechanical Engineering, and S&PP's Committee A. In addition, Prof. Anex was a guest speaker at the Society of Women Engineers' High School Girls Conference, where he discussed careers in engineering.

**Rajeev Gowda** participated in 1998 in nationally visible activities in addition to his regular service on various university and departmental committees and guest lectures. He was again a member of the Conference Program Committee for the Association of Public Policy Analysis and Management's research conference, where he organized panels on Behavioral Policy Research, and also chaired a session. He served on a national review panel for a National Science Foundation (NSF)/Environmental Protection Agency grant competition, and also reviewed proposals for NSF and New York Sea Grant, and articles for the *Journal of Policy Analysis and Management*. He jointly organized the Interdisciplinary Perspectives on the Environment programs Speakers Series and Learning Community activities, and was Faculty Sponsor for the Oklahoma

Energy Education Development Project, an undergraduate student organization at OU. He was also a member of the Asian Americans and Diversity Concerns Committee of the Oklahoma Multicultural Leadership Institute.

**Mark Meo** served on a number of University committees during the year, and also participated in a broad variety of professional activities. Meo gave presentations at local conferences in Oklahoma City (American Water Resources Association; *Women's Bold Journeys* conference) and in Tahlequah (Third Annual Conference on Sustainable Living); participated in a University workshop on user requirements as part of NOAA's reanalysis of its climatological data base; and organized a panel of academic and corporate speakers on the subject of Green Technology and Public Policy for the 150<sup>th</sup> annual meeting of the American Association for the Advancement of Science in Philadelphia. The panel papers are currently being organized by Meo and Prof. Sharfman as a special issue of the *American Behavioral Scientist*. In addition, Meo served on a review panel for the Human and Economic Dimensions Program in NOAA and reviewed a number of proposals for the National Science Foundation, the Environmental Protection Agency, the National Institute for Global Environmental Change, and the U.S. Geological Survey Water Resources Research Program.

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## Faculty Publications and Presentations

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### Publications, 1998-99

#### *Refereed Articles*

- "DuPont-Conoco and the Vapor Recovery Project: Using Innovation to Respond to Regulation." **Mark Sharfman, Rex Ellington, and Mark Meo.** *Journal of Industrial Ecology*. In press.
- "Regulation, Business, and Sustainable Development: The Antecedents of Environmentally-Conscious Technological Innovation." **Mark Sharfman, Mark Meo, and Rex Ellington.** In *Green Technology and Public Policy*, symposium issue of the *American Behavioral Scientist*, edited by **Mark Meo and Mark Sharfman**. In press.
- "Current Research on the Greening of Technology and Public Policy in Oklahoma." **Mark Meo, Joakim Laguros, and James Robertson,** in *6<sup>th</sup> Conference on Environmental Science and Technology Proceedings*, Samos, Greece. In press.
- "Heuristics, Biases, and the Regulation of Risk." **Rajeev Gowda.** *Policy Sciences* 32(1):59-78. March 1, 1999.
- "Bayesian Estimation of Volatile Organic Emissions from Wood Furniture Coating." **Robert Anex and Jay Lund.** *Journal of Environmental Engineering, ASCE* 125(1):92-96. January 1999.
- "Innovation and the Transformation to Clean Technologies: Life Cycle Management of Gas Turbine Systems." **Robert Anex, Sasidhar Velnati, Mark Meo, Rex Ellington, and Mark Sharfman.** In *Proceedings of the 1999 NSF Design and Manufacturing Grantees Conference*, Long Beach, CA. January 5-8, 1999.
- "Nuclear Waste and Native America: The MRS Siting Exercise." **Rajeev Gowda and Doug Easterling.** *Risk: Health, Safety and Environment* 9: 229-258. Summer 1998.
- "Ecological Risks, Stakeholder Values, and River Basins: Testing Management Alternatives for the Illinois River." **Mark Meo, Baxter Vieux, James Sipes, Edward Sankowski, Robert Lynch, Will Focht, Keith Willett, and Lowell Caneday.** In *1998 Water and Watersheds Program Review proceedings*, sponsored by the EPA/NSF Partnership for Environmental Research, pp. 17-18. Corvallis, OR. January 28-29, 1998.
- "Of Nuclear Energy and Acceptable Risk: The Relevance of Social Science to Societal Technology Choices." **Rajeev Gowda and Paula Long.** *Studies in the Social Sciences* 35: 74-84. April 1998.

#### *Book Chapters*

- "Water: Oklahoma's Vital Resource." Chand Wije and **Mark Meo.** In *Oklahoma Resources for Economic Development*, edited by Hans Spaeth, Gary Thompson, and Henry Eisenhart, pp. 55-72. OGS Special Publication 98-4. Norman OK: Oklahoma Geological Survey. 1998.
- "Forest and Nonfuel Mineral Resources." **Mark Meo, Kenneth Johnson, and Kenneth Luza.** In *Oklahoma Resources for Economic Development*, edited by Hans Spaeth, Gary Thompson, and Henry Eisenhart, pp. 157-176. OGS Special Publication 98-4. Norman OK: Oklahoma Geological Survey. 1998.
- "Social Trust and Risk Management: Cross-Cultural Insights from Native America." **Rajeev Gowda.** In *Advances in Social Trust Theory and Research*, edited by G. Cvetkovich and R. Lofstedt. London: Earthscan. 1998.

## Presentations, 1998-99

- "System Identification of a Mathematical Model of the Anaerobic Digestion of Organic Wastes." **Robert Anex**. Presented at the ASCE-CSCE Conference on Environmental Engineering, Norfolk, VA, July 25-28, 1999.
- "Risk Assessment Methods for Environmental Accounting." **Robert Anex**. Presented at the 1999 ASCE-CSCE Conference on Environmental Engineering, Norfolk, VA, July 25-28, 1999.
- "Sustainable Development and Smart Growth." **Mark Meo**. Presented at the U.S. EPA Region 6 Pollution Prevention Roundtable, Panel on Sustainable Development, Norman, OK, June 14-16, 1999.
- "Drought Policy Response in Oklahoma." **Mark Meo**. Presented at the NOAA Economics and Human Dimensions Investigators Meeting, Tucson, AZ, April 26-28, 1999.
- "Innovation and the Transformation to Clean Technologies: Life Cycle Management of Gas Turbine Systems." **Robert Anex, Mark Meo, Rex Ellington, Mark Sharfman, and Sasidhar Velnati**. Poster presented at the 1999 NSF Design and Manufacturing Grantees Conference, Long Beach, CA, January 5-8, 1999.
- "Insights from Risk Perception Research for Megan's Law." **Rajeev Gowda**. Presented at the Society for Risk Analysis Annual Meeting: Assessing and Managing Risks in a Democratic Society, Phoenix, AZ, December 6-9, 1998.
- "Environmental Uncertainty, Corporate Strategy, and Public Policy." **Knud Sinding, Mark Sharfman, and Robert Anex**. Presented at the Greening of Industry Network Conference, Rome, Italy, November 15-18, 1998.
- "Action and Reaction in Right-to-Know." **Rajeev Gowda**. Presented at the Association for Public Policy Analysis and Management annual meeting, New York, NY, October 29-31, 1998.
- "Interfirm Cooperation in Life-Cycle Oriented Environmental Management: Examples and a Conceptual Framework." **Mark Sharfman, Teresa Shaft, Robert Anex, Rex Ellington, Mark Meo, Ralph Meima, and Knud Sinding**. Presented at the Academy of Management annual meeting, San Diego, CA, August 7-12, 1998.
- "What Lessons Have U.S. Policymakers Learned from Risk Perception Research?" **Rajeev Gowda**. Presented at the Social Science Group on Risk meetings, Plage de St. Clair, France, June 14-17, 1998.
- "Societal Response to Hydrologic Variability: Flood Hazard Mitigation in Tulsa, Oklahoma." **Mark Meo and Karl Pepple**. Presented at the GCIP Mississippi River Conference, St. Louis, MO, June 8-12, 1998.
- "The Role of Life Cycle Assessment in Innovation and Transformation to Clean Technologies." **Robert Anex, Mark Meo, Rex Ellington, and Mark Sharfman**. Poster presented at the Gordon Research Conference on Industrial Ecology, Colby Sawyer College, NH, June 8-12, 1998.
- "A Political Economy Perspective on Interfirm Cooperation in Life Cycle Oriented Environmental Management." **Robert Anex, Mark Sharfman, and Teresa Shaft**. Poster presented at the Gordon Research Conference on Industrial Ecology, Colby-Sawyer College, NH, June 8-12, 1998.
- "Sustainability, Research, and Environmental Decision Making." **Mark Meo**. Presented at the National Conference on Environmental Decision Making, Knoxville, TN, May 3-6, 1998.
- "The OU-OSU Water and Watersheds Study of the Illinois River Basin." **Mark Meo**. Presented at the Oklahoma Section meeting of the American Water Resources Association, Oklahoma City, OK, March 2-4, 1998.
- "Regulation, Business, and Sustainable Development," **Mark Sharfman, Mark Meo, and Rex Ellington**. Presented at the American Association for the Advancement of Science 150<sup>th</sup> annual meeting, Philadelphia, PA, February 12-17, 1998.

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## Student Publications and Presentations

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### Project-Related Publications, 1998-99

"Scale-Aggregation of Landsat-TM Data and Information Loss." **Rezaul Mahmood**, Karen S. Humes, and David R. Legates. In *From Image to Information: Proceedings of the 1999 American Society of Photogrammetric Engineering and Remote Sensing Annual Conference*, pp. 733-742. 1999.

"Air Temperature Variations and Rice Productivity in Bangladesh: A Comparative Study of the Performance of the YIELD and the CERES-Rice Models." **Rezaul Mahmood**. *Ecological Modeling* 106:201-212. 1998.

"Thermal Climate Modifications and Potential Changes in the Cropping Pattern in Bangladesh." **Rezaul Mahmood**. *Theoretical and Applied Climatology* 61:231-243. 1998.

### Other Publications, 1998-99

"Life Cycle Assessment and Analysis of Gas Turbine Power Systems." **Sasidhar Velnati**. Master of Science Thesis in Mechanical Engineering. **Robert Anex**, thesis committee chair. 1999.

"Integration of Scientific and Legal Perspectives in Toxic Tort Litigation." Carolyn Vanarsdel. Master of Science Thesis in Environmental Science. **Mark Meo**, thesis committee chair. 1998.



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## Notes

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