

Research Institute for  
Environment, Energy and Economics



APPALACHIAN STATE UNIVERSITY

**THIRD YEAR REVIEW**

**Creating Change through Research, Outreach and Education**

**December 15 2011**



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# Research Institute for Environment, Energy and Economics



APPALACHIAN STATE UNIVERSITY

December 15, 2011

The Research Institute for Environment, Energy and Economics (RIEEE) was established to enhance the quality of research at Appalachian State University by broadening our understanding of natural, human, and economic systems, and their interrelationships, impacts and contributions to our wellbeing in our region, state and internationally. The RIEEE is charged with supporting the research and outreach capacity of the Appalachian Energy Center, the Center for Economic Research and Policy Analysis (CERPA) and the Southern Appalachian Environmental Research and Education Center (proposed) and also stimulating an examination of the linkages between our natural, economic and human-cultural systems.

The connections between our natural, social-cultural and economic systems are often unclear. We strive to help clarify through research and outreach activities throughout the RIEEE how our policies and actions impact directly or indirectly our environment, our economy or our society. More specifically, we aim to enhance our knowledge of how to preserve, restore and sustain our environmental, economic and cultural resources so as to ensure that future generations enjoy a high quality of life.

There is a demand for leadership in understanding our options for building a sustainable future. We believe that universities play a central role in responding to this demand because we have the capacity to generate new knowledge and technology and are willing to engage in exploring the nature of the issues that are part of building a sustainable future. Appalachian State University is committed to nurturing future leaders who will shape society and determine the paths taken that will ultimately form a sustainable society. Therefore, we are committed to involving students in our research and outreach initiatives.

In order to accomplish this, we must tap the expertise on our campus, partner with key off-campus organizations, and develop research initiatives that address regional, national and international priorities. Since the RIEEE was established in 2008, we believe that Appalachian State University has built upon the expertise of its faculty and students to address local and regional issues and is building innovative solutions to preserving and restoring our natural environment, while also finding affordable energy alternatives, and enhancing our human and cultural environment.

We currently draw on more than 75 faculty from 25 academic units within five colleges and many staff from our Centers and University administrative entities. Together, we have coalesced around three focal areas: Energy Conservation and Efficiency, Ecosystem Services, and Public Environmental Policy.

Since the RIEEE was established three years ago, we have established an organizational structure for our Centers, faculty and staff, and created administrative procedures to enhance research on our campus. The number, amount and duration of research proposals have increased with the intent of facilitating long-term research initiatives throughout the campus. We have helped to link faculty from many academic units so as to define research approaches that allow us to examine issues and problems that are

complex and beyond the scope of just one academic discipline. We have thus formed research clusters that support long term assessment of social, economic and environmental issues in Southern Appalachia. This regional perspective serves as a base for our effort that can be used on state, national and international applications. We believe that our students are critical in our research and attempt to engage them through our classes, sponsored research initiatives and in supporting independent student research projects. Finally, we appreciate the value of off-campus partners in the success of our research. Collaborations with faculty from other universities, government and non-profit agencies and private companies have enriched our research efforts. We will continue our very diverse partnerships and look for opportunities to broaden our collaborations off the campus.

We face complex social, economic and ecological challenges. These complexities require that we undertake a determined interdisciplinary approach in addressing these very difficult problems. RIEEE serves as a catalyst to support these broad-based approaches on behalf of our students, faculty, staff, and partners to engage in inquiry and problem solving.

The RIEEE and its Centers are guided by a core commitment to preserving, restoring and sustaining our natural, human and cultural, and economic capital so that present and future generations can enjoy a quality of life that is as good as, or better than, that which we enjoy today.

John C. Pine  
Director

## I. INTRODUCTION

### General Information

Name of Institute: Research Institute for Environment, Energy and Economics

Name of Centers:

Appalachian Energy Center  
Center for Economic Research and Policy Analysis  
Southern Appalachian Environmental Research and Education Center

Year Established:

RIEEE: November 8, 2008  
Appalachian Energy Center: 2001  
CERPA: November 2008  
SAEREC: To be proposed

Internet Home Page URL:

RIEEE: <http://www.rieee.appstate.edu>  
Energy Center: <http://energy.appstate.edu>  
CERPA: <http://cerpa.appstate.edu>  
SAEREC: <http://saerec.appstate.edu/>

Primary Designation: Research

Participating Campuses: Appalachian State University, Boone, N.C.

### Directors

John C. Pine, Ed.D.  
Research Institute for Environment, Energy and Economics (RIEEE)  
Professor, Department of Geography and Planning  
College of Arts and Sciences

Dr. John C. Pine has served for the past two and one-half years as Director of the Research Institute for Environment, Energy and Economics (RIEEE) and Professor, Department of Geography and Planning, Appalachian State University, Boone, NC. He joined the Appalachian faculty after serving thirty years at Louisiana State University in Baton Rouge where he directed the graduate and undergraduate Disaster Science and Management Program, and as Professor in the Department of Geography and Anthropology and the Department of Environmental Sciences. His research on disasters and emergency management centers on emergency planning, hazards and risk assessment, and risk management. He has worked with many federal, state and local entities to identify strategies to enhance community preparedness and ensure the resilience of communities impacted by disasters. His recent publications include *Natural*

*Hazards Analysis: Reducing the Impact of Disasters* from Taylor Francis Publishers in 2009, Technology and Emergency Management by John Wiley (2007) and Tort Liability Today by the Public Risk Management Association (2005). He has served on the Board of Visitors for FEMA's Emergency Management Institute in Emmitsburg, MD; his publications have been included in: *The Journal of Disaster Studies, Policy and Management, Disasters, Journal of Race and Society, International Journal of Mass Emergencies and Disasters, Oceanography, Journal of Emergency Management, Natural Disaster Review, Journal of Environmental Health and the Journal of Hazardous Materials*. He received his Doctorate in Higher Education Administration and Public Administration from the University of Georgia, Athens in 1979. E-Mail: [pinejc@appstate.edu](mailto:pinejc@appstate.edu) Phone: (828) 262-2764

Jeffrey Ramsdell, Ph.D. PE,  
Appalachian Energy Center  
Professor, Department of Technology and Environmental Design  
College of Fine and Applied Arts

Dr. Ramsdell has served as the Director of the Appalachian Energy Center at Appalachian State University since January 2010. He is also a Professor in the Department of Technology and Environmental Design. Dr. Ramsdell came to Appalachian State University in 2003 after 13 years in industry as a project manager and engineer. In his current position Dr. Ramsdell teaches materials science, building science, and renewable energy courses at both the undergraduate and graduate level, and directs the renewable energy and energy efficiency related activities of the Center. He is a full member of the graduate faculty at Appalachian and has also developed international summer courses to Latin American countries with a focus on sustainable construction and energy production. Recent scholarly activity has included research and application of alternative fuels for the State of North Carolina. Dr. Ramsdell earned a Ph.D. in Materials Science and Engineering from the University of Central Florida, where he was awarded a full fellowship from Lucent Technologies. He also earned a Master of Business Administration from Rollins College and a Bachelor of Science in Mechanical Engineering from the University of Florida. Dr. Ramsdell is a licensed Professional Engineer in the State of Florida.

Dr. Ramsdell has extensive industry experience, having held engineering and management positions with Georgia Pacific, Lucent Technologies, Boston Whaler, and Motorola, amongst others. He has also worked as a professional engineering consultant in the areas of materials characterization and testing, and alternative fuels. In the area of nanotechnology Dr. Ramsdell has performed extensive research in the surface characterization of nanostructures. This work has included extensive use of atomic force microscopy (AFM), x-ray photoelectron spectroscopy (XPS), static secondary ion mass spectrometry (SSIMS), nanoindentation and scratching, as well as other atomic-scale characterization techniques. Dr. Ramsdell is a member of the Board of Directors for the Biofuels Center of North Carolina, the North Carolina Biomass Council, the North Carolina Alternative Fuels Consortium, and the North Carolina Nanotechnology Initiative Planning Committee.

Todd Cherry, Ph.D.  
Center for Economic Policy and Analysis (CERPA)  
Professor, Department of Economics, Walker College of Business  
Senior Research Fellow, Center for International Climate and Environmental Research – Oslo,  
University of Oslo (Norway)

Todd L. Cherry is a Professor of Economics and Director of the Center for Economic Research and Policy Analyses (CERPA) within the Research Institute for Environment, Energy and Economics at Appalachian State University. He is also a Senior Research Fellow at the Center for International Climate and Environmental Research – Oslo at the University of Oslo (Norway). Dr. Cherry was a Stokley Scholar at the University of Tennessee and a Faculty Fellow in the Energy and Environment policy program at North Carolina State University's Institute for Emerging Issues. Dr. Cherry has spent time as a visiting researcher at the University of Wyoming and the University of Alaska Anchorage. At Appalachian, he has received awards for his research and service, including the appointment of the Honorable Harlan E. Boyles Professor. Dr. Cherry is a co-author of CERPA's monthly report on the region's economy (WNC Economic Index and Report) and serves as a source of information to stakeholders and the public on the regional economy. Additional public engagement includes his service as a Technical Advisor to the North Carolina Rural Economic Development Center and as a member of the Technical Advisory Committee of the Mountain Resources Legislative Commission.

Cherry received his Ph.D. in 1999 from the University of Wyoming, with specializations in environmental economics and regional economics. His research centers on the intersections of public policy, environment, energy and economic development. Cherry has published over 40 articles, chapters and books. His research has yielded seminal papers that have appeared in top journals such as the *American Economic Review* and *Journal of Environmental Economics and Management*. His work has been recognized as the most cited papers in leading journals such as *Journal of Economic Behavior and Organization* and *Resource and Energy Economics*. His research has been cited in regional and international popular news outlets, including The Washington Post, Atlanta Journal-Constitution, The Guardian (UK) and Germany's leading national business newspaper (Handelsblatt).

Howard Neufeld, Ph.D.

Southern Appalachian Environmental Research and Education Program (SAERE) (Proposed)  
Professor, Department of Biology, College of Arts and Sciences

Dr. Neufeld is currently a Professor in the Department of Biology at Appalachian State University, Boone, NC. He received a B.S. in Forestry from Rutgers University in 1975, a M.F. in Forest Sciences from the Yale School of Forestry and Environmental Science in 1977, and a Ph.D. in Botany from the University of Georgia in 1984. After his first postdoctoral position at New Mexico State University (where he studied light interception by creosotebushes and salt tolerance in range grasses), he began a National Research Council post-doctoral appointment under Drs. Dave Tingey and Bill Hogsett at the EPA Lab in Corvallis, OR, where he worked on the effects of ozone on root growth of tree seedlings. He has served as President of both The Association of Southeastern Biologists (ASB) and the Southern Appalachian Botanical Society and is now Chair of AppalAIR, the interdisciplinary atmospheric research group. He recently became the first Director of the Southern Appalachian Environmental Research and Education Center, which resides within the university's Research Institute for the Environment, Energy and Economics.

Dr. Neufeld's research expertise is in the area of plant physiological ecology, and has included work on desert plants, forest understory plants, and the role of anthocyanins in vegetative tissues in plants. For over 25 years, he has been active in air pollution effects research; he was the principal investigator of a National Park-U.S. EPA sponsored research project on the effects of ozone on plants native to Great Smoky Mountains National Park, and since 1992, his research group has investigated the impacts of ozone on native wildflowers in the Park. He has published 36 papers and one book chapter, and

mentored 20 graduate students, six of which have either completed or nearly completed their PhDs at other institutions. He is the recipient of several awards at the university for his research, including the Wachovia Award for Achievement in Environmental Research, the Faculty Research Award from the Association of Southeastern Biologists, the local Sigma Xi Chapter Outstanding Researcher Award, and most recently, the 100 Scholars Award for Research from the Office of Research and Graduate Education. In 2009, he organized the two-semester long Darwin Bicentennial Celebration at the university, which involved bringing in 14 distinguished Darwin Scholars in what was the largest such speaker series in the country.

## **Organizational Structure and Programs**

Effective governance includes both capable leadership and also an organizational structure that facilitates the accomplishment of expressed goals and objectives. The RIEEE has worked to establish a structure for internal operations that supports quality and sustainable research activities. This structure is built on Appalachian's established research and outreach initiatives throughout the campus and provides value added outcomes that were not part of the campus before the RIEEE was established. Our intent is to build solid research initiatives that engage a wide representation of faculty from our academic units, support graduate and undergraduate student research experiences, and involve staff from throughout the campus.

### **RIEEE Physical Location**

The RIEEE has a distributed presence throughout the Appalachian campus with offices provided by the Departments of Geography and Planning (RIEEE Director), Department of Biology (SAEREC Director), Department of Technology and Environmental Design (Energy Center), and the Department of Economics (Center for Economic Research and Policy Analysis – CERPA). The administrative office of the RIEEE and the Appalachian Energy Center is located at 130 Poplar Grove Connector in the Appalachian Enterprise Center. This space is off the main campus and provided by Watauga County. Meeting areas are provided by collaborating Departments including the Departments of Geography and Planning, Biology, Technology and Environmental Design, and Economics. Special events are held in public meeting space through our region and at the Student Union, Belk Library or other large auditoriums on the Appalachian campus. Specialized research facilities are located both on campus in academic units collaborating in our research activities as well as off-campus in Boone, Banner Elk, Hickory and other locations in western North Carolina. Institute and Center affiliated faculty members have offices in academic units on the Appalachian campus.

### **Research Laboratories**

Laboratories which support faculty and staff research activities are located in academic departments as well as on our Boone campus and at several off-campus locations. Many faculty research laboratories have been enhanced through funding from Appalachian's colleges, academic units, RIEEE Centers, student organizations, the Office of Business Affairs, external grants, support from state or federal agencies, as well as private and non-profit contributions. The following is a description of the laboratories associated with the RIEEE Centers.

## Appalachian Energy Center

The Appalachian Solar Energy Research and Demonstration Laboratory actively supports outreach, education, and applied research projects related to solar energy. Verification and regional characterization of solar system performance will allow North Carolina citizens to choose the solar technologies that offer the best return on investment. The lab hosts numerous public and special event tours, as well as hands-on solar workshops for the public. The facility allows potential solar adopters the chance to see first-hand installed modern solar technologies. The solar lab also offers Appalachian students valuable hands-on experience with a range of solar technologies. These students will likely join the North Carolina workforce and contribute to the growing renewable energy sector in the State. See additional information on this laboratory on page 67.

The Small Wind Research and Demonstration Facility on Beech Mt provides a site for the testing small wind turbines. This facility provides valuable information to small wind manufacturers and utilities, while providing students and the community with first-hand experience of small wind technology that can be easily replicated. Appalachian faculty and students are actively engaged in education, outreach, and research projects that utilize the facility. These projects benefit businesses and citizens of North Carolina interested in design, manufacturing, and implementation of wind energy systems. This work includes the testing of turbines to the Small Wind Certification Council (SWCC) standard. Research activities include those related to key issues such as noise levels, impact on local bird populations, relationship of wind turbine performance to utility loads, storage technologies, etc. Most of the wind turbines being installed in the state have come about after significant consultation with Appalachian State's Wind Application Center. We routinely provide wind maps and wind measurement equipment and analysis to individuals who subsequently install wind turbines. See additional information on this laboratory on page 67.

The Appalachian Biodiesel Research and Testing Facility at the Catawba County EcoComplex provides valuable feedstock, fuel quality, and emissions data to the biodiesel industry in the State of North Carolina. The modular nature of our facility allows substitution of specific equipment in the production line to determine optimal engineering design for conversion of different feed-stocks to biofuels while maximizing positive fuel properties and minimizing impact on air and water quality. The facility also allows experimentation with different processing elements to determine which components work together to provide the best overall production performance, fuel quality, and combustion emissions. Fuel quality and combustion emissions are analyzed well beyond ASTM and EPA standards, using advanced chemical analysis techniques.

Support for the establishment of the Biodiesel Research Facility with Catawba County, the Golden Leaf Foundation, the North Carolina Bio-fuels Center, and the North Carolina State Energy Office was initiated long before the RIEEE was established in 2008. The Appalachian Office of Research and Graduate Programs, the Energy Center and faculty from the Department of Technology and Environmental Design within the College of Fine and Applied Arts and the Departments of Chemistry and Biology within the College of Arts and Sciences recognized the value of building strong on-going external partnerships with our campus. It is facilities such as the Catawba County EcoComplex that not only will support many research efforts but also serve as a base for regional economic development initiatives.



Image 1: Catawba County Appalachian Bio-Diesel Research and Testing Facility

Alternative Fuels Research Labs on campus include Biodiesel Education and Research Laboratory (BEReL), Cell-Free Ethanol Production and NIR Monitoring of Biodiesel Lab (Chemistry), Algae Oil Production, Harvest, and Extraction Laboratory (Biology), Microwave-Assisted Synthesis of Biodiesel (Chemistry), and Landfill Gas Research and Development Labs.

Landfill Gas Research and Development Labs (Hickory, Boone, and local sites throughout North Carolina). This initiative develops landfill gas projects for community development, renewable energy implementation, and reduction of greenhouse gas emissions. See additional information on this laboratory on page 67.

#### Center for Economic Research and Policy Analysis (CERPA)

The Appalachian Experimental Economics Laboratory (AppEEL) supports experimental research that tests the validity of economic theories, examines the emerging questions of behavioral economics, and test-best new policies and mechanisms. AppEEL can improve predictions of policy outcomes by serving as a test site that reveals the response and outcomes associated with alternative policies. AppEEL and the related faculty are unique research assets that differentiates Appalachian State in the state, the country and internationally. The lab supports the experimental research group, which has an international reputation. The group is ranked among the top 10 percent in the world. CERPA provides support to the management and operation of the lab (e.g., equipment and subject pool maintenance), but also has provided research funds to faculty pursuing promising unfunded research. AppEEL is directed by Dr. Michael McKee.

The Appalachian Survey Research Laboratory (AppSRL) supports survey research and survey services to Appalachian faculty, staff and students; researchers at other institutions; local, state and federal agencies; and other working in the public interest. AppSRL facilitates a better understanding of how people view current social and economic issues and alternative public policies. The lab is equipped to

use multi-modes (telephone, internet and mail) to conduct local, state, regional and national surveys, and can undertake all phases of a survey project.

CERPA created AppSRL as part of a CERPA multidisciplinary research project that was funded by the NC Rural Center. CERPA provided startup funds to establish the lab and provides administrative support for operations, in particular, the management of employees of the lab (i.e., supervisors and callers). AppSRL recently has been upgraded with the multidisciplinary and multi-college support. The new research capacity from these efforts will benefit researchers across campus. AppSRL is directed by Dr. Todd Hartman.

#### Southern Appalachian Environmental Research and Education Center (SAEREC) (Proposed)

Appalachian Atmospheric Interdisciplinary Research (AppalAIR). High-elevation measurements are essential to understanding a number of regional atmospheric issues including air pollution transport, high-impact weather events, climate variability, and climate change. Air quality and climate data from high elevations are regionally representative because the values are not greatly influenced by local sources. Yet, there is currently very little air quality and climate related measurements in northwestern North Carolina. This research program is an interdisciplinary air quality and climate research initiative that will satisfy the data needs of the state and the region. The overriding goal of the project is to develop an intensive interdisciplinary research and teaching program for exploring atmospheric processes. This involves subjects such as air pollution formation and transport, the relationship of pollution and natural aerosol sources to a changing climate, and their impacts on regional ecosystems, weather, and climate. It directly supports research activities to improve understanding and forecasting of high impact events (e.g. winter weather, severe weather, and heavy rainfall) in the context of climate variability and change. It also includes an extensive outreach program designed to inform and educate people about atmospheric processes and pollution and how these impact high elevation ecosystems and local communities of the southern Appalachian Mountains. Funding provided by the National Science Foundation, NASA.

The AppalAIR initiative was established well before the creation of the RIEEE. This research collaboration involves multiple academic departments and was created by five faculty with the support of their department chairs and the Dean of the College of Arts and Sciences. AppalAIR is a long-term environmental monitoring and assessment initiative that has provided a model for interdisciplinary research clusters throughout the RIEEE. Other research clusters have been supported using this model as a way of using our unique mountain setting to understand the interplay between natural, economic and social systems. We hope to improve our region with this broader understanding and use this knowledge on state, national and international applications.



Image 2: AppalAIR Site

For more information, please visit <http://appalair.appstate.edu>.

### **Faculty Appointments and Affiliations**

Research initiatives must be guided and staffed by a cadre of capable personnel from throughout our campus and in collaboration with our off-campus partners. The following description outlines our vision of the positions that make up our research and outreach initiatives.

Institute Director: Appointed by the University Provost with concurrence of the faculty member's Dean and Department Chair. The first director is Dr. John C. Pine. Responsibilities of the Director include: (1) Managing the daily Institute activities; (2) Serving as the primary contact for the Institute; (3) Managing the process of setting the Institute's strategic direction; (4) Developing the Institute's competency: partnering, governance, management, measurement and advocacy through

public engagement and outreach. The Director reports to the Provost and serves as a member of the Provost's Council.

Center Directors: The Center Directors manage Center activities and are appointed by the University Provost and RIEEE Director with concurrence of the faculty member's Dean and Department Chair. The Center Directors are responsible for establishing the strategic direction of their Center, selecting and mentoring Research Cluster Leaders, managing the operations of their Centers, and recruiting and mentoring faculty and staff to participate in the Center's activities.

Center Associate Directors: Associate Directors function as the research program leader within each Center, are the first to step in for the Center Director when that person is absent, and are appointed by the Center Director and the RIEEE Director.

Assistant Directors: Serve as leaders for focused research clusters or programs within a Center or in an Institute wide responsibility (Education and Outreach). They are appointed by the Center Director and the RIEEE Director. These leaders: (1) Guide individual areas and integrate each strategic imperative and provide coordination with the overall Center direction; (2) Engage in active resource solicitation in support of the area; and (3) Select and provide incentives to faculty, students, staff, and other stakeholders.

Research Professors (Professor, Associate Professor and Assistant Professor): These are faculty members with terminal degrees in their discipline and have demonstrated a track record of excellent research. They work under the direction of a Center director or the principle investigator of a sponsored research project. They maintain an academic appointment in an Appalachian academic unit, may teach in the unit's academic program, but do not vote or serve on departmental committees. Research Assistant Professors may also be post-doctoral researchers paid by a center or by a grant through a center.

Research Partners, Research Fellows or Adjunct Fellows: These are Appalachian faculty or staff who are co-investigators on center research projects. Center Directors, the Institute Director, and appropriate academic or operational units approve their association with research projects. Research Adjunct Fellows are individuals not employed by the university but who are active collaborators in a center research activity. Fellows may serve as paid or non-paid personnel on a research activity. Adjunct Fellows may be paid or non-paid and are recommended by the research project principle investigator and approved by the Center Assistant Director (research cluster or program lead) in consultation with the Center and Institute Directors.

Research Associates: These are researchers associated with a Center research activity who have an earned graduate degree. A research associate may have a position supported by a grant or contract associated with a Center. They may also have a designated role in a research or outreach initiative and serve in a non-compensated capacity. A research associate may serve as a principle investigator on a research proposal and direct the research project as a compensated employee if funded.

Research Affiliates: These are research collaborators who are not employed by Appalachian State University but are engaged in research activities of a Center. Research Affiliates are recommended by principle investigators of research projects and approved by the Center and Institute Directors in consultation with Appalachian faculty, Deans and Chairs at Appalachian.

## External Advisory Board

The External Advisory Board was established to provide consultation for the development and operation of the Institute and its Centers. The membership is composed of both public agency officials from Federal, state and local agency managerial personnel in North Carolina, non-profit agency directors and individual citizens whose interests or agency mission is aligned with the purposes of the Institute. Members of the Advisory Board are called on by the Director of the RIEEE on a quarterly basis to provide updates on Institute activities and to solicit input on program activities. The Advisory Board members have agreed to work with the RIEEE and have been extremely helpful in providing assistance in making contacts with potential funding agencies and collaborations on external funding proposals. The Advisory Board Members must be approved by the Appalachian State University Board of Trustees.

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## Internal Advisory Board

The Internal Advisory Board was established to increase communications between academic and research units on the Appalachian campus. Ongoing meetings with the members of this Advisory Board are held to discuss specific issues with faculty within these units and their association with Institute research centers. The members of the Advisory Board provide essential input on issues involving faculty time, research support, external collaborations, and multi-disciplinary funding opportunities. The Advisory Board meets during the fall and spring semesters.

Johnny Waters, Professor and Chair  
Department of Geology

Brian Ellison, Professor and Chair  
Department of Government and Justice Studies

Steven Seagle, Professor and Chair  
Department of Biology

Jeff Tiller, Professor and Chair  
Department of Technology and Environmental Design

Claudia Cartaya Marin, Professor and Chair  
Department of Chemistry

Jesse Lutabingwa, Associate Vice Chancellor  
International Education and Development

Michael Briley, Professor and Chair  
Department of Physics and Astronomy

Janice Pope, Professor and Chair  
Department of Communication

James Wilkes, Professor and Chair  
Department of Computer Science

Mary Sheryl Horine, Interim Director  
Inst. For Health and Human Services

Eric Marland, Professor  
Department of Mathematical Sciences

Ged Moody  
Director, Office of Sustainability

Pat Beaver, Professor,  
Department of Anthropology and Director  
Center for Appalachian Studies

Paul Gaskill, Professor and Chair  
Department of Health, Leisure and Exercise  
Science

John Whitehead, Professor and Chair  
Department of Economics

Kathalene Schroeder, Professor and Chair  
Department of Geography and Planning

## **RIEEE Programs**

RIEEE promotes inter-disciplinary program initiatives that evolve both from focused research clusters within our Centers and from faculty and staff groups that represent different disciplines from our campus. Since the Institute was established three years ago, we have supported inter-disciplinary research by supporting the development and management of both funded and non-funded research efforts, providing travel, conference and equipment support funds.

We thus encourage faculty to link their own areas of interest with faculty in other disciplines and to look beyond traditional disciplinary boundaries to draw upon the broader group to answer complex questions inherent in environmental, energy and economic systems. Linking research initiatives between the environment, energy and economics recognizes that our search for knowledge is not bounded in single disciplines or perspectives. A broader examination joining these three perspectives stresses a balanced view and an appreciation of our natural environment, our need for sustainable energy, all embedded within social, social, cultural and economic priorities. Sustainable economies at all levels must be based on a balance that meets our social, cultural, and economic needs while ensuring that we are in harmony with our environment.

### Appalachian Energy Center

Energy Efficiency and High Performance Buildings: This program area seeks to improve the efficiency of both new and existing buildings in North Carolina and beyond. Recent specific areas of work by Appalachian Energy Center staff and Appalachian faculty members include increasing the number of high performance residences constructed in North Carolina, increasing the efficiency of low income housing, improving the efficiency of commercial buildings, and support of improved residential and commercial building codes through building performance and economic analyses. Applied research activities within this program area include:

- Remote monitoring of building energy use and indoor environmental quality (IEQ) and their relationship to system operation and occupancy behavior.
- Research on the optimization of daylight in buildings as it relates to visual and thermal comfort of occupants.
- Thermal characterization of building materials and systems that can lead to improved wall and roof system designs.
- Integration of photovoltaic and solar thermal systems into building skins.
- Research on high density, low cost thermal energy storage.
- Examination of the impact of simplified duct design on comfort and performance.

These activities are closely associated with faculty from the Department of Technology and Environmental Design and other academic units on the Appalachian campus. The Center facilitated the NC ENERGY STAR and RESNET national conference in which there were more than 950 attendees.

Renewable Energy: This program supports design, manufacturing, and implementation of renewable energy technologies. Focus topics include Solar Thermal, Photovoltaics, Wind Energy, Hydro Power, and Renewable Energy Resources. Specific areas of work by Energy Center staff and Appalachian faculty members within this program include:

- Education, outreach, and research activities that lead to an increase in the number and scale of renewable energy systems installed in North Carolina and beyond. These systems include wind, solar, and hydro technologies. This work includes the acquisition and analysis of topographic, weather, hydrological, and land parcel data with geographic information systems (GIS) to assess and map areas with high renewable energy production potential.
- Appalachian Solar Energy Research and Demonstration Laboratory activities supporting outreach, education, and applied research projects. Applied research projects aim to identify solar technologies that perform well in North Carolina climates. Verification and regional characterization of solar system performance, allows citizens to choose the solar technologies that offer the best return on investment. The lab also hosts numerous public and special event tours, as well as hands-on solar workshops for the public. The facility allows potential solar adopters the chance to see first-hand installed modern solar technologies. The solar lab also offers Appalachian students valuable hands-on experience with a range of solar technologies. These students will likely join the North Carolina workforce and contribute to the growing renewable energy sector in the State.
- The Appalachian Small Wind Research and Demonstration Facility on Beech Mountain provides valuable information to small wind manufacturers and utilities, while providing students and the community with first-hand experience of small wind technology that can be easily replicated. Appalachian faculty and students are actively engaged in education, outreach, and research projects that utilize the facility. These projects benefit businesses and citizens of North Carolina interested in design, manufacturing, and implementation of wind energy systems. This work includes the testing of turbines to the Small Wind Certification Council (SWCC) standard. Research activities include those related to key issues such as noise levels, impact on local bird populations, relationship of wind turbine performance to utility loads, storage technologies, etc. This work also includes the monitoring and reporting of estimated output of wind energy facilities in North Carolina as installations expand in number and size.

Alternative Fuels: The work of this program area contributes to the economic and technological expansion of alternative fuel sectors in North Carolina and beyond through education, outreach, and research activities. This cluster includes wide participation from the Departments of Biology, Chemistry, and Technology and Environmental Design. Specific areas of work by Appalachian Energy Center staff and Appalachian faculty members include:

- Efforts to increase agricultural production of biodiesel crops, improve biodiesel production processes, and test emissions of vehicles utilizing biodiesel manufactured from various feed-stocks grown in North Carolina. This work includes education, outreach, and research activities that lead to an increase in the production and use of biodiesel fuel in North Carolina. Workshops and other technical assistance are provided to support market development through growers of oil seed crops, as well as to biofuels manufacturing companies. These activities utilize the Appalachian Biodiesel Research, Development, and Production Facility at the Catawba County EcoComplex.
- Landfill gas (LFG) to energy project work in North Carolina and internationally. This work includes continued support of NC counties that received ARRA funding for LFG utilization projects, as well as support to additional municipalities seeking to initiate a LFG project. Energy Center staff provide technical analysis and input, as well as economic and financial analysis

assistance for these projects. This analysis includes consideration for the sale of carbon credits and renewable energy certificates (RECs). International work in this area includes US EPA funded projects in Brazil.

- Testing of state-of-the-art, cost effective systems for the utilization and treatment of landfill gas on small to medium-sized landfills. This work includes testing of gas separation technologies that would allow for higher quality methane fuel and clean carbon dioxide.
- The development of remote monitoring to reduce operation and maintenance costs of landfill gas systems and to create maximum return from sale of environmental attributes such as carbon credits and RECs.
- Collaboration with the Appalachian GIS lab to continue the work of others toward the creation of a GIS utility locating existing and potential landfill gas and biogas resources in North Carolina.

Policy, Industry, and Economic Development Support: Activities under this area of work support the pursuit of economic prosperity, new jobs, and the growth of business and industry related to the “clean/green economy” through applied research, analysis, program and project development, and education and outreach in topic areas that include the following:

- Environmental asset market opportunities including Green Power, Renewable Energy Certificates, small power producer sales, and greenhouse gas offsets and allowances.
- Emerging energy technology development and commercialization including hydrogen fuel cells, smart grid, electric vehicles, and others.
- Economic development support including that of local, regional, state and national economic development practitioners, decision makers, and key stakeholders.

#### Center for Economic Research and Policy Analysis (CERPA)

Experimental Economics: This discipline applies the laboratory method of inquiry to better understand how society and policy work. Experiments in the lab and the field allow for a more precise investigation of how individual, social and institutional characteristics influence individual behavior and aggregate outcomes. Consequently, the lab can serve as a test laboratory for policy analysis to better predict the responses and outcomes of competing policies. Such policy simulation increases the power of economic inquiry and policy analysis. The program is centered on six experimental economists that constitute one of the largest and strongest experimental groups in the country. The group’s research is currently ranked among the top 10 percent worldwide. This research group focuses on environmental policy, including climate change, compliance, renewable energy and environmental protection.

NOTE: During the past eight months, CERPA has organized a research working group that integrates the ‘experimental economics’ and ‘experimental psychology’ groups. The group meets about once a month to discuss and present research ideas and opportunities. CERPA recently funded the group’s first external visiting speaker, and the event exceeded expectations. The vision is that the Experimental Economics program will evolve to a Social Science Experimental program, which will include economics, psychology and political science.

Economic Development: This group facilitates research and policy analysis that promotes higher standards of living and improved economic and social conditions. The program addresses a wide range

of economic and social issues, such as the urban-rural divide, workforce development, health care, income and job growth. With an eye on engagement to meet social and institutional needs, the program maintains an area of work that focuses on Western North Carolina economic and social issues. WNC initiatives attempt to improve conditions in the region by providing relevant and accurate information to people in the private and public sectors. **Current** WNC initiatives include: the *WNC Economic Index and Report*, a monthly report that measures and tracks regional economic conditions; and *WNC Data Center*, a source of data that focuses on WNC economic and social conditions.

**Survey Research:** This program provides critical capacity to conduct research and analyses on current social and economic issues. The program has already contributed to projects such as assessing the disparities in economic and social conditions across different segments of North Carolina, investigating the benefits of marine wildlife conservation, and estimating the impact of off-shore wind turbines on NC coastal tourism. The new survey research program hit the ground running. With an investment from CERPA's residual funds and expertise of CERPA faculty, the new survey lab was able to quickly support four research projects that entailed 2,427 hours of interviews and 1,833 completed surveys. The cost per completed interview was \$17.42, which is quite low relative to outside providers. More than \$30,000 was paid to students for interviewing and supervising. Support from related departments and colleges enabled a recent upgrade to the lab, and this new research capacity will benefit the researchers from these and other academic units.

**Environment and Energy:** This program promotes research and policy analysis on critical environmental and energy issues, such as conservation and land-use policy, benefit-cost analysis of renewable energy, invasive species management, non-market valuation of green energy programs, and the impact of climate change on the NC coast. CERPA researchers employ a diverse set of approaches with a comprehensive perspective that considers the interdependence of economics, energy and the environment. The Environment and Energy Program is directly supported and connected to the Experimental Economics and Survey Research programs. The program is supported by faculty across campus, which have strong working relationships with leading researchers at other institutions. It is closely aligned with the Center for International Climate and Environmental Research – Oslo, which is an international leader in climate and environmental research. CERPA's collaboration with CICERO has yielded funding and valuable opportunities for researchers at Appalachian.

#### **Southern Appalachian Environmental Research and Education Center (SAEREC)**

The Southern Appalachian Environmental Research and Education Center (SAEREC) is the newest member Center of RIEEE, now just beginning its second year of existence. Despite its relatively new status, it is already administering a variety of research projects aimed at both regional and national environmental issues. Major existing and proposed research clusters are discussed below. SAEREC's role in promoting research in these clusters is limited to facilitating faculty interactions, letting faculty know about specific RFPs, and acting to coordinate multi-institutional collaborations if so asked. It is our hope that SAEREC will facilitate faculty collaborations that arise from the bottom-up collaborations, both within Appalachian as well as with other institutions. A listing of prospective faculty in each cluster is provided at the end of this document. Note that some faculty may cross over several clusters, so this grouping should be viewed only as a preliminary classification and not something set in stone.

Atmospheric Issues: (AppalAIR – Appalachian Atmospheric Interdisciplinary Research Group) This group was formed within the College of Arts and Sciences in 2008. Its primary mission is to understand the role of atmospheric processes in affecting ecosystems in the southern Appalachian Mountain region. The initial research focus is on aerosols, which can greatly affect radiative forcing and in turn, temperatures in this part of the country. AppalAIR is also a member institution of the NOAA Aerosol Monitoring Network, and the only such station in the eastern United States. A second goal is to educate the public about the importance of atmospheric research and climate change.

Water Resources: The Water Resource Planning Committee is a group of faculty that share interests in water quality issues. This highly diverse group is already addressing issues related to streams on campus, and hydrological issues in the region. Two recent submissions (2011) are the products of this research cluster and focus on the impact of riparian areas and water quality.

Earth Systems: The Earth Systems Group combines the interface between our earth systems including weather and climate, pollution, forest systems and land-use. The group has established research methodologies and has been gathering data sets in anticipation of implementing a comprehensive earth systems assessment. The group is currently bringing together off-campus partners to collaborate in our research efforts, provide critical data sets, and assist in this comprehensive research initiative.

Conservation Ecology: This research cluster will support a campus wide meeting in the spring of 2012 to formalize this research cluster and assemble interested faculty and students with off-campus partners. The Southern Appalachian Mountains support a unique and highly diverse biota which is under threat from both development and climate change, and thus conservation ecology will be a major focus of Center efforts for the years to come.

### Institute Wide Initiatives

Educational Outreach Programs: In July 2010 the RIEEE supported two faculty members to identify potential strategies for building an Institute-wide environmental education outreach initiative. During that summer, instructors Carla Ramsdell and Laura England identified Appalachian faculty engaged in environmental science education initiatives and their off-campus collaborators. During the 2010 fall and 2011 spring semesters, two proposals were submitted and are currently under review. This environmental education program team continues to review opportunities for external funding and build collaborations that position Appalachian to develop a comprehensive multi-disciplinary environmental education program. One of the proposals is currently under review by the Regional U.S. EPA office. A two day wetlands workshop for land managers and public school teachers was held in mid-November at Watauga High School, and advance attendance for each workshop has already exceeded expectations. Some of the funding for this workshop was derived from contributions from local businesses with interests in this subject and helped offset registration costs for the teachers who attended.

Agra-Business Research and Outreach: A group of faculty representing the university's Sustainable Development Program, Department of Computer Science, Department of Finance, Banking and Insurance, The Department of Geography and Planning, the Department of Psychology, the Appalachian Energy Center, and the Watauga County Extension Office have met to explore common research and outreach interests. This group continues to examine opportunities to assist small agri-businesses operations in Western North Carolina and to obtain external funding agencies to support the region's

economic base, small agri-business operations, and university partnerships. The group will continue to expand its connections throughout the Appalachian campus and explore projects that address economic, energy and environmental questions.

## II. MISSION AND GOALS

Appalachian's Research Institute for Environment, Energy, and Economics (RIEEE) was established in November 2008 to enhance research opportunities for faculty and students whose interests focus on environmental science, renewable energy and economics. The Institute serves as an umbrella organization for three centers including The Appalachian Energy Center, the Center for Economic Research and Policy Analysis (CERPA), which currently exist, and the proposed Southern Appalachian Environmental Research and Education Center (SAERE). The Centers represent the three major elements of research and educational outreach that cover issues related to the environment, energy, and economics.

Because of its setting, Appalachian State University has attracted faculty and students to the campus who have a strong commitment and interest in environmental issues. This commitment on the part of our students is symbolized by their support of renewable energy (Appalachian student sponsored Renewable Energy Initiative). Appalachian's strong academic programs include studies in Biology, Chemistry, Physics, Geology, Geography and Planning, Computer Science and Mathematical Sciences, and Technology and Environmental Design. The Appalachian campus has very strong multi-disciplinary programs including Environmental Science, Sustainable Development, the Masters concentration in Environmental Policy in the Department of Government and Justice Studies, and the collaborative Masters in Appalachian Studies. All of these are high quality, grounded, multi-disciplinary programs that symbolize Appalachian's commitment to formal studies in the environment, energy and economics.

From this beginning, the University has built a reputation that attracts faculty, staff and highly motivated students who are interested in the interface of the environment, energy and economics. Today, many faculty members across several colleges and from multiple disciplines focus on research at the nexus of these three topics.

### Who We Are

- The RIEEE Centers, faculty, staff, students, and partners contribute to our broader and deeper understanding of complex problems associated with the environment, energy and economics by conducting multidisciplinary research and outreach initiatives that are of value to our region and globally.
- We emphasize in our research and scholarly activities that focus on renewable energy, energy efficient and healthy buildings, atmospheric monitoring and assessment, water resources, environmental conservation, preservation and resource management, economic policy, and economic sustainability.
- Our research clusters influence change through innovation, engagement on campus and with our partners in public agencies, businesses and citizens in our region, the state, the nation and internationally.
- Our faculty and staff are a valuable resource through their efforts to mentor graduate and undergraduate students, to be engaged throughout our university and community, and collaborating with public and non-profit agencies and businesses in our state and region.

- We support sustainability on our campus by collaborating with the Appalachian Office of Sustainability, Office of Business Affairs, academic units throughout the campus and supporting research in labs associated with renewable energy, survey research, and environmental sciences.

### **What We Need**

- Opportunities to consolidate faculty, staff and student research resources in the natural, socio-cultural and economic sciences and which cross traditional academic disciplines in order to foster innovative, multi-disciplinary research efforts.
- Financial resources to support such multi-disciplinary research inquiry into the interdependence of our natural, social-cultural, and economic systems.

### **What We Strive to Achieve**

- Knowledge which impacts change locally, regionally and internationally.
- Collaborations for internally and externally supported research and outreach indicatives.
- A culture of inquiry and discovery that engages our entire campus on issues of importance to our local, region, nation and internationally.
- Interdisciplinary research teams that are dedicated to a broader understanding of complex problems that affect our society, economy, and environment.
- New ways of understanding environment, economic and energy challenges and most importantly, of communicating this understanding to the surrounding community.
- Raising both the quantity and quality of research so that it can compete on a national and international scale.
- Involvement of students with faculty and staff in the analysis of complex problems.
- Increased innovation through research that supports economic development in our region
- Greater levels of collaboration and engagement with public, private and non-profit organizations.

### **Mission**

Research on our campus is conducted to enhance our understanding of natural, human, economic and built systems, their interrelationships, impacts and contributions to our human and environmental wellbeing.

The RIEEE's mission is to enhance Appalachian's internationally recognized multi-disciplinary research base that supports the development of knowledge, technology and

leadership to build and sustain prosperous, productive and resilient communities. We seek to foster a deeper understanding and appreciation of the sustainable use of our social, cultural, economic and natural capital.

The RIEEE serves as a point of contact, facilitator, catalyst, and supporter of multi-disciplinary research and outreach activities for:

- Graduate and undergraduate academic programs, faculty and students at Appalachian State University and other universities in our state, nationally or internationally;
- K-12 student populations, teachers and educational systems;
- Local, regional, state and national public and non-profit agencies;
- Decision makers in business and industry; and
- The general public.

## **Goals**

Our primary goal is to facilitate the highest quality research, application and outreach that bridges disciplines associated with the environment, energy and economics. The RIEEE brings together faculty, staff and students from throughout the university in partnership with external collaborators. The intent is to create a holistic perspective of problems and issues associated with a changing environment, economy and society. The Institute will support research and outreach efforts through financial administration, funding and proposal development, project logistics and operations, and dissemination of project results. In addition we will:

- Facilitate collaborative efforts across departmental, college and administrative structures.
- Facilitate extramural funding for faculty and student research as well as support the development of future research facilities and acquisition of equipment.
- Provide a point of contact for outside agencies and possible collaborators.
- Disseminate knowledge and information from project and program initiatives.
- Assist Appalachian State University in efforts to improve energy efficiency, environmental conservation, and sound public policy.
- Develop community, regional, and international research and outreach partnerships that compliment our research priorities and capabilities as well as our geographic attributes.

We believe that the pressing problems today are global in nature and that we can benefit from partnerships that allow us to reach beyond our regional and national boundaries. We also see that in order to contribute to change, we must have strong partnerships with public agencies at all levels, non-profit entities and businesses. These collaborations build stronger research initiatives and provide the avenues to reach policy makers, to access to research data and resources, to reach diverse audiences, and a broader more encompassing perspective on problems and issues of such global import.

## **Appalachian Energy Center (AEC)**

### **Mission**

**Appalachian Energy Center (AEC)** is committed to research, development, policy analysis, and demonstrations in all areas of energy, with a stated mission to facilitate the work of faculty and students engaged in teaching, research and outreach activities associated with energy technologies, conservation, and policy.

### **Goals**

The primary goal of the AEC is to create and disseminate knowledge related to the sustainable conversion and conservation of energy. The following objectives lead to fulfilling this goal:

- Conduct research germane to alternative energy technologies including solar thermal, photovoltaics, hydro power, wind power, biomass and biofuels, combined heat and power, fuel cells, and geothermal.
- Conduct research germane to all aspects of energy conservation including building energy efficiency, thermal characterization of materials, high performance design, passive solar design, remote monitoring of energy use and indoor environmental quality, high-density low-cost energy storage, high performance HVAC design, and occupancy behavior.
- Support the pursuit of economic prosperity, new jobs, and the growth of business and industry related to the “clean/green economy” through applied research, analysis, program and project development, and education and outreach activities. Provide public and professional education related to energy efficiency and renewable energy that allows citizens, policy makers, and industry professionals to make informed decisions related to the true benefit implementing these technologies.
- Conduct community outreach activities that lead directly to energy conservation and independence both domestically and abroad.

## **Center for Economic Research and Policy Analysis (CERPA)**

### **Mission**

**The Center for Economic Research and Policy Analysis (CERPA)** is a multidisciplinary unit at Appalachian State University. The mission of CERPA is to improve policy- and decision-making by producing rigorous research and disseminating relevant information on current economic and policy issues. To that end, CERPA maintains research programs in the specific areas of economic development, environment and energy, and experimental economics and survey research. CERPA achieves this mission by creating capacity and facilitating opportunities for faculty research within and across disciplines.

### **Goals**

Expand the Experimental Economics program to become a broader Social Science Experimental program. The experimental economics group is highly productive with an international reputation. The new program would integrate psychology and political science in the existing economics group. The

purpose is to facilitate a multidisciplinary research group that will enhance research ideas and opportunities for the researchers. This is currently in progress. The result is uncertain and the merger of these groups will be determined by the faculty.

Restart the WNC Economic Index, which was suspended due to budget cuts. Regional leaders, public and private, have formally expressed their disappointment with the decision to suspend the monthly report. The reaction reveals the significant positive impact that CERPA can have on the region and state. CERPA is working with these stakeholders to identify means and methods for restarting the report.

Expand and strengthen off-campus collaborations. The off-campus connections have been extremely valuable to faculty research, even though it does not directly appear in the numbers. For example, CERPA's connections with Center for Climate and Environmental Research – Oslo (a worldwide leader in climate and environmental research) have afforded faculty with significant funding and research opportunities. Specifically, Appalachian faculty has received funds from CICERO for experimental research and travel support to visit their offices in Oslo to discuss research. This connection has led to a new potentially fruitful partner: Strategic Challenges in International Climate and Energy Policy (CICEP), which is affiliated with UC San Diego, Fudan University (China) and CICERO (Norway). These exciting collaborations resulting in well-established collaborative relationships with leading research universities in the U.S., which will continue to be productive as well.

Expand and strengthen on-campus collaborations. The Economic Development program recently collaborated with the Center for Entrepreneurship on a study that assessed the small business environment in WNC. The Center for Entrepreneurship has undergone a change in leadership, and efforts should be made to ensure this collaborative relationship continues. The Environment and Energy program continues to collaborate with the Energy Center, and maintaining this strong relationship is a priority. Opportunities for further on-campus collaboration are possible, including strengthening connections between economics and political science, establishing the survey lab (AppSRL) as the central entity for surveys on campus, and exploring opportunities of environmental health research with the College of Health Sciences.

Finalize funding for the multidisciplinary research project that was proposed to NOAA in 2011. This major project would provide on-going funding of approximately \$400,000 annually, which would serve as a valuable baseline for CERPA and RIEEE. Efforts to pursue the funding were near certain until recent budget uncertainties. We continue to work with NOAA to resolve these uncertainties.

More generally, continue to evolve by responding to relevant opportunities and needs. CERPA's research programs are defined by faculty interests and strengths. These interests and strengths will evolve. CERPA will lead this evolution by facilitating new opportunities, but it will also follow this evolution to serve the needs of the faculty.

## **Southern Appalachian Environmental Research and Education Center (SAEREC)**

### **Mission**

The Southern Appalachian Environmental Research and Education Center (SAEREC) promotes interdisciplinary environmental research and educational outreach in the southern Appalachian Mountain Region (SAMR). Through these efforts SAEREC will contribute to an increased understanding of the critical challenges facing natural ecosystems in this region resulting from natural causes and human activities.

The specific objectives of SAEREC are to:

- 1) support research in the southern Appalachian mountain region that has both regional and global implications
- 2) promote an understanding of increased human resource demands on ecosystems of the southern Appalachian mountain region
- 3) encourage interdisciplinary collaborations to solve environmental problems in the region
- 4) actively engage and mentor students in environmental research and educational outreach

### **Goals**

The goals of the SAEREC are to enhance the quality and quantity of environmental research performed by faculty and students at Appalachian State University. Another goal is for the SAEREC to engage in active outreach to the public. One way to do that is to sponsor a series of ongoing environmental teaching workshops for teachers and the public.

Another goal is to provide opportunities for interdisciplinary research on environmental issues of concern in the SAMR. This can be accomplished by bringing together faculty who otherwise might not consider an interdisciplinary research effort, by finding research and collaborative opportunities with external agencies, at either the state or Federal level, and by creating an intellectual atmosphere conducive to interdisciplinary collaborative efforts.

Finally, a major goal of the SAEREC will be to focus its efforts on the most critical environmental research needs in the SAMR. The identification of these foci will come about by having numerous discussions with SAEREC members, the Board of Advisors, and with faculty. It is thought that initially, the SAEREC would benefit by trying to selectively engage faculty on research with common themes (e.g., climate change impacts) rather than extending itself too broadly. As the SEAREC grows, and the number of personnel and researchers increases, it will be able to tackle additional problems that it now cannot.

### III. RELEVANCE TO INSTITUTIONAL MISSION AND STRATEGIC PLAN

**Priority 1: Create and maintain superior curricula, programs, financial incentives, and intellectual environments to attract, educate, and graduate an exceptional and diverse community of students.**

**Initiative 3: Appalachian will continually assess and conduct research to improve academic programs and administrative services and identify new program initiatives.**

- Conduct research and prepare policy analyses to inform university decision makers.

The RIEEE has worked closely with the Office of Business Affairs to link resources of each of our Centers to needs on the campus from the examination of renewable energy options and performance of existing technologies on the campus, the impact of university funded research on the North Carolina economy and the restoration of University property impacted by erosion along the South Fork of the New River. The RIEEE serves as an advocate for not only Center research and outreach clusters but also as a resource for new ways that faculty and staff can assist campus enterprises such as New River Light and Power, food services, housing, or Student Affairs. It should be noted that the Director of the RIEEE serves on the Board of Directors for the National Committee for the New River which is managing the restoration of the New River along with the Town of Boone and the university.

The Center for Economic Policy and Analysis (CERPA) completed a study supported by the University of North Carolina General Administration (UNC GA) concerning the impact of external funding on the state of North Carolina. The information provided by this study continues to influence university system and campus policy decisions especially in light of state fiscal budget reductions. Clarifying the economic impacts from institutional research efforts is critical in making sound governance decisions for institutions of higher education. CERPA also completed a study for the North Carolina Rural Center examining economic challenges and strategies that face rural counties.

**Priority 2: Provide resources to enable all faculty members to perform quality research and creative activities, and enhanced resources in successive, focus areas of strength to enable Appalachian to make sustained and major contributions in those fields.**

A fundamental responsibility of a university is the advancement of knowledge through research and creative activities, and great universities are recognized for the scholarly accomplishments of their faculty. To become a nationally recognized university and engage the best students, Appalachian must significantly advance its overall research profile and achieve prominence in research that is associated with environmental, energy and economic issues.

**Initiative 1: Appalachian will foster success in scholarship across the university.**

- Sponsored program support to \$18 million.
- Discipline-appropriate scholarly or creative performance (e.g., peer-reviewed publications/ products, presentations, performances, student theses, honors).
- Increase graduate research assistantship stipends by 15 percent.

The RIEEE has assisted in increasing the total amount of external support for research and outreach

activities. Specifically, the RIEEE works closely with the Office of Sponsored Programs in not only identifying sources of funding but in following up with individual faculty and department chairs on funding sources that fit with faculty research priorities. The RIEEE also supports Center research clusters by facilitating discussions with federal and state agency offices to further clarify how university research efforts could support agency activities. Examples of this type of support include the facilitation of discussions with principle investigators who have received funding for projects related to faculty research interests, obtaining copies of the agency funded proposals for review by faculty and visits with agency personnel to the Appalachian campus to see first hand research labs that would support agency related research efforts. The RIEEE thus serves as a key resource to faculty, research clusters, and departments for the development of agency research proposals and in exploring what laboratory resources may be needed for research initiatives. It also works with University administrators in getting those resources for our faculty. Increasing the level of external support for research efforts is a team effort between faculty, department chairs, deans, and the Office of Sponsored Programs. The fact is that faculty have a limited amount of time that can be devoted to building research capacity; the RIEEE and its Centers are a key advocate for faculty in increasing support for research and outreach activities.

External funding from new grants and contracts for the RIEEE and its centers has grown from \$661,475 in FY 2009 when the Institute was created to \$753,285 in FY 2010 and \$4,230,807 in FY 2011. Continuing funds reflect multi-year projects; these funds have grown from \$1,453,614 in FY 2009 to \$1,837,203 in FY 2010 and to \$2,098,584 in FY 2011. Additional funding to support research and outreach activities is provided by the State of North Carolina through the State Energy Office to the Appalachian Energy Center (\$562,545 for FY 2009; \$612,750 for FY 2010; \$512,340 for FY 2011; and \$100,000 for FY 2012). These funds supported faculty and staff travel, personnel costs, equipment purchases, supplies and student stipends. External funding provides the resources to support faculty release time for research, graduate student assistantships, and undergraduate student support funds.

**Initiative 2: Appalachian will build nationally competitive research programs in focus areas (environment, energy and economics).**

- Establish the Research Institute for Environment, Energy, and Economics.
- Hire high-profile faculty members.
- Increase sponsored program awards in each focus area to \$5 million.
- Establish research partnerships with other institutions.

The RIEEE was established in November 2008 by the Appalachian State University Board of Trustees. The initial task was to pull together the two existing Centers and get the third started. In November of 2008, Appalachian Energy Center was led by a part time Director who also led the activities of the Center and the Center for Economic Policy and Analysis (CERPA). In July of 2009, the Appalachian Energy Center and CERPA were moved organizationally to the RIEEE. During FY 2010, a Director was appointed for the Appalachian Energy Center from Appalachian faculty and a Director from the Appalachian faculty was appointed to lead the proposed Southern Appalachian Environmental Research and Education Center. By July 2010, the RIEEE and its Centers had been fully staffed. It should be noted that each of the Center Directors have a limited percentage of their time allocated to their centers.

Research faculty appointments during FY 2010 to the Departments of Biology, Physics and Astronomy and Technology included time allocated for research. Collaborations have been initiated between these units and the RIEEE centers for two of the research faculty who remain at Appalachian. At the time

that the RIEEE was approved, additional research faculty appointments were anticipated. Because of budget reductions in FY 2009 and beyond, no additional research faculty resources were provided to the RIEEE and its Centers.

Appalachian faculty with strong research activities have received research funds from the Appalachian Energy Center and CERPA. Faculty from the Departments of Technology and Environmental Design, Chemistry, Physics and Astronomy, Geography and Planning, Sustainable Development, Government and Justice Studies and Biology received support for research activities. Funds were used to purchase equipment, support graduate and undergraduate students, travel and faculty time. Faculty from the Department of Government and Justice Studies received support from CERPA, the Energy Center and the College of Arts and Sciences to establish and expand a survey research laboratory. This type of collaboration in supporting new research initiatives is critical in building the capacity for faculty research on campus.

Collaborations reflecting ongoing partnerships with external groups have grown since the formation of the RIEEE. These partnerships include many with UNC universities (N.C. State, UNC Chapel Hill, East Carolina University, UNC Charlotte, Western Carolina, UNC Asheville, and N.C. A. and T. University). Other university partnerships were initiated with Dartmouth University, Texas A. and M. University, the University of Minnesota Duluth, University of California Chico, the City University of New York, Auburn University, and Clemson University. Federal and state agency collaborations include U.S. E.P.A., NASA, NOAA, USGS, US AID, the NSF and DOE. Many of these collaborations are the direct result of faculty member efforts to build lasting relationships with external agencies; others are the result of contacts facilitated by the RIEEE and its Centers. The key is that faculty, chairs, deans, RIEEE and Center Directors as well as members of research clusters work together to form and expand our external collaborations. We believe that these collaborations will be invaluable to our efforts to secure external support for our research.

Partnerships with nonprofit organizations and private businesses have also been established including the National Committee for the New River, Grandfather Mountain Stewardship Foundation, and Lowe's Inc. These partnerships provide essential financial resources but also the engagement of key personnel that promote quality research activities.

**Priority 4: Apply our intellectual, academic, cultural, and research resources to promote sustainable economic growth, prosperity, and quality of life throughout this region and state.**

**Initiative 1: Appalachian will address the state's workforce needs by recruiting and graduating students in projects areas of need.**

The RIEEE and academic units on campus have engaged more than 125 graduate and undergraduate students in our research and outreach efforts over the past three years. Many of these students have worked closely with our faculty and staff on research and technical assistance projects and then gone on to employment positions in our state, region and nationally. These former students are demonstrating the successful experiences that come from internships, fellowships and employment with our research projects and partners. The Appalachian Energy Center and the Department of Technology and Environmental Design have supported undergraduate and graduate interns and graduate fellows in placements with regional energy companies and entities including local and state government agencies

and non-profit organizations.

**Initiative 2: Appalachian will provide constructive public service to this region, state and nation.**

- Strengthen community program offerings.
- Expand K-12 outreach activities.

Our research activities are also engaged in outreach to area schools including support for science clubs for area elementary schools and energy audits for the new Watauga County High School. Campus engagement has stretched from outreach efforts locally and regionally to efforts internationally in Brazil, South Africa, and Mexico.

**Priority 5: Develop and implement a comprehensive plan to protect and enhance our distinctive historical, geographical, and cultural identity associated with our location in the Appalachian Mountains.**

Two hallmarks of Appalachian are our location in an aesthetically pleasing as well as culturally and recreationally rich, mountain environment and a campus that attracts faculty, staff, and students seeking a high quality of life. We are committed to conscientious stewardship of these important resources and to assertive leadership by promoting sustainable policies and practices. Faculty, staff, and student interest and expertise in sustainable development, along with our location, compel us to provide leadership in sustainable development.

**Initiative 1: Appalachian will enhance our sustainability efforts.**

- Office of Sustainability.
- Campus-wide sustainability plan.

The RIEEE has supported the Office of Sustainability since its creation by having Center Directors serve on the Sustainability Council. Faculty from our research clusters serve on Council Committees and a part of this campus wide effort to build a strong organizational sustainability program.

The RIEEE has also supported the Center for Appalachian Studies in hosting the Appalachia and Wales: Coal Conference held in 2010. The Center for Appalachian Studies provided program direction for this initiative and secured funding from the North Carolina Humanities Council. Collaborations with academic units on the campus is critical in ensuring that adequate support is provided for research and outreach activities and in avoiding the duplication of program initiatives.

**Initiative 2: Appalachian will develop a master plan that promotes our intimate residential campus character.**

RIEEE Center staff and faculty serve on university facility committees providing discipline specific expertise campus operational units. The types of consultation and technical support range from emergency management, flood modeling of campus creeks, energy efficiency for buildings, renewable energy initiatives, stream restoration, economic cost benefit studies, hazards analysis, policy analysis, and program assessment.

## **IV. MEASURES OF PERFORMANCE**

### **Personnel and Affiliated Faculty**

Personnel associated with the RIEEE include a full time director and administrative assistant. The RIEEE Director is a full time state funded position and the administrative assistant is supported one-half time with state funds.

The RIEEE has expanded its faculty appointments by using research faculty. In FY 2011, a Research Assistant Professor was appointed within SAEREC in collaboration with the Biology Department and the College of Arts and Sciences. This faculty member teaches one class each semester and receives 25 percent of his salary from state funds. The remainder of his salary is from external grant and contract funds and from state funds through the College of Arts and Sciences.

In FY 2011, a Professor Research joined the RIEEE faculty after retirement from a federal agency. A second Research Assistant Professor also joined the RIEEE and SAEREC in FY 2012 in a joint appointment with the Department of Geography and Planning. These Research appointments do not have teaching assignments and are compensated for through grant and contract funds. No state funds are allocated to either of these positions.

The Appalachian Energy Center has the largest number of staff who are engaged in research and outreach activities. Staff are supported by both grants and contract funds and funding provided to the Energy Center through the State Energy Office. The number of Energy Center staff has grown from seven to 14 and who are engaged in faculty directed research and outreach projects. As external funding has grown over the past few years, more EPA staff have been hired to support these research and outreach efforts.

A total of 75 faculty are associated with the RIEEE and represent twenty-five academic units, five colleges (College of Arts and Sciences, Walker College of Business, College of Fine and Applied Arts, University College, and the College of Health Sciences) and administrative units. Faculty affiliates are full time members of the Appalachian faculty who serve as principle investigators or co-investigators on funded activities of the Energy Center, CERPA and SAEREC. Faculty may receive compensation (including summer salary) in addition to their regular salary for their work on research and outreach activities. Compensation for research activities is provided exclusively by contracts and grants. It should be noted that Appalachian faculty are allocated a percentage of their time during the academic year for research and scholarly activities. Table 1, "Number of FTE Faculty, Staff and Affiliated Faculty" shows the breakdown of personnel by unit within the RIEEE by fiscal year. It is anticipated that the number of affiliated faculty will continue to increase in the coming years as research teams expand the scope of their activities and new faculty are engaged in these activities.

**Table 1: Number of FTE Faculty, Staff and Affiliated Faculty**

<b>Unit</b>	<b>Faculty FTE</b>	<b>EPA Staff</b>	<b>SPA Staff</b>	<b>Faculty Affiliates</b>	<b>Departments</b>	<b>Colleges Schools</b>
<b>FY 2011</b>						
RIEEE Energy Center	2		0.5	3	5	2
CERPA	0.5	14	0.5	25	6	3
SAEREC	0.25	0	0	23	5	2
	1.25	2	0	24	6	2
<b>FY 2010</b>						
RIEEE Energy Center	1		0.5		1	1
CERPA	0.25	10	0.5	24	8	3
SAERE	0.25		0	12	5	2
	0.25		0	15	5	1
<b>FY 2009</b>						
RIEEE Energy Center	1		0.5	22	7	1
CERPA	0.25	7	0.5	0	0	2
SAERE	0.25			0		0
	0		0	0	0	0

## **Expenditures and Source of Funds**

### Institutional Allocations

Appalachian State University provides financial support to cover the full time twelve-month salary for the Director of the RIEEE and 50 percent of the salary for the RIEEE Financial Management SPA Staff Specialist. Support for travel and other office expenses has been provided during FY 2010, 2011 and 2012 (\$3,000 for FY 2010 and FY 2011; \$1,800 for FY 2012).

The Institute's primary source of funding comes from a portion of the 'indirect charges' associated with contracts and grants that are supported by the RIEEE as well as external grants and contracts. In November 2008, the University Board of Trustees approved an allocation of the University's grants and contracts indirect charges. The RIEEE was designated to receive 20 percent of indirect charges for contract and grants that are part of their programs and research activities. For FY 2011, this amounted to approximately \$11,000; for FY 2012 the indirect cost funds returned to the RIEEE and its Centers amounted to \$34,000. The allocation of these funds within the RIEE is:

- 25 percent to the RIEEE;
- 25 percent to the Center that sponsors the contract or grant; and
- 50 percent to the principal investigator (PI).

The RIEEE and the Centers have used the indirect costs funds to support new research and outreach initiatives, student research projects, travel, and conferences.

Support for Center Directors: The Office of Academic Affairs allocates funds for a portion of the salary for each of the Center Directors. Table 2: Expenditures by Source of Funds by Type, shows the amount of University support for each of the Centers. Funds in the amount of \$3,000 a semester are allocated by the University to the academic unit of the Center Directors. These funds cover the time for the Center Directors and are used by Departments to hire a replacement for the faculty member's class. It should be noted that a limited amount of travel funds from state sources was allocated to the RIEEE for Directors in FY 2011.

Registration fees associated with workshops, institutes and conferences sponsored by units of the RIEEE are processed through the Division of Outreach and Summer Programs (DOSP) within the University. All expenditures for the sponsored activity are paid by the DOSP and remaining funds are then transferred to the Institute's operating unit for use by the Principle Investigator of the outreach activity.

### State Allocated Funds

The Appalachian Energy Center has received financial support from funds appropriated through the Dept. of Commerce, State Energy Office. These funds provide programmatic support for research and outreach activities of the Energy Center and are used to cover a portion of the Energy Center's operating expenses. Funding for the Energy Center from the State Energy Office amounted to \$562,545 for FY 2009, \$612,750 for FY 2010, and \$512,340 for FY 2011. Expenses for printing, phones and supplies were permitted as part of the use of these funds. Funds from the State Energy Office to the Appalachian Energy Center were reduced to \$100,000 for FY 2012.

Individual and Institutional Gifts

Total expenditures for the RIEEE and its units have increased from FY 2009 as the scope of research and outreach has expanded thus having a greater impact on our region and the state. Table 2, “Expenditures by Source of Funds by Type” summarizes financial support for RIEEE program activities by the amount of new grant awards, funds allocated to the Energy Center through the N.C. State Energy Office from the state budget allocation, Appalachian support from state funds (salaries, operating expenses, and Center Director salary support), other Appalachian support (indirect costs returns to the RIEEE or conference fees), and gifts. The expenditures are broken down by RIEEE unit and by fiscal year. It should be noted that CERPA operated under the Walker College of Business during the 2009 fiscal year but shown in Table 2 to assess change in funding over the past three years. The Energy Center operated within the Office of Sponsored Programs and the Graduate School during the 2009 fiscal year and is also noted in Table 2 for informational purposes.

**Table 2: Expenditures by Source of Funds by Type**

	<b>Grants Awarded</b>	<b>(1) State Appropriation</b>	<b>University Support</b>	<b>University Other (3)</b>	<b>Gifts</b>	<b>TOTAL</b>
<b>FY 2011</b>						
RIEEE			170,000	3,000		173,000
Energy Center	3,459,657	\$512,340	\$12,000	\$7,000		\$3,990,997
CERPA	18,000		6,000	300		24,300
SAERE (4)	452,830		6,000	300		459,130
<b>Total</b>	<b>3,930,487</b>	<b>\$512,340</b>	<b>\$194,000</b>			
<b>TOTAL Budget</b>						<b>\$4,647,427</b>
<b>FY 2010</b>						
RIEEE			170,000	0		170,000
Energy Center	165,003	612,750	3,000	0		780,753
CERPA	93,428		6,000	0		99,428
SAERE (4)	581,400		0	0		581,400
<b>TOTAL</b>	<b>839,831</b>	<b>612,750</b>	<b>179,000</b>	<b>0</b>		
<b>Total Budget</b>						<b>1,631,581</b>
<b>FY 2009</b>						
RIEEE	34,444		100,000	0		134,444
Energy Center	403,886	562,545	\$6,000	\$0		972,431
(2) CERPA	223,145		6,000	0		229,145
SAERE (4)	0		0	0		0
<b>Total</b>	<b>661,475</b>	<b>562,545</b>	<b>\$112,000</b>	<b>\$0</b>		
<b>Total Budget</b>						<b>\$1,336,020</b>

\* Annual Report FY 2009 (Office of Research & Graduate Studies)

(1) State Energy Office - North Carolina State Appropriation

(2) Center for Economic Research and Policy Analysis - Moved to RIEEE from Walker College of Business 7/1/09

(3) Other funds include indirect charges rebate and unit transfers

(4) Southern Appalachian Environmental Research and Education Center (Proposed) January 2010

## Contracts and Grants Awarded

Table 3: “Table 3: Number of Grants or Contracts Awarded by Funding Source by Unit and Fiscal Year” represents new awards by fiscal year and reflects the sources of the award. The “other category” represents awards that are from local governmental units or public non-profit agencies such as the Golden Leaf Foundation.

External funding in the form of grants, or contracts reflects support for specific research and outreach activities conducted through the RIEEE. Excluded from this discussion of contracts and grants are internal Appalachian funds that are allocated to support RIEEE research activities.

### Number of Grants or Contracts Awarded by Unit and Fiscal Year

The number of external grants and contracts awarded has grown from a total of 16 in FY 2009 to 34 in FY 2011. It should be noted that CERPA was not a part of the RIEEE during FY 2009 and was transferred organizationally in July 2009. The proposed Southern Appalachian Environmental Research and Education Center began functioning in July 2010 with the appointment of a Director.

A major indicator for external funding is the length of the award or contract. A longer period of performance provided under an agreement has a significant impact on what may be accomplished in the activity. Multi-year performance agreements allow the principle investigator(s) to develop and implement more complex activities and achieve results that might not be possible in a project running one year or less. Our faculty and staff thus strive to have a longer award period in their projects.

Appalachian faculty and staff have also been successful in securing awards from different funding sources including federal and state governmental agencies, local governmental units, non-profit foundations and private businesses or industries. The category of agencies in Table 3: “Table 3: Number of Grants or Contracts Awarded by Funding Source by Unit and Fiscal Year” is shown below as ‘other’ reflects awards from local governmental units as well as non-profit organizations. It should be noted that in FY 2009 grants and contracts were primarily from federal and state government agencies while in FY 2011 grants and contracts were from a much broader set of agencies. Given that public agencies at all levels have greater limitations on their discretionary funds, it will be critical to secure external support from foundations and private businesses and industry.

**Table 3: Number of Grants or Contracts Awarded by Funding Source by Unit and Fiscal Year**

<b>Unit</b>	<b>Federal</b>	<b>Industry</b>	<b>State</b>	<b>Other (1)</b>	<b>Continuing</b>	<b>Total</b>
<b>FY 2011</b>						
RIEEE					1	1
Energy Center	4	0	1	4	9	18
CERPA	0	0	2	0	4	6
SAEREC	3	2	3	0	1	9
<b>FY 2010</b>						
RIEEE					1	1
Energy Center	3	0	1	0	7	11
CERPA	0	1	1	1	0	3
SAERE	3	1	0	0	0	4
<b>FY 2009</b>						
RIEEE	1					1
Energy Center	2		0	2	7	11
CERPA (3)	0		4	0	0	4
SAERE (2)						

(1) Other includes local government and public non-profit organizations

(2) SAERE began operations in January 2010

(3) Center for Economic Research and Policy Analysis moved to RIEEE from Walker College of Business 7/1/09

Amount of Awarded Grants and Contracts by Unit and Fiscal Year

The amount of external funding from grants and contracts has grown steadily from FY 2009 through FY 2011. The greatest increases have been from federal agency awards and from private gifts especially in FY 2011 when the Solar Decathlon received support from private sources including Lowe’s Inc. During FY 2011, the Appalachian Energy Center received a \$10,000 planning grant from the National Science Foundation to support the development of a multi-institutional university business research center. It is anticipated that Appalachian will complete the application process in FY 2012 to NSF and include significant private support as a part of their submission proposal. Other research and outreach initiatives are also looking to partnerships with private and non-profit organizations as a strategy to enhance resources for program activities.

**Table 4: Amount of Awarded Grants and Contracts by Unit and Fiscal Year**

Unit	Federal	Industry	(4) State	(1) Other	Continuing	Total
<b>FY 2011</b>						
RIEEE					0	0
Energy Center	3,352,664		32,378	74,615	1,453,614	4,913,271
CERPA			18,000		100,000	118,000
SAEREC	304,586	10,033	138,211		499,970	952,800
<b>Total</b>						5,984,071
<b>FY 2010</b>						
RIEEE					34,444	34,444
Energy Center	35,870		129,133	0	1,708,160	1,873,163
CERPA	0	39,000	51,415	3,013		93,428
SAERE	474,684			20,170		494,854
<b>Total</b>						2,495,889
<b>FY 2009</b>						
RIEEE	34,444	0		0	0	34,444
Energy Center	374,546	0	0	29,340	1,453,614	1,857,500
CERPA (3)	0	0	223,145	0	0	223,145
SAERE (2)						
<b>Total</b>						2,115,089

(1) Other includes local government and public non-profit organizations

(2) SAERE began operations in July 2010

(3) CERPA moved from Walker College of Business to RIEEE in July 2009

(4) State Contracts and Grants do not reflect the funding provided by N.C.

FY2009	\$562,545
FY 2010	\$612,750
FY2011	\$512,340

## Expenditures: External Grants and Contracts by Unit and Fiscal Year

Table 5: “External Funding by Fiscal Year and Unit” shows the funding level for each unit and funds awarded, in review, or denied. The additional categories of funding provide a more comprehensive view of the level of effort by the faculty and their success rate in securing external funding. Although we regret being turned down for any of our proposals, we attempt to learn from the experience and any new submissions benefit from feedback from funding agencies on proposals that are rejected.

Total awards for the RIEEE increased from \$661,475 in FY 2009 to \$753,285 in FY 2010 and \$4,230,807 in FY 2011. Further, the number of submissions increased in their size and the duration of the proposed project. Although we would like all our submissions to be successful, it is not realistic. The significant increase in funded proposals from FY 2009 through FY 2011 is associated with a larger number of submissions and a much greater total amount of funds requested. Total proposals submitted but denied totaled \$441,117 in FY 2009 and increased to \$15,382,930 in FY 2011. We expect to see continuing increases in the number of proposals to external sources and the total amount requested to rise.

We also intend to continue to request support for research and outreach activities that are spread over multiple years. It should be noted that for many projects, a longer duration period allows our faculty, staff and students to focus their efforts and allow the activity to evolve. We believe that we can address more complex issues and problems with a longer period of support and larger sums in the award. We thus intend to have larger sums in projects that continue beyond a single fiscal year.

Note 2 on Table 5 makes a reference to collaborations with North Carolina counties. In FY 2011, the Appalachian Energy provided technical support and consultation to North Carolina counties to support methane recovery energy initiatives. Awards were made to N.C. counties in the amount of \$8,175,657. These funds were awarded directly to the counties but the Appalachian Energy Center provided essential services to the counties in getting these awards. North Carolina counties were not billed for the services from the Energy Center since these services were provided as part of the program support with North Carolina funds allocated through the N.C. Department of Commerce, State Energy Office.

**Table 5: External Funding by Unit and Fiscal Year** (August 2011)

Unit	Awarded	In Review	Denied	Continuing	(1) N.C. Funds	TOTAL
<b>FY 2011</b>						
Energy Center (2)	3,459,657	65,000	\$3,618,184	\$1,498,614	\$512,340	\$5,470,611
CERPA	18,000	1,507,894	1,623,947	100,000		118,000
SAEREC	753,150	293,371	10,140,799	499,970		1,253,120
<b>Total 2011</b>	<b>4,230,807</b>	<b>1,866,265</b>	<b>\$15,382,930</b>	<b>\$2,098,584</b>		
<b>TOTAL RIEEE Funds</b>						<b>\$6,841,731</b>
<b>FY 2010</b>						
Energy Center	165,003	0	1,338,308	\$1,837,203	612,750	2,614,956
CERPA	93,428	0	629,852	0		93,428
SAEREC	494,854	0	418,243	0		494,854
<b>TOTAL 2010</b>	<b>753,285</b>	<b>0</b>	<b>2,386,403</b>			
<b>Total RIEEE Funds</b>						<b>3,203,238</b>
<b>FY 2009</b>						
Energy Center *	403,886	120,000	\$437,493	1,453,614	562,545	2,420,045
CERPA (3)	223,145	0	3,624	0		223,145
SAEREC (4)	0	0	0	0		
RIEEE	34,444	0	0	0		34,444
<b>Total 2009</b>	<b>661,475</b>	<b>120,000</b>	<b>\$441,117</b>			
<b>Total RIEEE Funds</b>						<b>\$2,677,634</b>

\* Annual Report FY 2009 (Office of Research & Graduate Studies)

(1) N.C. Funds - State Energy Office - State Appropriation

(2) Collaborations with Counties - Landfill Gas ARRA \$8,175,657 not included in amount awarded

(3) Center for Economic Research & Policy Analysis (CERPA) in the Walker College of Business - Moved to RIEEE 7/1/2009

(4) Proposed Southern Appalachian Environmental Research & Education Center (SAEREC) began operations 1/1/2010

## Deliverables: Publications, Presentations and Technology Transfer Activities

### Publications

**Table 6: Number of Publications by Unit, Type and Fiscal Year**

	Books	Book Chapters	Journal Articles	Proceedings	Reports	TOTAL
<b>FY 2011</b>						
RIEEE	0	2	1	1		4
Appalachian Energy Center	0	0	6	0	29	35
CERPA	0	3	18	0	2	23
SAERE (4)	0	0	6	0	0	6
						68
<b>FY 2010</b>						
RIEEE			1	0		1
Appalachian Energy Center	0	0	1	9	32	42
CERPA				0	18	18
SAERE (4)			3	0		3
						64
<b>FY 2009</b>						
RIEEE	1		2	0		3
Appalachian Energy Center (1)	0	0	0	0	14	14
CERPA (2)	0		0	0		0
SAERE (4)	0		0	0		
						17

- (1) Annual Report FY 2009 (Office of Research and Graduate Studies)
- (2) Center for Economic Research and Policy Analysis - Walker College of Business
- (3) Other funds include indirect charges rebate and unit transfers
- (4) Southern Appalachian Environmental Research and Education Center  
(Proposed) Began operations 7/1/2010

Presentations

**Table 7: Number of Presentations by Unit, Type and Fiscal Year**

	<b>Public Events</b>	<b>Workshops</b>	<b>Professional Development</b>	<b>TOTAL</b>	<b>Individuals Served</b>
<b>FY 2011</b>					
RIEEE			4	4	850
Appalachian Energy Center	4	12	33	37	14,500
CERPA	1			1	250
SAERE (3)	1		6	7	325
				49	15,925
<b>FY 2010</b>					
RIEEE			2	2	350
Appalachian Energy Center	6	14	16	36	13,500
CERPA	15		11	26	2,200
SAERE (3)	4		11	15	1,400
				79	17,450
<b>FY 2009</b>					
RIEEE	2		2	4	275
Appalachian Energy Center (1)	32	55	70	157	24,000
CERPA (2)					
SAERE (3)					
				161	24,275

(1) Annual Report FY 2009 (Office of Research and Graduate Studies)

(2) Center for Economic Research and Policy Analysis - Walker College of Business – Moved to RIEEE 7/1/2009

(3) Southern Appalachian Environmental Research and Education Center (Proposed) Began operations 7/1/2010

Technology Transfer Activities

Appalachian Energy Center personnel submitted two intellectual property disclosures in 2010 related to the production of algae as a source of biomass. Other initiatives in energy efficiency and materials characterization will likely lead to additional disclosures.

## **V. MAJOR SERVICES DELIVERED TO NORTH CAROLINA**

### **Clientele Served**

The RIEEE was established to enhance our understanding of our natural, human, economic and built systems and their interrelationships. In collaboration with our faculty, academic units and our colleges, we serve as a facilitator, catalyst, and supporter of multidisciplinary research and outreach activities clarify the connections between our natural, social/cultural and economic systems. We work in partnership with local, regional, state and national public and non-profit agencies to conduct our research and outreach activities. These agencies either provide funding or work side by side with us in conducting the research; agencies often provide critical data to our projects.

Outcomes of our research and outreach efforts are primarily directed to:

- Decision makers and policy makers in public, non-profit and business and industry entities;
- Local, regional, state and national public and non-profit agencies;
- K-12 student populations, teachers and educational systems; and
- The general public.

A key clientele that we serve are the graduate and undergraduate students at Appalachian State University. Many research projects include support for graduate and undergraduate students and their time and talents are critical in many research efforts. We also see that the development of their research and technical skills and their view of complex of problems and issues is an investment in a quality academic program on our campus and their capacity to serve our society in the future. More than 125 graduate and undergraduate students were supported by RIEEE research activities over the past three years.

We not only support student workers and graduate assistants in our research project but also support small seed grants to graduate and undergraduate students; the grants result from an open solicitation by the Energy Center through the Office of Undergraduate Research. In FY 2010, 20 students were provided up to \$500 for travel, supplies or data acquisition

The Centers in the RIEEE serve public and private entities as well as the general public. They serve public groups at the local, regional and state governments, such as the Mountain Resource Legislative Commission, University of North Carolina General Administration, Advantage West and North Carolina Rural Center. They serve private industry with direct consultation and indirect use of center generated information (e.g., Mission Health, financial institutions, etc.). The Centers serve as a resource of information for the general public on issues facing the region (economic impact of renewable energy initiatives). The dissemination of important information that is relevant to the region and state occurs through written reports, public talks and interviews with popular press.

### **Societal Benefits**

The societal impacts of the RIEEE research and outreach initiatives are reflected in the impact on our students, and the economic contributions of our research and outreach in our state, region, nationally and internationally. Graduate and undergraduate students are directly engaged in campus research and

outreach activities. For some, their thesis has been recognized by Appalachian and some have been nominated for the UNC Outstanding Thesis Award.

Many students gain a first hand appreciation of the value of research project in their field of study and the application of the skills and knowledge in their discipline. Several of our students completed their undergraduate honors thesis work with our faculty and successfully published their work. Faculty and staff also mentor students providing essential coaching to motivate students to pursue their discipline in jobs or continue studies following graduation. In addition to students who serve as temporary employees or graduate assistants for research and outreach activities, each of the Centers in the RIEEE have interns who receive course credit for their engagement with the Centers. Departments providing interns include the Department of Technology and Environmental Design (Appropriate Technology, Architecture, and Interior Design Programs), the Department of Communication, Appalachian Studies, and Biology. Interns have gone on to graduate studies at Appalachian State University (Biology, Computer Science, Geography, Masters in Business Administration, Masters in Public Administration, and Technology and Environmental Design) as well as to graduate programs in the U.N.C. System (U.N.C. Greensboro, U.N.C. Chapel Hill, and N.C. State University) or graduate programs throughout the United States (Drexel and the University of Florida). Some graduate assistants completed their academic program at Appalachian and have become full time employees to work on the research or outreach activities (Geography, Physics, Technology and Environmental Design). Our graduate assistants have secured employment with federal, state and local public agencies (National Geospatial Intelligence Agency, the National Park Service, U.S. Environmental Protection Agency, the U.S. Forest Service, and many private companies in the Charlotte area.

The Appalachian Energy Center and the Department of Technology and Environmental Design collaborated in obtaining funding from the U.S. Department of Energy for a Student Energy Internship and Fellowship Program.’ This project provided funding and employment placements for Appalachian student interns and recent graduates (fellows) with energy related businesses, offices of economic development, local government agencies, and with offices within Appalachian. Each intern and fellow worked with the collaborating agency for one year; many have been hired full time by these employers. Our collaborating employers and the students both benefited from this program that will conclude in the spring of 2012.

A second area where our research and outreach activities benefit society involves the use of our research by public officials and private sector policy makers in sponsored studies of current economic and policy issues. CERPA conducted studies for Mission Health in Asheville, the UNC General Administration (UNC GA) and the N.C. Rural Center to address specific public policy issues. The study sponsored by the UNC GA examined the economic benefits of external funding grants and contracts with UNC System institutions to the North Carolina economy. This project generated and disseminated information on the economic benefits of sponsored research activities on our North Carolina economy. Improved decisions that result from better information can directly and indirectly improve the lives of those living in local, regional and state communities.

Our local community has directly benefited from our research and outreach activities as illustrated by the North Carolina CAN-DOO (Climate Action Network through Direct Observations and Outreach): Promoting Climate Science Awareness through Statewide Partnerships. CAN-DOO, is an Appalachian State University project (originating in AppalAIR) that is supported by NASA. It has developed a

successful model for enhancing public awareness of climate science and involving citizens and students in authentic climate science measurements in the High Country of North Carolina. CAN-DOO has resulted in the creation of a climate science curriculum and partnerships with local school districts and Grandfather Mountain International Biosphere Reserve (GMIBR), a public facility that reaches hundreds of thousands of visitors annually. Visitors to GMIBR benefit from the CAN-DOO curriculum development effort; students in school science clubs have utilized the same curriculum in gaining a broader understanding of our changing climate. The CAN-DOO project has been so popular that other local school districts have asked to be included in this initiative and other public science museums have partnered with the CAN-DOO faculty and staff in the submission of proposals to extend the science education activities throughout North Carolina. There is also an international collaboration with schools in South Africa.

### **State and Regional Priorities Being Addressed**

The research centers of the RIEEE directly work to address issues facing local, regional and state economic development, as well as broader issues facing society. Specific issues addressed include the divergent economic prosperity between urban and rural parts of the state, economic conditions and issues in western North Carolina, education and poverty (CERPA), environmental management and policy, and energy resources and policy (CERPA and the Appalachian Energy Center). Research has focused on national and international concerns (e.g., environmental and energy policy), which directly affects the region and the state. Extensive collaborations between the Appalachian Energy Center, county governments in North Carolina, the Golden Leaf Foundation and the N.C. Department of Commerce (State Energy Office) have allowed our staff to support sound decision-making in utilizing landfill gas resources in a sustainable environmental economic manner.

An indication of state and regional priorities being addressed in our research and outreach activities is reflected in our ongoing collaborations with external agencies, businesses and non-profit agencies. Appendix I provides a complete list of collaborating organizations with the RIEEE.

### **Economic Impact**

The Appalachian Energy Center beginning in 2001 and more recently CERPA have had significant engagement with public and private agencies in North Carolina and assisting in both direct and indirect economic development efforts. The Energy Center with support from the State Energy Office and the N.C. Department of Commerce has stressed consultation, outreach and engagement activities with policy makers at the state and local levels as well as businesses associated with design, construction and development activities. Faculty from the Department of Technology and Environmental Design as well as staff from the Energy Center have supported the revision of the N.C. Building Code and work with companies to adopt new building practices that stress both energy and environmental conservation. Further, the Energy Center has been very active in facilitating both statewide and national conferences for professionals related to renewable energy technologies and building practices. Many of the publications and presentations listed in past annual reports center on outreach and service to energy and construction related enterprises. The Energy Center project “The North Carolina Energy Efficiency Marketing Development and Implementation Program” has provided critical technical consultation and training to North Carolina employers who provide growing “green” technology services in both the

construction and technical services industries. These employers have better trained employees and the services they provide are at a higher level as a result of this outreach activity.

The Appalachian Energy Center community based landfill gas development program partnered with 24 N.C. counties in obtaining Department of Energy grants for implementing landfill gas projects. This effort has stimulated investment in excess of \$8 million in economically distressed communities across the state during Fiscal Year 2011.

Dr. Marie Hopefl (Technology and Environmental Design) with funding from the U.S. Department of Energy supported current and former students from academic programs throughout the campus for internships with employers. Many of these interns and fellows were hired by N.C. employers at the conclusion of their service on the DOE internship program.

CERPA's Economic Development program focuses on research and policy analysis that promotes higher standards of living and improved economic and social conditions. The program specifically centers on the social and economic issues facing WNC and NC, such as workforce development, urban-rural divide, and the disproportionate impacts of the business cycle on WNC. A major element of this work entails the dissemination of timely and relevant economic information to regional leaders in the private and public sectors. This is accomplished through the monthly release of the WNC Economic Index and Report and a series of reports and policy briefs. Efforts to serve the regional need for information and insights have led to regular appearances in state and regional press outlets (e.g., NC Business Magazine, NC News Network, Winston-Salem Journal, Asheville-Citizen Times, etc.) and many local press outlets (e.g., Alleghany News, Mitchell News, News Topic (Lenoir), Journal-Patriot (Wilkes), etc.). Efforts have led to many public speaking engagements to community groups (e.g., Chamber of Commerce, Rotary Club, etc.).

Beyond the engagement efforts, CERPA's Economic Development program has conducted leading research that directly affects WNC and NC. For example:

- CERPA collaborated with the UNC School of Government in a two year study that examined the risks and opportunities facing people in NC. The work was funded by the NC Rural Center and is having a direct impact on state economic development policy. The research was selected for the Transforming NC Research Award by the Graduate School at Appalachian State University.
- CERPA collaborated with the Center for Entrepreneurship to conduct a survey of regional small businesses to assess the strengths and weaknesses of the small business environment in WNC. The work resulted in a report "Expectations in an Uncertain Economy", which was disseminated with the help of a university press release to the public.
- CERPA conducted an analysis that estimated the economic impact of research activities taking place on the UNC campuses. The work was funded by the UNC General Administration and revealed that public support for research at public universities is a good investment and a critical driver for economic development.

- CERPA conducted an analysis that estimated the economic impact of Appalachian State University on the surrounding five-county region. The work was funded by Academic Affairs at Appalachian State. Results quantified and documented the critical role that Appalachian has in the regional economy.
- CERPA released a series of reports that examined the disproportionate effect the business cycle has on WNC. For example, a report “The WNC Economy: A Decade in Review, 2000-2009” documented that WNC was negatively affected to a greater extent than the rest of the state, and in particular, the foothill counties of WNC incurred great economic losses. Such reports provide the WNC region a way to understand their social and economic conditions, but maybe more important, they provide a means to raise awareness of WNC economic conditions.

## VI. SIGNIFICANT ACCOMPLISHMENTS IN THE LAST THREE YEARS

### **Accomplishment 1: Fostered Inter-disciplinary Research Initiatives**

The RIEEE fosters inter-disciplinary research that examines the linkages between our natural, economic, and human systems and supports Appalachian's efforts to enhance our knowledge of how to preserve, restore and sustain our environmental, economic and cultural resources so as to ensure that future generations enjoy a high quality of life.

The RIEEE and its Centers support existing inter-disciplinary research clusters by collaborating with faculty additional sources of financial support to sustain and enhance existing research initiatives. The RIEEE the AppalAIR team by expanding collaborations with the National Climatic Data Center and NOAA to include a proposal to study the economic and social impacts of extreme weather and climate change, a collaboration with Discovery Place, Inc. on a proposal to the U.S. Environmental Protection Agency, and with the Grandfather Mountain Stewardship Foundation on a research and outreach facility at Grandfather Mountain. The RIEEE and SAEREC have supported the expansion of the AppalAIR atmospheric monitoring network with Grandfather Mountain Stewardship Foundation and with other state agency partners.

The RIEEE and its Centers have worked with faculty to initiate new inter-disciplinary research and outreach initiatives. It is possible that faculty teams might have successfully submitted proposals, but a conscious effort has been made since the formation of the RIEEE to initiate faculty collaborations across the campus and support inter-disciplinary proposals to external agencies. This was accomplished by meeting with individual faculty members to explore their short and long term research interests. In addition Energy Center staff supported with state funds were encouraged to work with faculty on research proposals. Many of the inter-disciplinary initiatives described below are the result of such collaborations.

It should be stressed that faculty members have a limited amount of time to devote to the preparation of research proposals. Staff of the Energy Center offered a significant level of support that was directed to proposal development beginning in FY 2010. Energy Center staff made a major contribution to proposals submitted to external agencies during FY 2010 and FY 2011 and the awards that resulted from these submissions. Funding provided to the Energy Center from the N.C. Department of Commerce through the State Energy Office not only resulted in quality research and outreach activities but by enhancing the university's research initiatives. Unfortunately, CERPA and SAEREC have not enjoyed this level of state financial support. We anticipate that without these additional staff resources that have existed in the Energy Center, inter-disciplinary research efforts will expand at a lower rate in both CERPA and SAEREC.

The development of new inter-disciplinary research teams has evolved from RIEEE initiatives to collaborate with federal and state agencies. As a result of on-going relationships with our partners, we have been called on to participate in joint proposals with Texas A and M University and Dartmouth University and agency mission driven efforts with the NCDC in Asheville. Building collaborations with external organizations is an intentional effort that is intended to link faculty research interests with agency priorities.

## Appalachian Energy Center

1. Dr. Susan Doll (Department of Technology and Environmental Design) submitted two proposals to Housing and Urban Development (HUD) through the Appalachian Energy Center titled: The Healthy Homes Technical Studies Grant Program: What Are People Breathing? Establishing Baselines Before and After Home (Amount: \$999,725). The two-year project included staff from the Energy Center (Bruce Davis and Kellie Stokes). The proposal was denied but received excellent reviews by HUD and the research team was encouraged by HUD to resubmit. A follow-up proposal was resubmitted to HUD in FY 2012.
2. A multi-disciplinary proposal was funded by the National Renewable Energy Laboratory (Department of Energy) for the 2011 Solar Decathlon in the amount of \$100,000 and led by Dr. Jamie Russell and Dr. Chad Everhart (Technology and Environmental Design). Additional support for this project was provided by Lowe's Inc. Students and faculty from throughout the campus have participated in this project over the past year and illustrates our partnerships with academic units in multi-disciplinary research. The RIEEE and the Energy Center provided invaluable financial management support for this initiative. Funds for this project were directed to the activity rather than to cover any of the costs incurred by the RIEEE or the Energy Center. No indirect costs were allocated by the funds administered by the RIEEE or the Energy Center.
3. Dr. Marie Hopefl (Technology and Environmental Design) received a grant from the U.S. DOE for the Appalachian Energy Internship Program (\$485,857). Current and former students received support under this project to work with units on the campus, the private sector and local government entities in western North Carolina. This project had a direct impact on the level and quality of services provided by the sponsoring organizations. Many of the students supported by this project now work for the sponsoring organizations. Others have been employed as a result of this experience.
4. Dr. Jeff Tiller (Technology and Environmental Design) was awarded a grant in the amount of \$2,550,000 (through the Appalachian Energy Center) from the Department of Energy through the N.C. State Energy Office. The title of the project: North Carolina Energy Efficiency Marketing Development and Implementation Program. This multi-year project brings innovative sustainable building technologies and designs to residential housing in N.C. Energy efficiency programs of the Energy Center are expected to save more than \$5 million in savings over the lifetime of the projects.
5. A proposal to the Golden LEAF Foundation, Inc. was submitted through the Appalachian Energy Center in the amount of \$749,917 (STEM Initiative: STEMulating Appalachia). This project was led by Dr. Brian Raichle along with co-PI's Carla Ramsdell (Physics and Astronomy), Dr. Jerianne Taylor and Dr. Dennis Scanlin (Technology and Environmental Design), and Laura England (Biology). This multi-disciplinary effort reflected a targeted submission in the area of environmental education. Although this proposal was not funded, other proposals have been submitted to the U.S. EPA and NOAA.

## **Center for Economic Research and Policy Analysis (CERPA)**

1. Developed significant multidisciplinary proposals that would not have arisen without CERPA's playing a role. For example:

(a) CERPA created a team of researchers from four Appalachian Departments (Economics, Sociology, Geography and Planning and Government and Justice Studies) to develop a proposal for the NC Rural Center. The Appalachian team collaborated with the UNC School of Government on the proposal. It was awarded funding, and the resulting research was very well received by the NC Rural Center and within policy circles in Raleigh. The project also led to many long-term benefits, including new research relationships on- and off-campus and served as the initial motivation for creating the survey research laboratory.

(b) CERPA and RIEEE assembled a team of researchers to develop a proposal for the U.S. Department of Agriculture (USDA): "Climate Change and Southern Forest Management: Landowner Decisions and Valuing Ecosystem Services" (Amount: \$994,852). The team collaborated with Texas A and M and Dartmouth on the proposal. Dr. Mike McKee led the Appalachian faculty team that included Dr. Todd Cherry, Dr. Todd Hartman, Dr. Dave McEvoy, Dr. Ash Morgan and Dr. John Whitehead. Although this proposal was not funded, it reflects our efforts to foster multi-disciplinary multi-year research projects.

(c) CERPA is leading a proposal titled: "CICS: Monitoring and Assessing Weather and Climate Events from a Socio-economic Perspective" through the National Climatic Data Center, NOAA Cooperative Institute (N.C. State University). This proposal (\$1,418,131) is currently under review. The proposal was in collaboration with Dr. Todd Cherry, Dr. John Pine, Dr. Ash Morgan (Economics), Dr. Chris Badurek (Geography and Planning) and Jason Hoyle (Energy Center).

(d) The National Committee for the New River (NCNR) led collaboration with Appalachian and Radford University in a proposal to the National Science Foundation. Although this proposal was not funded, we expect this collaboration to continue. Future joint proposals will deal with land-use, water quality and forest resources and conservation issues.

2. Creation of the Appalachian Survey Research Laboratory (AppSRL). CERPA identified an opportunity to enhance research at Appalachian when it identified the combination of faculty needs and faculty interests. Survey research has long been a part of the research in the Department of Economics, but survey operations were not organized administratively or operationally. CERPA recognized the opportunity for a survey lab after learning of the survey lab experience that Dr. Todd Hartman (Department of Government and Justice). CERPA provided initial space and funds to develop the survey lab, which has supported numerous research CERPA research projects. CERPA also provides critical administrative support (via RIEEE) to handle the considerable paperwork associated with employing supervisors and callers. The creation of the lab introduces new capacity for researchers across campus and

multidisciplinary research projects.

3. Creation of the Social Science Experimental research group. CERPA initiated the formation of a research working group that includes researchers from economics, psychology and political science that employ the experimental method. The purpose is to facilitate cross fertilization of ideas and methods by bringing together researchers from different disciplines that share interests and methods. The research group has been meeting for about 8 months thus far, and CERPA recently provided funds for the group to bring in its first external speaker. The event was successful, bringing together researchers from five different departments. CERPA plans to support additional external speakers for the group. This project illustrates CERPA's approach of simultaneously (a) leading research by creating capacity and facilitating opportunities while also (b) following faculty needs and interests.

4. Collaboration with the Center for Entrepreneurship (CE). CERPA's Economic Development program engaged with CE on a study that assessed the small business environment in WNC. The project was a collaboration of researchers from Economics, Management and the Energy Center. The work resulted in a report titled "Expectations in an Uncertain Economy" and press releases that disseminated the findings to the general public, business and government leaders.

### **Southern Appalachian Environmental Research and Education Center (SAEREC)**

1. Dr. Eric Marland (Mathematical Sciences) led a multi-institutional team through SAREC with a submission to the National Science Foundation (Amount: \$10,000,000). Title: "Science, Technology, Engineering, and Mathematics Talent Expansion Centers (STEP Centers)." The National Institute for Climate Science Education (NICSE). The proposed center was in collaboration with the City University of New York – Hunter College, University of Minnesota Duluth, and Chico State University California. The proposal represented a broad based group of Appalachian faculty and engagement with three universities similar to Appalachian. This faculty team will continue to look for opportunities to establish a national focus in collaboration with other university partners.

### **Accomplishment 2: Expanded Collaborative Research Initiatives**

Appalachian faculty through the RIEEE's three research centers have continued to partner with off-campus entities in initiating or enhancing research and outreach activities.

Appendix 1 provides a list of external organizations that have collaborated with the RIEEE and its Centers on research and outreach initiatives. Our collaborators range from state and federal agencies, non-profit organizations, and private businesses. Many of these collaborations existed prior to the formation of the RIEEE but most have been established or significantly enhanced after 2008.

Laura England and Carla Ramsdell hosted an Appalachian faculty campus presentation by the Director of Research for the N.C. Natural Science Museum Dr. Meg Lowman. We expect on-going collaborations between the Natural Science Museum and our faculty. They also held a two-day workshop on wetlands for teachers in November, 2011.

The AppalAIR CANDOO environmental education initiative submitted a proposal to the Environmental Protection Agency in collaboration with Discovery Place, Inc. This proposal was an outgrowth of the successful collaboration by this group with Grandfather Mountain Stewardship Foundation.

In July 2009, the Director of the RIEEE was asked by the university to represent the campus to the Learning Lodge at Grandfather Mountain. The Learning Lodge formed a non-profit organization composed of the Grandfather Mountain Stewardship Foundation Inc., the N.C. Museum of Natural Sciences, N.C. State Parks, the Nature Conservancy, the N.C. Audubon Society, and Appalachian. The Learning Lodge will be constructed on property donated by Grandfather Mountain and serve as a research laboratory and environmental education site for our region. The Director of the RIEEE serves as President of the Learning Lodge. Advanced planning for this facility will be completed in January 2012. The planned Learning Lodge facility will include facilities for the Grandfather Mountain State Park staff, a museum, conference and meeting space, offices, and research facilities. This collaboration has led to joint proposals between Appalachian and some partners, a joint faculty position between Appalachian and the Natural Science Museum, and collaborative research initiatives focusing on ecosystem services.

### **Appalachian Energy Center**

1. The Catawba County Eco-Complex Biodiesel Research Development and Production Facility was completed in the spring of 2011 and opened in August 2011. This collaboration between the Energy Center and Catawba County reflects a strong commitment to sustainable energy sources. The Appalachian Energy Center bio-diesel work is supported by a grant from the Golden LEAF Foundation (\$750,000) awarded in 2008, the U.S. Department of Energy (\$295,200, UNC GA (\$275,000, and the Biofuels Center of North Carolina.
2. The Appalachian Energy Center community based landfill gas development program has partnered with 24 N.C. counties in obtaining DOE grants for implementing landfill gas projects. This effort has stimulated investment in excess of \$8 million in economically distressed communities across the state.
3. The Appalachian Energy Center collaborated on the development of an NSF I/UCRC with UNC Charlotte, Carnegie Mellon University, and City College of New York (part of the CUNY system).

### **CERPA**

CERPA has pursued off-campus research partners in a number of ways.

1. First, CERPA has provided funds to bring leading researchers from other institutions to Appalachian's campus.
  - (a) CERPA has organized and funded a Policy Lecture Series that brings leading scholars to campus. In 2009, the speaker was Dr. Jason Shogren, Stroock Professor of Natural Resource Conservation and Management, University of Wyoming; Lead Author for the IPCC, Senior Economist in the Clinton White House; Member of the Royal Swedish

Academy of Sciences. During his visit, he met with over 10 faculty members from different departments.

- (b) CERPA, in collaboration with the Department of Economics, is organizing and financially supporting a conference on environmental economics and policy for April 2012. Currently, 17 scholars are scheduled to attend the two-day conference. They will be representing Virginia Tech, NC State, Duke, Tennessee, William and Mary, College of Charleston, among others.
- (c) CERPA initiated and provided funding for the new multidisciplinary social science experimental research group to bring a guest speaker to campus for a seminar. Dr. Jeff Dych, a psychologist from James Madison, presented his research to a diverse group of Appalachian faculty.

2. CERPA's research efforts have reached out to external partners and created a network of research assets for future work. For example:

- (a) The NC Rural Center project developed an on-going relationship with the UNC School of Government and the NC Rural Center. To illustrate, the CERPA director has served as a technical advisor to the NC Rural Center.
- (b) CERPA's Environment and Energy program has established strong relationships with researchers at East Carolina University and Colorado State University, which has enhanced research for Appalachian faculty.
- (c) CERPA's Experimental Economics program has established many strong relationships with researchers across the country, including the University of Alaska Anchorage, University of Massachusetts, University of Tennessee, University of Houston, Georgia State University, among others. These relationships have enhanced research for Appalachian faculty.

## **SAEREC**

1. A proposal submitted by Dr. Brett Taubman (Chemistry) in collaboration with Discovery Place, Inc. in Charlotte, N.C. This proposal titled: Environmental Education Regional Grants Climate Action Network through Direct Observations and Outreach (CAN-DOO) in the amount of \$99,797 is under review by EPA. This outreach effort is an innovative environmental education initiative with local elementary schools, home-schooled students, Watauga County teachers, the N.C. Science Festival, and public and non-profit partners (N.C. State Parks, Grandfather Mountain Stewardship Foundation, N.C. Museum of Natural Sciences and Discovery Place, Inc.
2. Dr. Mike Gangloff (Biology) was awarded several contracts with the U.S. Fish and Wildlife Service and the N.S. Wildlife Resources Commission.
3. Dr. Gabrielle Katz has research that is supported by the U.S. Department of Interior, USGS.

4. Dr. Howard Neufeld, Director of SAEREC, has a contract with the U.S. EPA to conduct ozone response work on native wildflowers.

### **Accomplishment 3: Extended Research Activities Internationally**

The RIEEE Director serves on the Advisory Board for International Education and Development. A close working relationship has been developed and support for international research and outreach activities are ongoing. Each of the RIEEE Centers has been encouraged to engage in international collaborations to foster research activities. The Director also serves on NOAA's Climate Change Assessment program.

#### **Appalachian Energy Center**

1. The Appalachian Energy Center extended its local landfill gas project with counties in N.C. to Brazil with additional funding from the US EPA. The EPA has funded two separate phases of this work to bring a community scale LFG-to-energy project to Northeast Brazil.
2. Dr. Jeff Ramsdell was a visiting scholar at the University of the Free State (UFS) in South Africa during the Spring 2011 semester. Research related to building energy efficiency begun during this visit is continuing with colleagues from UFS. This work will first be published and presented at the 8<sup>th</sup> World Congress of the International Cost Engineers Council in Durban, South Africa in June 2012.

#### **CERPA**

1. Dr. Todd Cherry (CERPA Director) holds a research appointment at the Center for International Climate and Environmental Research – Oslo in Norway (CICERO); a worldwide leader in climate and environmental research. CERPA has leveraged this relationship to benefit research at Appalachian. In particular, CICERO has provided travel and research funds to other Appalachian faculty. Also, Dr. David McEvoy (Dept of Economics) recently had an opportunity to visit CICERO to discuss research on international environmental treaties. This relationship has become stronger with the addition of Gregg Marland, which also works with CICERO.
2. CERPA's Experimental Economics program has an international reputation and therefore regularly interacts and collaborates with researchers outside the U.S. In particular, the experimental group has worked with researchers at University of Innsbruck, University of Oslo, University of Munich, University of Calgary, University of Christ Church, among others. These on-going collaborations provide a valuable resource for research opportunities.

#### **SAEREC**

1. The CAN-DOO faculty team has extended its environmental monitoring internationally by teaming with faculty from the University of the Free State in South Africa and St. Michael's School. Students will be making atmospheric observations in collaboration with the CAD-DOO team at Appalachian.

## **Accomplishment 4: Increased External Funding**

A critical goal of the RIEEE is to create an environment that encourages and supports securing external funding for research at Appalachian. A programmatic structure has been established throughout the RIEEE that serves as a base for enhancing inter-disciplinary research initiatives and the formation of new faculty clusters. The research program of the RIEEE is facilitated by an organizational structure and policies that nurture successful collaborative research initiatives. External and internal advisory boards provide a means of engaging those who can offer insights on the direction and impact of our research. Our primary goal is to enhance outstanding research and outreach activities across our campus. Increases in external funding are an outcome from the quality of our research efforts.

External funding awarded during the first three years of operation of the RIEEE, has grown from \$438,330 in FY 2009 to \$892,346 in FY 2010 and \$3,426,178 in FY 2011. Submissions to external agencies (but not funded) have grown from \$441,117 in FY 2009 to \$2,386,403 in FY 2010 and \$15,382,930 in FY 2011. The RIEEE has proposals currently under review in the amount of \$1,866,265.

Continuing funding from grants and contracts awarded in one fiscal year but used over a performance period that runs beyond a single fiscal year is a reflection of growing fiscal resources to RIEEE activities. External multi-year funding grew from \$1,453,614 in FY 2009, to \$1,837,703 in FY 2010 and \$1,498,614 in FY2011. See Table 5: External Funding by Unit and Fiscal Year.

It should be stressed that faculty appointments are within academic units and the RIEEE has limited if any control over faculty members who serve on research initiatives. Faculty associated with research clusters and teams because they wish to do so and with the support of their departmental chairs and deans. The RIEEE thus serves the interests of faculty and in building strong alliances throughout the campus. It is not driven to build a separate independent operation with limited contact and interface with academic units.

## **Accomplishment 5: Enhanced Student Engagement**

The RIEEE supports academic programs by facilitating the involvement of students in funded research projects. This is a key service that is provided through the Centers and directed by faculty members. A goal of the RIEEE and its Centers is to provide learning opportunities for students in our academic programs. The number of students supported with funds associated with research projects is an indication of our efforts to contribute to the academic life of Appalachian.

1. Graduate and undergraduate students are engaged with faculty research projects funded through the Energy Center, SAEREC, and CERPA. More than 125 students experienced first hand the value and impact of focused research.
2. The Energy Center funded ten peer reviewed student research projects in FY 2011. The results of these projects will be made available through departmental and center web sites to the public in the fall of 2011.

3. The RIEEE will continue to support undergraduate research during FY 2012 by making funds available through the Office of Undergraduate Research. These funds will be used by students to implement research projects that related to environmental, energy and economic issues.

### **Accomplishment 6: Increased the Number of New Research Faculty**

The RIEEE welcomed Dr. Gregg Marland as a Research Professor in April 2011. He joins the RIEEE from the Oak Ridge National Laboratory where he served for over 35 years and since 2000 as Distinguished Research and Development Staff. He has served as a member of the National Research Council Committee on Methods for Estimating Greenhouse Gas Emissions, co-chair of the United State Interagency Carbon Cycle Science Working Group, and National Research Council Committee on Global Change Research. He recently served the Intergovernmental Panel on Climate Change (IPCC) where he was lead author of *Guidelines for National Emissions Inventories* (2006), lead on for the *Special Report on Carbon Capture and Storage*, contributing author on *Radiative Forcing of Climate Change* for the *First Assessment Report*, lead author on *Energy Primer for the Second Assessment Report*, lead author on *Land-Use Change and Forestry for the Third Assessment Report*, and lead author on *Special Report on Land-Use, Land-Use Change and Forestry*. He currently serves on the editorial board of the *Environmental Science and Policy Journal* and editorial advisory board for the *Mitigation and Adaptation Strategies for Global Change Journal*. Dr. Marland is the second research professor in the RIEEE and brings an outstanding world-class research record to Appalachian.

Dr. Anindita Das joined the faculty of the RIEEE as an Research Assistant Professor in August 2011 after she completed her PhD. in Oceanography and Coastal Sciences at Louisiana State University. Her academic appointment is with the Department of Geography and Planning. She will join faculty in the Earth Systems research group and contribute as a program manager. This research team will take advantage of Dr. Das' knowledge and skills in modeling hydrological dynamics and earth sciences.

### **Accomplishment 7: Awards**

Jeff Ramsdell (Department of Technology and Environmental Design) received the Transforming North Carolina Faculty Research Award (2008-09) for research associated with the Appalachian Energy Center. Todd Cherry (Department of Economics) received the Transforming North Carolina Faculty Research Award (2010-11) for a research project associated with the Center for Economic Research and Policy Analysis. Howard Neufeld (Department of Biology) received the 100 Scholars Award (2008) from the Cratis D. Williams Graduate School for his record of research while at Appalachian.

### **Accomplishment 8: Enhanced Research Facilities**

The Appalachian Energy Center and CERPA have continued to expand and enhance facilities both on campus and off. Major expansions and additions include: the AppalAIR campus and Grandfather Mountain sites plus a mobile meteorological tower. Enhance the Solar Training and Research Facility at the University's State Farm Road site, the Appalachian Biodiesel Research and Testing Facility at the Catawba County Eco-Complex, and Landfill Gas Research and Development Lab at the Watauga County Landfill, the Appalachian Experimental Economics Laboratory (AppEEL), and the Survey Research Lab (SRL). While some of these facilities are currently operating on a limited basis and offering some data, all will be complete and fully operational by the end of 2011.

## **VII. ROLE OF THE INSTITUTE WITHIN THE UNIVERSITY OF NORTH CAROLINA SYSTEM**

### **Geographic Region Served by the RIEEE and its Centers**

Because of the unique mountain setting in Western North Carolina, Appalachian State University has attracted faculty and students who have a strong commitment and interest in environmental issues. As a result, much of the research and outreach activities of the RIEEE centers on the Western North Carolina mountain region. Faculty and students throughout the RIEEE examine renewable energy technologies and conservation, the impact of changing weather patterns on our region, economic development forces that impact commercial and residential development as well as the environmental impacts of development density on water quality and ecosystem services. The Energy Center within the RIEEE has stressed energy conservation policy and technology along with the need to understand renewable energy options are of high interest because of economic conditions in rural communities and the severe weather conditions of our region.

Many of our research and outreach activities are not limited to western North Carolina but are directed statewide, nationally and internationally. Appalachian faculty and the Energy Center staff have led a revision of the N.C. State Energy Code and worked with builders and public officials to better understand its benefits. The Center for Economic Research and Policy Analysis has examined the impacts of sponsored research funds on North Carolina's economy and social-economic challenges facing North Carolina's rural counties.

The RIEEE has been engaged internationally. The Appalachian Energy Center with support from the U.S. Environmental Protection Agency has worked in Brazil to assist in the utilization of methane gas from rural landfills. This international collaboration continues in an implementation phase that will provide a demonstration of the benefits and costs associated with using this source of energy. The AppalAIR team has expanded its weather collection network to St. Michaels School in South Africa. They are working to expand their network of climate monitoring stations in Asia. CERPA (Dr. Todd Cherry) has an on-going collaboration with the Center for International Climate and Environmental Research in Oslo, Norway.

Engaging our faculty and students on a regional, state, national and international perspectives provides an opportunity to compare and contrast problems and issues on different geographic scales and explore variations that may reveal unique perspectives on environmental, energy and economic issues. We are firmly based in western North Carolina, but open to opportunities to collaborate throughout our region, nation and internationally.

### **Duplication of the RIEEE within the UNC System**

The RIEEE was established to enhance our understanding of natural, human, and economic systems, their interrelationships and impacts and contributions to our human and environment wellbeing. Our research focus is multi-disciplinary and aims to support the development of knowledge, technology and leadership to build and sustain prosperous, productive and resilient communities.

The RIEEE was charged to utilize two existing research centers on the campus including the Appalachian Energy Center established in 2001 and the Center for Economic Research and Policy Analysis (CERPA) that was established in 2008. The Southern Appalachian Environmental Research and Education Center is a major research program area for the campus and will be proposed as a formal center in the near future.

The RIEEE is a unique research initiative within the University North Carolina System in its emphasis on multi-disciplinary research that addresses linkages and interdependencies between the environment, energy and our economy. Other centers and institutes within the UNC System address research associated with one or two of these focus areas but do not have the charge to develop and implement multi-disciplinary research activities linking energy with the environmental and economic issues and problems. Specifically, the North Carolina A and T University Center for Energy and Technology (1984) as well as the North Carolina State University Solar Center (1993) have a similar research interest as the Appalachian Energy Center. Each has unique programs that fit the faculty and program resources of their campuses but do not address the linkages between the environment, economy and energy.

Several institutions within the UNC System have a research interest in Economics including the UNC Greensboro's Center for Business and Economic Research, the UNC Greensboro Institute for Community and Economic Engagement (2008), and the Public Policy Institute at Western Carolina University. Although these centers have a focus on economics, none have the charge to develop and implement multi-disciplinary research initiatives in the areas of economics, the environment and energy as with the RIEEE. The multidisciplinary approach of economic development and environmental policy is particularly noteworthy, as is the initiative on the WNC economy. Also, CERPA's program in Experimental Economics and the related research lab (AppEEL) is unique to the state and region and serves as a field of research in which Appalachian leads the state and region.

The University of North Carolina Institute for the Environment (1998) has a major emphasis on energy and environmental research issues. This Institute complements the research areas of the RIEEE. Specifically, The Center for Sustainable Energy, Environment and Economic Development collaborates with the Institute for Advanced Materials, Nanoscience and Technology at UNC Chapel Hill in coordinating campus activities related to Energy and Environment. These collaborations are built around the areas of education, research and outreach and focus on: 1) Energy Sciences (new sources of energy or the reduction of energy use in industrial processes); 2) Environment and Health (environmental health impacts); 3) Policy, Planning and Economic Development (energy, social and sustainable societies); and 4) Greening of the UNC Chapel Hill campus. Opportunities for multi-institutional research collaborations have been explored by the RIEEE with the Institute for the Environment. To date, no joint proposals have been proposed to funding agencies. Opportunities for collaboration will continue to be explored with the Institute for the Environment.

The University of North Carolina Charlotte established the Infrastructure, Design, Environment and Sustainability Center (IDEAS) in 2002. In 2010, the Appalachian Energy Center collaborated with the IDEAS Center on an NSF proposal. This collaborative initiative continues and a full NSF proposal is expected during FY 2012.

## **Inter-Institutional Cooperative Activities Involving the RIEEE**

Successful research and outreach efforts are never achieved without external collaborations. We stress the continued engagement of our off-campus partners in our research and outreach activities. The diversity of our partnerships is significant from governmental agencies at all levels, private businesses, non-profit entities as well as other universities in our region and internationally. See Appendix 1 for a listing of the external research and outreach collaborations.

### **Appalachian Energy Center**

The Appalachian Energy Center has collaborated with the two other university based energy research centers in North Carolina. The N.C. State Solar Center and the North Carolina A and T Energy Center combine their resources in statewide initiatives. The Appalachian Energy Center recently opened the Bio-Fuels Research Center at the Catawba County Eco-Complex in Hickory, N.C. This facility will produce fuel for heavy equipment for the Catawba County Landfill and assess alternative feedstock for the production of the fuel.

The Energy Center has worked with North Carolina counties statewide providing technical support for the development and installation of methane gas recovery and energy production. This initiative has provided financial resources to the counties, an available energy source and implemented in a sustainable manner.

### **CERPA**

CERPA faculty have worked closely with East Carolina State University, the University of North Carolina Asheville, and N.C. State University to analyze public environmental policy issues. The analysis examined the potential impacts of sea level rise, use of wind turbines in coastal environments, and challenges facing N.C. rural counties. CERPA has also collaborated with UNC School of Government and the UNC General Administration.

### **SAEREC**

AppalAIR is a member institution of the Mountain Research Initiative, which coordinates and disseminates information about atmospheric research in mountains around the world. AppalAIR is the only participating site east of the Mississippi River in the National Oceanic and Atmospheric Administration's (NOAA) global aerosol monitoring network.

AppalAIR monitors the weather at the summit of Grandfather Mountain. This cooperative research and outreach efforts with the Grandfather Mountain Stewardship Foundation have demonstrated how the university can develop a valuable climate science curriculum. This curriculum has been used in the on-going environmental education program provided by the Stewardship Foundation. Citizens of all ages benefit from this enhanced education programming.

Collaborations with other North Carolina Universities have resulted in a network of weather sensors and data analysis. Faculty from Appalachian State work closely to collect and analyze weather data with the State Climate Office at N.C. State University, the University of N.C. at Asheville, the University of N.C. at Chapel Hill and Western Carolina University.

The North Carolina Division of Air Quality is assisting AppalAIR in the maintenance and calibration of their trace gas instruments. The North Carolina State Climate Office maintains climatic records for the state and supports some of our meteorological monitoring. Watauga County Schools.

AppalAIR participates in a summer science camp for kids through the Pisgah Astronomical Research Institute. The National Aeronautics and Space Administration (NASA) collaborates with AppalAIR through a recent grant to support educational outreach for public school children in the western North Carolina region.

AppalAIR collaborates with faculty member Dr. Doug Miller with the Department of Atmospheric Science, UNC-Asheville on atmospheric modeling efforts. AppalAIR faculty are collaborating with Ryan Emanuel with the Department of Forestry and Environmental Resources, NC State University on an NSF funded grant on atmospheric monitoring.

## **VIII. PLANNED CHANGES FOR PROGRAM IMPROVEMENTS DURING NEXT THREE YEARS**

### **Strategic Initiatives**

Appalachian's research builds on a strong academic tradition that is based on outstanding comprehensive undergraduate programs and has attracted many talented undergraduate students. Our growing graduate programs provide a sound base for targeted research initiatives. Together, our students bring talented and energetic partners to our research efforts.

We recognize that federal, state and local governments will have more constrained budgets in the future and that there will be more limited resources for research. To say the least, we are in a more competitive market and we must look for ways to attract additional external funding. We believe that broad-based multi-disciplinary research initiatives will enable us to be more competitive in this environment and to pose more difficult and complex research questions. We recognize that human, economic and natural systems are interconnected and our approach to research must address these connections.

The cost of energy continues to rise making advances in technology (renewable energy, buildings, and conservation strategies) vital to our future. Understanding the impacts of public policies, business practices, and individual choice making must be a part of our research agenda. At the same time, we see many environmental changes that are influenced by human actions; monitoring and assessing these changes will be essential for understanding our options for living on a changing earth.

Appalachian State University has outstanding academic programs associated with the environment, energy and economics. In addition, our student organizations as well as our campus business operations have been active in taking steps to ensure that Appalachian is on track to become a fully sustainable campus. Unfortunately, many of these activities are unrelated to each other and are not clearly visible. What we can provide is a mechanism for building strong research-focused collaborations within our campus and with our external partners. Further, we can facilitate more opportunities for meaningful dialogue that evolves from our academic resources and contributes to the advancement of our scholarly activities. There is a great demand for leadership and engagement on environment, energy and economic issues locally, regionally, nationally and internationally. The RIEEE and its Centers have an opportunity to provide the linkages that facilitate more innovative research and outreach activities.

#### **Strategic Initiative 1: Expand New Inter-Disciplinary Research Initiatives**

New inter-disciplinary research initiatives are being supported by our faculty in an effort to address challenges presented by issues at the heart of growing energy demands, increasing environmental impacts and tough economic conditions. It is only through the collaboration of faculty from different disciplines that we will be able to build research teams that can address these complex problems.

#### **Appalachian Energy Center**

What are people breathing? Establishing baselines before and after home weatherization measures. This study collects simultaneous, real-time data, before and after weatherization, for nine indoor environmental health hazards identified in the Healthy Homes Strategic Plan: combustion by-products

(CO, CO<sub>2</sub>, NO<sub>2</sub>), formaldehyde, Total Volatile Organic Compounds (TVOCs), particulate matter (PM), radon, temperature, and relative humidity. Outdoor weather stations will be placed at each home during indoor monitoring. Additional data to be collected include building characteristics, occupant daily activities during monitoring, and weatherization measures performed. Collaborating organizations on this project include Community Action Agencies (CAA) in three different North Carolina (NC) climate zones to recruit participant homes from their weatherization program clients. This proposed project is under review by the U.S. Department of Housing and Urban Development (2011 HUD Healthy Homes Technical Studies (\$783,383 - three years).

## **CERPA**

CERPA's relationship with the Center for Climate and Environmental Research – Oslo (CICERO) presents an exciting array of multidisciplinary research for CERPA's Environment and Energy program, as well as RIEEE in general. CICERO is a leading climate and environmental research center that consists of about 80 full-time researchers (no teaching) covering the natural sciences and social sciences. The relationship has already provided excellent opportunities for collaboration, and as the relationship develops further, more will follow.

CERPA initiated a program to facilitate multidisciplinary experimental research by establishing the Social Science Experimental research group. CERPA will continue to support this emerging group with coordination efforts, administrative support and funds when possible.

CERPA is undertaking efforts to establish its two multidisciplinary research labs as cost centers. The intent is to capture some cost-recovery from projects that do not allow the collection of indirect charges, which seems to be an issue for much of CERPA's work. The revenue will help support the labs, and hopefully enable them to be self-sufficient over time.

**Monitoring and Assessing Weather and Climate Events from a Socio-economic Perspective.**  
Climate and weather events have far reaching impacts on society and the economy. The project will (1) develop a portfolio of timely indicators that assess and communicate the socio-economic impacts of weather and climate, (2) construct a static model of the weather/climate's effect on local and regional economies that allows the estimation of socio-economic impacts, in dollar and categorical terms, of specific short-term to mid-term extreme weather events, and (3) build a dynamic model of the climate's effect on the broader economy that enables the estimation of socio-economic impacts, from longer term climatic events, as well as related mitigation and adaptation responses by individuals and governments. This project proposal is currently under review by the National Climatic Data Center, NOAA (\$1,418,472 over three years).

## **RIEEE Interdisciplinary Initiative**

The following initiative provides an example of our approach in building interdisciplinary research teams that bridge the three research centers within the RIEEE.

Earth Systems (Coupled Systems) Research Group: This research group was organized in February 2011 to link natural and human systems. The group is composed of faculty from Biology, Geography and Planning, Chemistry, Geology, Mathematical Sciences, Government and Justice Studies, and

Economics. Off-campus collaborations for this group include the National Climatic Data Center (NOAA), U.S. Forest Service, the N.C. Nature Conservancy, the National Committee for the New River, Elon College, and the University of Georgia. The following project description provides an example of our approach in defining the scope of a research initiative that crosses our three Centers. We continue to define our research methodology, assemble data, clarify our modeling options and use existing resources to enhance our research capacity. We are encouraging faculty to use this initiative to build on their existing research agenda, prepare publications and to submit proposals for external funding.

Project Title: Long Term Assessment of Forest Ecosystem Services and changes in Land-use, Economic Conditions and Climate Changes

Project Goals:

1: To understand the key relationships in the southern Appalachian Mountains between forest ecosystem services and socio-economic drivers, weather and climate forces, and land use management decisions by public, private and non-profit entities. Key relationships to be understood and modeled include:

- Relationships between population density, economic variables and their effects on land use forest management decisions by business entities, private landowners, and public agencies (federal, state and local) in the southern Appalachian region,
- Effects of short term weather conditions and long term climate change on forest conditions (ecosystem services – this could then include not only the services in our natural environment but also in support of recreation, tourism etc.) in the southern Appalachian region, and
- The effect that informing (education) landowners, businesses, the public, public officials concerning the impacts of climate change, weather conditions, forest management options on ecosystem services (air quality, public health, water quality, recreation, tourism).

2: To understand and model the feedback effects between land use management decision and ecosystem services. The feedback will include:

- Economic feedback effects generated by independent landowners and large scale landowners (businesses) responding to actual or potential (modeled) land value, forest product values, agricultural product value and/or subsidies, and

Policy feedback effects via government implementation of adaptive management to deal with uncertainty and cost effectiveness.

- To use a socio-economic landscape model to assess the cost, benefits, and environmental effects of present and alternative policies affecting ecosystem services and make recommendations concerning land-use change and development.

## **Strategic Initiative 2: Enhance Existing Research Initiatives**

The Appalachian Energy Center provides an excellent example of how our ongoing research initiatives have expanded in the past three years in both the scope of research and outreach. The scope of the effort has been extended throughout our state, region and internationally. Additional applied research laboratories have been developed on and off-campus, projects have extended their reach internationally. Collaborating organizations such as Catawba County and Advanced Energy have allowed us to take on more complex projects and serve wider audiences from builders, architects, suppliers, or regional farm operations. Research questions include:

Appalachian Biofuels and Biomass Initiative is an effort to encourage and support economic expansion of biofuels and biomass sectors in North Carolina through outreach activities and dissemination of applied and fundamental research. Our current efforts include expanding the planting area and familiarity of alternative oilseed crops agronomics in Catawba Valley. The Biofuels Center of North Carolina's *Strategic Plan for Biofuels Leadership* states that by 2017, 10 percent of liquid fuels sold in North Carolina will come from biofuels locally grown and produced. The Biofuels Center also states that currently 5.6 billion gallons of fuel are consumed annually by the state. Not accounting for growth, by 2017 it will be expected that North Carolina will produce and consume approximately 560 million gallons of biofuel. Our current combustion emissions analysis research will allow a better understanding of the potential climate and health impacts of biofuels manufactured from different alternative feedstock. With the amount of biofuels already consumed in the state as well as the estimated future consumption, it is important that we make informed decisions regarding not only which biofuels are most efficient economically and energetically, but also those with the least environmental and health impacts. The Appalachian Biodiesel Research and Testing Facility in Catawba County will produce bio-diesel from oilseed crops. Funding provided by grants from the N.C. Golden Leaf Foundation, Inc., the N.C. Biotechnology Center, the University of N.C. General Administration, the Biofuels Center of North Carolina, and the U.S. Department of Energy.

Building Energy Efficient Affordable Housing Initiative. An energy study was completed for four individual duplexes in a Watauga County low-income development. This study was completed in order to better understand the actual real-time performance of typical heat pumps of this size and to gain a set of examples of how some families operate their space conditioning equipment. Heat pump energy use (including separate data for the compressor, blower unit, and strip heat; indoor temperature and relative humidity; air handler coil temperature; and the outdoor temperature) was recorded for a 12-month period. This research provides data that support policies that provide better ongoing maintenance oversight to secure improved ongoing performance and efficiency of heat pumps. Funding was provided by the U.S. Department of Energy.

Appalachian State University participated in the U.S. Department of Energy Solar Decathlon. This competition was composed of 20 collegiate teams which each design, build, and operate solar-powered houses that are cost-effective, energy-efficient, and attractive. The competition was held on the National Mall's West Potomac Park in Washington, D.C., Sept. 23–Oct. 2, 2011. Partial funding for each team came from DOE (\$100,000) and from gifts and contributions from private companies. This campus-wide collaboration was initiated and led by faculty from the Department of Technology and Environmental Design. The planning for the Appalachian house required extensive research into

innovative design, materials, and construction practices. The innovative technologies that are an outgrowth of this effort will be leveraged into new research initiatives. Administrative support including financial management was provided by the Department of Technology and Environmental Design and the Appalachian Energy Center.



Image 3: Solar Decathlon Building Rendering

Community-based Landfill Gas Utilization in Brazil – Phase II – Methane to Markets Program. In Phase 1 of the project, the research team conducted site visits at seven landfills in the state of Ceara, gathered technical data on the landfills, and established an extensive network with state and local government units. In Phase II, the design of a cost effective gas (LFG) unit from the Maracanaú’s Landfill will be completed and used to create local economic opportunities for small businesses and create jobs for 75 families of “catadores” who rely on the landfill as their source of livelihood. Maracanaú intends to develop an energy park next to the landfill that will use landfill gas in the industrial facilities. The study will also investigate the potential for solid waste management systems such as anaerobic digestion and / or gasification with the potential to efficiently dispose of organic materials in solid waste, while creating energy and reducing environmental degradation. Funding for this project provided by the U.S. Environmental Protection Agency and conducted in collaboration with the Federal University of Ceara (UFC) and Unifor University (\$120,000).



Image 4: Methane Gas Powered Generators Catawba County EcoComplex

The RIEEE will also host frequent presentations by campus faculty who will discuss their research initiatives. These sessions will provide opportunities for faculty to understand the nature of research efforts on the campus and explore how additional collaborations might be initiated.

**Strategic Initiative 3: Expand support for graduate and undergraduate academic programs and initiatives by providing administrative, laboratory, financial, and mentoring resources.**

The RIEEE and its Center have worked with faculty and staff along with the Office of Research to identify potential funding sources and to make personal contact with sponsor's program staff. Our administrative support staff assist principle investigators in facilitating student and faculty payroll, procurement orders, meeting facilitation and project management. Our support of Appalachian students goes well beyond payroll services and has established through the Energy Center with the Office of Undergraduate Research opportunities for small stipends to students or teams of students for the support of mentored focused research.

The Energy Center has provided *Seed Grants and Research Opportunities to Students and Faculty*. These funds increase research collaboration between students and faculty. This support focuses in two areas: (1) competitive seed grants for multidisciplinary research groups (MRG), (2) competitive seed grants for research engagement or re-engagement in interdisciplinary research related to the environment (ENERGi). Funds have been used by faculty to upgrade their research labs, participate in conferences, pay students, and cover the costs in adapting research projects to address new areas of interests. See the Annual Report for the RIEEE to see a further explanation of how the Energy Center has supported a broad range of Appalachian faculty research efforts.

The RIEEE will continue support for student research by working through the Office of Undergraduate Research to provide funding for student research efforts. The funding provided during FY 2012 will be less than in past years.

**Strategic Initiative 4: Facilitate broader collaborations with our public, private and non-profit partners in research and outreach activities.**

An indicator of our success is not just in obtaining resources to support research but also in the partnerships that we establish with public agencies, universities, non-profit organizations and private businesses. Our engagement with our partners is not just at home but internationally and extending our reach beyond our borders into Mexico, to South America, Africa, and the Far East. While we strive to publish our research results in academic journals, books, and conferences, we believe that successful research evolves from the strong partnerships that we establish as we conduct our research and reach out to the public and the academic community to share our results.

With support from the U.S. DOE, faculty from the Department of Technology and Environmental Design and the **Energy Center** developed and implemented a statewide “Wind for Schools” program. The project included the identification of 177 schools in the state with average winds on their campus of 10 mph or higher. These schools have been invited to participate in the program, as well as organized, advertised and conducted workshops for teachers. Further, the project raised \$200,000 to support the purchase and construction of small wind turbines at 8 – 10 schools in the state and begun the process of identifying the schools where the turbines will be constructed, locating the turbines, and working with the appropriate authorities to obtain needed permits. In addition faculty worked with the Albermarle RC and D and workforce development programs to develop wind energy curricula for the College of the Albermarle. Faculty also participated in several Wind Working Group meetings and worked with the NC Solar Center to facilitate the meetings and provide relevant information about wind energy issues to the group. The towers shown below illustrate the types of wind turbines that have been deployed to schools. The turbines shown below are located at the Small Wind Test Site on Beach Mountain near Banner Elk, N.C. The Appalachian Energy Center provided financial management support for this project.



Image 7: Small Wind Testing Site Beach Mountain, NC

The U.S. Department of Energy funded the 'Student Energy Internship and Fellowship Program' through the N.C. State Energy Office (\$485,857). This project was led by faculty from the Department of Technology and Environmental Design in collaboration with the **Energy Center**. It supported placement of current Appalachian Students and recent graduates with energy related businesses, offices of economic development, local government agencies, and with offices within our own University. Each intern and fellow worked with the collaborating agency for one year. These collaborations are invaluable in increasing communication and collaboration with our partners. The Appalachian Energy Center provided financial management support for this initiative.

CERPA's western North Carolina initiative is a formalization of nearly 10 years of engagement with public and private leaders, as well as the general public, at the local, regional and state levels. The Western North Carolina Economic Index and Report was released monthly for over eight years, and the effort filled a void of timely and relevant regional information. Local, regional and state news outlets regularly covered the information provided by the report. The report was used by public and private entities, including banks and Advantage West.

The Index and Report led to many public speaking engagements with community and business groups across the region, even in Murphy NC (all were unpaid and travel was not reimbursed). Generally, the engagement efforts caused Appalachian to be the leading authority on WNC economic and social issues. For example, Dr. Todd Cherry (CERPA director) was recently invited to participate on a high level panel discussion on western North Carolina economy with Dr. Bardo (WCU ex-Chancellor) and other state leaders. Also, Dr. Cherry was interviewed by Business NC (the leading statewide business magazine) on the western North Carolina economy. And recently, the Washington Post cited Dr. Cherry in a story that examined the economic impact of the growth in server farms in western North Carolina.

The engagement activities have increasingly yielded a reputation and network that presents various opportunities for faculty at Appalachian. For example, Mission Health called CERPA for assistance in assessing the economic impact of the Mission Health System. Support for the WNC Index was suspended this past year, but CERPA is currently working with stakeholders to restart the work. It is noted that the value of the western North Carolina Index and Report is revealed by regional and state leaders actively expressing disappointment that the work has been suspended and actively pushing for the work to resume.

CERPA's director is a member of the Technical Advisory Committee for the Mountain Resource Commission (MRC)—a legislative commission that is authorized by the NC General Assembly. The MRC meets monthly across western North Carolina, and membership consists of regional and state leaders that are generally appointed by the Governor. This engagement has extended to collaborations with many of these leaders to develop a western North Carolina Report Card that will assess the sustainability of WNC resources.

CERPA's director served as a Technical Advisor for the NC Rural Center. This engagement strengthened relationships with public agencies in Raleigh NC.

New River Flood Hazard Mitigation in Rural Appalachian Communities. Flood hazard mitigation is an important component of community resilience in flood prone areas. This study addresses the interrelationships among flood hazard policies, practices and impacts in rural Appalachian communities in North Carolina and Virginia along portions of the New River watershed by (1) conducting an institutional analysis of existing policies and practices that affect the resilience of rural communities in the New River watershed; (2) describing the relationships that exist between rural development practices, natural hazard risk, community risk reduction policies and observed community resilience in the New River watershed; and (3) increasing access by government officials and local citizens to disaster information, planning and mitigation procedures. This proposal was submitted to the National Science Foundation in a collaborative effort with the National Committee for the New River (\$108,532) in collaboration with Appalachian State University (\$183,732) and Radford University (\$99,882). Although it was not funded, this proposal illustrates our commitment to collaborative research with other universities and non-profit entities.

The AppalAIR (Appalachian Atmospheric Interdisciplinary Research) in collaboration with SAEREC is being expanded to include atmospheric monitoring sensors at Grandfather Mountain in collaboration with the Grandfather Mountain Stewardship Foundation. The second monitoring site will provide additional data on atmospheric conditions at high elevations in the United States and provides unique data to understand the nature of pollution. A mobile sampling laboratory has also been added to allow the research team to obtain short-term sampling of atmospheric conditions. AppalAIR has initiated ongoing climate education outreach efforts with Watauga County Schools and submitted an expansion of activities with local school systems in collaboration with Discovery Place, Inc. and the North Carolina Museum of Natural Sciences. Ongoing research collaborations have continued with the Department of Forestry and Environmental Resources at N.C. State University, the Department of Atmospheric Sciences at the University of N.C. Asheville, the State Climate office at N.C. State University, the North Carolina Division of Air Quality, NASA and NOAA.



Image 5: AppalAIR Atmospheric Sensors Grandfather Mountain

The AppalAIR has designed and installed a science education display at Grandfather Mountain in collaboration with the Grandfather Mountain Stewardship Foundation. The initiative is an effort to demystify the science behind climate change by involving and engaging visitors to Grandfather Mountain in highly interactive climate science displays.



Image 6: AppalAIR Climate and Weather Interactive Information Display  
Grandfather Mountain Stewardship Foundation

## **Size**

The greatest change in the size of the RIEEE and its Centers will be in the representation of faculty affiliates within Appalachian State University and our collaborative partners off campus. Current interdisciplinary teams will have a broader representation from faculty from throughout the campus and new teams will be formed to support new faculty research initiatives. Since July 2011, new multi-disciplinary teams have been formed in the areas: 1) small agri-business research and 2) elderly response to stress in disaster recovery. The new initiatives were put together to support the submission of current solicitation of federal agency request for proposals and anticipated funding opportunities. We anticipate that in the next three years, new multi-disciplinary teams will be created within each of the Centers thus expanding the scope of their programs.

External collaborations are being developed with groups such as The Nature Conservancy as part of our team formation efforts in climate change and conservation with SAEREC. External collaborations will continue in this initiative with the addition of both federal and university partners.

New personnel joined the RIEEE in the spring of 2011. Dr. Gregg Marland retired from Oak Ridge National Laboratories and joined the RIEEE as a Research Professor with an academic appointment in the Department of Geology. Within three months after joining the RIEEE, Dr. Marland has submitted two proposals with faculty from the Department of Mathematical Sciences and the Department of Geography and Planning. In August 2011, Dr. Anindita Das joined the RIEEE as a Research Assistant Professor with a faculty appointment with the Department of Geography and Planning. Dr. Das is currently traveling internationally but is expected to return to campus in December and join a multi-disciplinary team focusing on bio-fuels. These research appointments at this point do not have state funds allocated to the positions. They are entirely funded by external sources. It is expected that additional research faculty will join the RIEEE in the next three years with each of our Centers.

## **Budget**

The programs and activities of the RIEEE are primarily supported by external funds in the form of contracts and grants as well as a percentage of the indirect cost associated with external funding. A percentage of the indirect costs that are a part of grants and contracts are provided to the principle investigator, the Centers and the RIEEE. Proposal submissions over the past year have been larger and for longer periods of performance. We anticipate that the total budget for the RIEEE Centers will continue to increase in the next three years.

State funding provides support for the RIEEE Director's salary and one-half of the RIEEE Administrative Assistant. A limited amount of travel funds were provided to the RIEEE from the Office of Academic Affairs in FY 2010 (\$3,000), 2011 (\$3,000) and anticipated in FY 2012 (\$1,800). We do not anticipate any change in state funding for the RIEEE in the next three years.

A key budget challenge for the next three years will be the capacity of the RIEEE to continue to provide excellent financial and administrative services expanding research and outreach activities. Current research activities supported by the RIEEE have included major commitments for externally funded projects that do not provide for indirect costs. Future funds to support the RIEEE and its centers will not

include funds that result from this investment in research and outreach activities that do not include indirect charges.

The primary financial constrain that impacts research activities is the allocation of faculty time for the preparation of proposals and the administration of awarded grants and contracts. Research is a fundamental part of the academic mission of the university and greater financial support will need to be allocated for faculty time if a significant increase in both external funding and the conduct of research activities is to occur on the campus. Faculty time will need to be allocated to proposal development along with specific expectations for the submission of quality proposals to external funding units. Although faculty may be able to allocate time to conducting research as part of the funded efforts, but in some cases this is not possible. Faculty must be provided adequate time to do the sponsored research where budget limitations in the project do not allow for adequate compensation for their time. Leading complex inter-disciplinary research initiatives requires a willingness to devote extra time beyond a faculty member's existing research efforts. Despite an interest in the scope of interdisciplinary research initiatives, many faculty are either unable or unwilling to devote the necessary time required to manage the complex proposal preparation process. Allocating additional time to faculty who are willing to lead these inter-disciplinary research activities is one alternative for enhancing research on the Appalachian campus.

### **Administrative Structure**

We will continue to monitor our administrative structure to ensure that we provide exceptional administrative support for funded research and outreach activities led by our faculty and staff. We have no planned changes in our structure.

### **Mission**

The mission of the RIEEE was carefully established by a multi-disciplinary team of faculty in consultation with numerous off-campus partners. We will continue to assess how the RIEEE serves the Appalachian campus and determine if new initiatives should be undertaken. We do not anticipate changing from our emphasis on enhancing multi-disciplinary research and outreach activities on our campus and developing even broader off-campus partnerships to support these activities.

## APPENDIX 1

### EXTERNAL RESEARCH AND OUTREACH COLLABORATIONS

<b>Organization</b>	<b>Type of Entity</b>	<b>Form of Collaboration</b>
Catawba County Eco-Complex (Hickory, NC)	Local Government	Funding & Research Partner
Watauga County School System (Boone, NC)	Local Government	Funding & Research Partner
Landfill Gas Collaborations	Local Government	Funding & Research Partner
National Science Foundation	Federal	Funding
National Climatic Data Center	Federal	Funding
NASA	Federal	Funding
U.S. Environmental Protection Agency	Federal	Funding & Research Partner
U.S. Department of Interior	Federal	Funding
Fish and Wildlife Service	Federal	Funding
U.S. Department of Energy (DOE)	Federal	Funding
Wind Powering America	Federal	Funding
Oak Ridge National Laboratories	Federal	Funding
National Renewable Energy Laboratory	Federal	Funding
U.S. Geological Survey	Federal	Funding
U.S. Housing & Urban Development	Federal	Funding
Mountain Research Initiative (Swiss NSF)	International	Funding
The Nature Conservancy (North Carolina)	Non-Profit	Research Partner
Rural Economic Development Center, Inc.	Non-Profit	Funding
Golden LEAF Foundation	Non-Profit	Funding
Z. Smith Reynolds Foundation	Non-Profit	Funding
N.C. Farm Center for Innovation and Sustainability	Non-Profit	Funding
Society for Human Resource Management Foundation	Non-Profit	Funding
Discovery Place, Charlotte, NC	Non-Profit	Research Partner
N.C. Nature Conservancy	Non-Profit	Research Partner
N.C. Audubon Society	Non-Profit	Research Partner
Grandfather Mountain Stewardship Foundation	Non-Profit	Research Partner
Cape Fear Resource Conservation and Development	Non-Profit	Funding
N.C. Farm Center for Innovation & Sustainability	Non-Profit	Funding
N.C. Fuel Cell Alliance	Non-Profit	Funding
Advanced Energy Corporation	Non-Profit	Research Partner
		Funding & Research Partner
N.C. Department of Environmental and Natural Resources	State	Partner
N.C. Museum of Natural Sciences	State	Research Partner
N.C. State Parks	State	Research Partner
N.C. Wildlife Resources Commission	State	Funding
Division of Air Quality	State	Research Partner
N.C. Department of Commerce, State Energy Office	State	Funding
N.C. Biofuels Center	State	Funding
N.C. Space Grant Consortium	State	Funding
Virginia Marine Resources Commission	State	Funding
University of North Carolina, Charlotte	University	Research Partner
Carnegie Mellon University	University	Research Partner
University of North Carolina, Chapel Hill	University	Research Partner
North Carolina State University	University	Research Partner
Western Carolina University	University	Research Partner
University of North Carolina, Asheville	University	Research Partner
East Carolina State University	University	Research Partner
		Funding & Research Partner
Auburn University	University	Partner
Arizona State University	University	Research Partner

George Mason University	University	Research Partner
Texas A. & M University	University	Research Partner
Dartmouth	University	Research Partner
University of California, Chico	University	Research Partner
University of Minnesota, Duluth	University	Research Partner
George Mason University	University	Research Partner
City University of New York, Hunter College	University	Research Partner
Bridgewater State University	University	Research Partner
University of Wyoming	University	Research Partner
University of Houston Clear Lake	University	Research Partner
University of California, San Diego	University	Research Partner
UDLAP in Puebla, Mexico	University	International Research Partner
The University of the Free State in Bloemfontein, South Africa.	University	International Research Partner
CICERO – University of Oslo	University	International Research Partner
Lowes Inc.	Business	Funding
Southern Energy Management	Business	Research Partner
International Centre for Hydrogen Energy Technologies (UNIDO-ICHET) (United Nations)	Business	Funding
Mission Health	Non-Profit	Funding

**APPENDIX 2:**

**EXTERNAL GRANTS AND CONTRACTS BY YEAR AND UNIT**

**Continuing from FY 2008**

232-AEC	557191 142	Wind Powering America - NC Mountain Outreach			
		US Dept of Energy Wind Powering America - Priority States Wind Outreach - National Renewable Energy Laboratories	Dennis Scanlin	3/19/08	11/30/10 \$75,321.00
232-AEC	558053 142	Green Business Watauga County Green Business Certification Program			
		Watauga Co Econ Dev Commission	Laurel Elam	8/1/07	6/30/11 \$58,093.00
232-AEC	559672 110	Biodiesel Testing Facility			Golden Leaf Foundation
		Jeffrey Ramsdell		7/1/07 12/31/11	\$750,000.00
232-AEC		Utility Savings Initiative - Energy Efficiency			NC DoA State Energy Office Jeffrey Tiller
		4/1/08		9/30/08	\$110,000.00
232-AEC		NC Wind Energy Workshops			Appalachian Regional Commission Dennis Scanlin
		7/1/08		9/30/08	\$20,000.00
232-AEC		Building America - High Performance Buildings			Building America NC DoA State Energy
		Office	Jeffrey Tiller	7/1/08	3/31/09 \$69,468.00
232-AEC		Energy Efficiency Improvements			NC State Energy Office Jeffrey Tiller
		9/1/08		6/30/09	\$77,250.00

**FY2009**

232-AEC	105500	Energy Center			NC Department of Commerce
		7/1/08	6/30/09	\$562,545.00	State Appropriation
232-AEC	552013 110	Energy Center			Community-based Landfill Gas Utilization in Brazil - Phase I
		US Environmental Protection Agency	Jeffrey Ramsdell	4/1/09	3/31/11 \$120,000.00
231-CERPA	557228 110	Economic Effects of State Research			University of North Carolina General
		Administration	Todd Cherry	3/1/09	7/15/10 \$27,515.00
232-AEC	557229 142	Improved Energy Code for NC			US Department of Energy thru NC State
		Energy Office	Jeffrey Tiller	4/22/09	12/31/11 \$254,546.00
231-CERPA	557246 110	Rural Economic Opportunity			"Rural Economic Opportunity: Barriers, Resources and Best Practices for the NC Rural Economic Development Center"
		Development Center, Inc."	Todd Cherry	6/1/09	12/31/10 \$100,000.00
231-CERPA	110	Economic Effects of State Research			University of North Carolina
		General Administration	Todd Cherry	3/1/09	6/30/09 \$79,630.00
231-CERPA	557248 110	Promoting Strategic Coastal Retreat Policies			Western Carolina University

John Whitehead	4/1/09	3/31/11	\$16,000.00		
230-RIEEE	559769 110	Community Resilience Index Framework and Implementation Strategy	Community Resilience Index - a Conceptual "ImageCAT, Inc.	John Pine	4/1/09 9/30/10 \$34,440.00
232-AEC	1/1/09	Madison County Wind Initiative	Madison County	Dennis Scanlin	12/31/09 \$14,815.00
232-AEC	4/1/09	Residential Energy Services Network - RESNET		Laurel Elam	4/1/10 \$14,525.00
<b>FY2010</b>					
232-AEC	7/1/09	106500 Energy Center	NC Department of Commerce		6/30/10 \$612,750.00 State Appropriation
233-SAEREC	4/1/10	552015 110 CAN-DOO	"Climate Action Network through Direct Observations and Outreach (CAN-DOO): Promoting Climate Science Awareness through Public Outreach, STEM Education, and Citizen Science"	National Aeronautics and Space Administration (NASA) Brett Taubman	3/30/13 \$389,931.00
233-SAEREC	Michael Gangloff	552023 110 Tombigbee River	"Distribution of Endangered Mussels in the East Fork Tombigbee River, Itawamba and Monroe Counties, Mississippi"	US DOI Fish and Wildlife Services	6/1/10 5/31/11 \$52,753.00
233-SAEREC	Geological Survey	552029 110 "Russian Olive Tree, Western US"	Factors Influencing Proliferation and Control of the Invasive Russian-Olive ( <i>Elaeagnus angustifolia</i> ) in Western US	US DOI United States	Gabrielle Katz 6/15/10 9/30/13 \$32,000.00
232-AEC	2/1/10	553488 110 SIBS Collaborative	Collaborative Research: Planning Grant: I/UCRC for Sustainable and Integrated Buildings and Sites	National Science Foundation Jeffrey Ramsdell	1/31/11 \$10,000.00
232-AEC	7/1/09	557270 142 20 Percent Wind by 2030	"Appalachian State University Western NC Wind Energy Initiative, NC Solar Center"	US Dept of Energy Dennis Scanlin	6/30/11 \$25,870.00
232-AEC	Biodiesel Feedstocks	557241 110 Extraction & Refinement of Oils	Extraction and Refinement of Oils from Biofuels Center of NC	Nicole Bennett	7/1/09 11/30/10 \$129,133.00
232-AEC	Russell	557265 142 Technical Assistance	Technical Assistance	NC State Energy Office James	9/24/09 5/31/12 (Funding based on billing time on the project)
231-CERPA	Christopher Badurek	558073 142 GIS Analysis/Mapping-Watauga Co TDA	GIS Analysis and Mapping for Watauga County Tourism Development Authority	Watauga County Tourism Dev. Auth.	7/1/09 8/28/09 \$3,013.00
231-CERPA	Virginia Institute of Marine Sciences	559814 110 Multi-Mode Chesapeake Bay Survey	Multi-Mode Chesapeake Bay Menhaden	John Whitehead	4/1/10 12/31/10 \$51,415.00

233-SAEREC	559815	110	Lower San Pedro	Lower San Pedro Riparian Vegetation Monitoring and
Condition Assessment	Platt Environmental LLC			Gabrielle Katz
5/1/10	5/31/11		\$20,170.00	
231-CERPA	559822	142	Economic Impact of Mission Health	The Total Economic Impact of Mission
Health on the Regional Economy	"Mission Health Systems, Inc."			Todd Cherry
4/1/10	7/31/10		\$39,000.00	

**FY 2011**

232-AEC	106500	Energy Center	NC Department of Commerce	
7/1/10	6/30/11	\$512,340.00	State Appropriation	
232-AEC	559876	Landfill Gas for Community Development	Landfill Gas for Community	
Development	Z. Smith Reynolds Foundation	Stan Steury	2/1/11	4/30/12 \$25,000.00
232-CERPA	09-0239	Todd	"Rural Economic Opportunity: Barriers, Resources and Best Practices for the NC Rural Economic Development Center"	"NC Rural Economic Development Center, Inc."
Todd Cherry	7/1/10	6/30/11	\$10,000	
231-CERPA	10-0321	Promoting Strategic Coastal Retreat Policies	Western Carolina University	
John Whitehead	Aug-11	\$8,000		
232-AEC	552040	110	"Gas Utilization, Brazil-Phase 2"	Community-based Landfill Gas
Utilization in Brazil - Phase II and Extension	US Environmental Protection Agency			
Stan Steury	4/1/11	11/30/12	\$120,000.00	
233-SAEREC	552027	Mussels on the Fla Panhandle	Surveys for Candidate Freshwater Mussels on	
the Florida Panhandle	US DOI Fish and Wildlife Services			
Michael Gangloff	8/9/10	6/1/12	\$104,000.00	
232-AEC	557293	ARRA-NC Energy Efficiency Marketing	NC Home Energy Efficiency	
Marketing Development & Implementation Program	ARRA - US DOE thru NC SEO			
Jeffrey Tiller	7/1/10	4/20/12	\$2,626,950.00	
232-AEC	557294	ARRA-ASU Energy Interns	Student Energy Internship and Fellowship	
Program	ARRA - US DOE thru NC SEO	Marie Hoepfl	7/1/10	6/30/12 \$485,857.00
233-SAEREC	557346	Effects of Small dams on NC Mollusk Population	An Assessment of low-head	
dam impacts on mollusk assemblages in NC Piedmont and Coastal Plain streams	NC Wildlife Resources			
Commission	Michael Gangloff	7/15/11	5/31/12	\$30,000.00
232-AEC	558077	Watauga Co. Energy Project Analysis	Watauga Co. Energy Project Analysis	
Watauga County, NC	Jason Hoyle	9/1/10	10/31/10	\$1,975.00
232-AEC	558084	ARRA Wilkes County Landfill	ARRA Wilkes County Landfill	"Wilkes
County, NC"	Stan Steury	6/20/11	3/31/12	\$7,038.00

233-SAEREC	11-0133	RUI: Acquisition of a mobile Tower System for Interdisciplinary Atmospheric Research	North Carolina State University (NCSU)	Howard Neufeld	
Jun-11	\$77,880				
233-SAEREC	11-0117	Special Study to Confirm Foliar Symptoms Due to Ozone Exposure of Cut-Leaf Coneflower from Rocky Mountain National Par	EPA	Howard Neufeld	
5/1/11	\$25,312				
233-SAEREC	10-0017	Opportunities in Education and Public Outreach for Earth and Space Science Climate Action Network through Direct Observations and Outreach (CAN-DOO): Promoting Climate Science through Public Outreach and Citizen Science	NASA	Bret Taubman	May-11 \$175,274
232-AEC	559889	Wind Training Instruction		Northeastern Workforce Development Board	
Dennis Scanlin	9/29/11	12/12/11	\$32,378.00		
233-SAEREC	559823	Land Parcel GIS Development for WNC		"Highland Mapping, Inc."	
Christopher Badurek	5/1/10	8/11/10	\$4,033.00		
232-AEC	559833	Appalachian State University Wind Application Center (APPWAC)			
National Renewable Energy Laboratories		Dennis Scanlin	9/1/10	12/31/13	\$119,857.00
233-SAEREC	559854	Auburn Fish and Wildlife Conservation Planning Research Project - Year 5	Auburn University	Cooperative Unit's Inventory and Michael Gangloff	
1/1/11	12/31/11	\$30,331.00			
232-AEC	559870	Landfill Gas Utilization for Columbus County	Stan Steury	Cape Fear Resource and	
Development		4/26/11	7/30/11	\$6,000.00	
233-SAEREC	559836	Effects of Russian Olive Control		Three River Alliance	
Gabrielle Katz	6/15/10	12/14/11	\$6,000.00		
232-AEC	559827	Green Economic Asset MappingZ.		Smith Reynolds Foundation	
Jason Hoyle	7/1/10	6/30/11	\$34,602.00		

**FY-2012**

232-AEC	106500	Energy Center	NC Department of Commerce		
7/1/11	6/30/12	\$100,000.00	State Appropriation		
232-AEC	559883	Foothills Landfill Gas Project - Rutherford		Foothills Connect	
Business and Technology Center		Jason Hoyle	9/27/11	1/31/12	\$11,000.00
233-SAEREC	557255	Effects of small dams on N.C. Mollusk Population		N.C. Wildlife Resources Commission	
Mike Gangloff	9/21/2011	5/31/2012	\$30,000		

## APPENDIX 3:

### PUBLICATIONS (FY 2010-11)

**Pine, John C.** (2011). "Understanding Climatic, Geographic and Topographic Considerations for Assessing Disaster Vulnerability." Ed. Julie Framingham and Martell Teasley. *Behavioral Health Response to Disasters*. CRC Press, Taylor Francis Group.

**Pine, John C.** (2011). Ed. Marjan van den Belt, B. Costanza and E. Wolanski. "Enhancing the Resilience of Coastal Communities: Dealing with immediate and long term impacts of natural hazards ," *Treatise on Estuarine and Coastal Science*. Elsevier.

Plummer, C., Buchanan, T., Kennedy, B., Rouse, L., & **Pine, J.** (in press) (2011), Broadening perspectives: A multi-disciplinary collaborative teaching and learning experience. *The Journal of Community Engagement and Scholarship*. University of Alabama.

**Pine, John C.** (2009). *Natural Hazards Analysis: Reducing the Impact of Disasters*. Taylor Francis Publishers.

**Pine, John C.** Jan Shoemaker, Bruce G. Sharky, Elizabeth Mossop and Marsha R. Cuddeback (2009). "Student engagement in community development." *Public Universities and Regional Development*. Kathryn Mohrman, Jian Shi, Sharen E. Feinblatt, and King W. Chow Editors. Sichuan University Press.

**Pine, John C.** (2009). "Enhancing Graduate Hazards and Disaster Management Programs." Ideas From An Emerging Field: Teaching Emergency Management in Higher Education. Jessica A. Hubbard, Editor. Public Entity Risk Institute. Fairfax, VA. Pp. 143-148.

Curtis, Andrew, Bin Li, Brian D. Marx, Jacqueline W. Mills and **John Pine** (2010). A multiple additive regression tree analysis of three exposure measures during Hurricane Katrina. *Disasters: The Journal of Disaster Studies, Policy and Management*. Online ISSN: 1467-7717.2010.01190X

### Appalachian Energy Center

Tiller, Jeff. 2010. "Impact and Projected Costs of the Proposed North Carolina Energy Code." A Report for the North Carolina Building Code Council. Appalachian Energy Center. Boone, NC.

Tiller, Jeff. 2010. "Development and Implementation of an Improved Residential Energy Code for North Carolina." A Report for the North Carolina Building Code Council. Appalachian Energy Center. Boone, NC.

Tiller, Jeff. 2010. "Development and Implementation of an Improved Commercial Energy Code for North Carolina." A Report for the North Carolina Building Code Council. Appalachian Energy Center. Boone, NC.

Gray, Sean M., Susan C. Doll, Bruce E. Davis. 2010. "While Laurel HVAC Performance Study at Laurel Reach." A Report Submitted to Northwestern Regional Housing Authority, May 25. Appalachian Energy Center. Boone, NC.

Badurek, C.A., et al., 2010. *NC-MARE: North Carolina Microhydro Assessment for Residential Energy. Technical Report for Energy Center, Appalachian State University.*

- Badurek, C.A., et al., 2011. NC-MARE: North Carolina Microhydro Assessment for Residential Energy. Final Technical Report for Energy Center, Appalachian State University.
- Sanderson, Matthew C., Mark E. Venable. A Novel Assay of Acyl-CoA: Diacylglycerol Acyltransferase Activity Utilizing Fluorescent Substrate. *Journal of Phycology*, In press
- Domermuth, D. H. (in press). Biomass Gasification and Char production ASEE. (under review).
- Raichle, B. W., & Carson, W. R. Wind Resource Assessment in the Southern Appalachian Mountain Ridges in the Southeastern United States Sustainable Energy Reviews. *Elsevier* (vol. 13, issue 5, pp. 1104-1110).
- Smyth, M., & Russell, J. A. 'From graft to bottle' - Analysis of energy use in viticulture and wine production and the potential for solar renewable technologies. *Renewable and Sustainable Energy Reviews* (vol. 13, issue 8).
- Hoyle, Jason; Little, Joseph; Cherry, Todd; et al. *Retail Carbon Offset Survey 2009*. May 2010. Available at <http://www.envcc.com/images/pdf/retailcarbonoffsetsurvey2009.pdf>
- Hoyle, J.W. (2010, June). Public Comments on Draft Version 4 of the Landfill Project Protocol [Submitted in response to request for comments]. *Climate Action Reserve*, Landfill Project Protocol, Version 4.
- Hoyle, J.W. (2011). Monetizing Green Assets & Incentives: Watauga County, NC. Boone, N.C.: Appalachian State University, Appalachian Energy Center.
- Hoyle, J.W. (2010). Electricity Service Options at the Watauga County Landfill. Boone, N.C.: Appalachian State University, Appalachian Energy Center.
- North Carolina State Energy Report. Tiller, Jeffrey S., Anna Erwin, and Laurel Elam. Appalachian State University Department of Technology and Energy Center. Published by the North Carolina State Energy Office. March, 2010.
- Economic Developer's Guide to the Renewable Energy Industries, Volume 4, Spring 2010
- Lehman, John. 2010. North Carolina Western Wind Draft Report. Research Institute for Environment, Energy and Economics and Appalachian Energy Center.

#### **Center for Economic Research and Policy Analysis (CERPA)**

- Caudill, S. B., Groothuis, P. A., & **Whitehead**, J. C. (in press). The Development and Estimation of a Latent Choice Multinomial Logit Model with Application to Contingent Valuation *American Journal of Agricultural Economics*. (Journal Article, Academic Journal)
- Cherry**, T.L., Kallbekken, S. and Kroll, S. "Do You Not Like Pigou, or Do You Not Understand Him? Tax Aversion and Revenue Recycling in the Lab" *Journal of Environmental Economics and Management*, in press. (Journal Article, Academic Journal)
- Cherry**, T.L. and Cotton, S. "Sleeping with the Enemy: The Economic Cost of Internal Environmental Conflicts" *Economic Inquiry*, in press. (Journal Article, Academic Journal)

**Cherry, T.L. and McKee, M.** (2011). "Experimental Methods and Environmental and Natural Resource Policy," in *Research Tools in Natural Resource and Environmental Economics*, (Batabyal and Nijkamp, editors) World Scientific, New York, 2011.

"Taxpayer Information Assistance Services and Tax Compliance Behavior" (with J. Alm, M. Jones and **M. McKee**) *Journal of Economic Psychology*, Volume 31, Number 4, August 2010.

**Cherry, T.L.** "Pigouvian Tax Aversion and Inequity Aversion in the Lab" (with S. Kallbekken and S. Kroll) *Economics Bulletin*, Volume 30, Number 3, July 2010.

**Dickinson, D. L.** (in press). Job allocation rules and sorting efficiency: Experimental outcomes in a Peter Principle environment. *Southern Economic Journal*.

**Dickinson, D. L., & Oxoby, R. J.** (in press). Cognitive dissonance, pessimism and behavioral spillovers *Journal of Economic Psychology*.

**Dickinson, D. L., & McElroy, G. T.** (2011). Rationality around the clock. Sleep and time-of-day effects on guessing game responses. (2nd ed., vol. 108, pp. 245-248). *Economics Letters*.

**McElroy, G. T., & Dickinson, D. L.** Thoughtful days and valenced nights: How much will you think about the problem? (7th ed., vol. 5, pp. 516-523). *Judgment and Decision Making*.  
[journal.sjdm.org/10/10618/jdm10618.pdf](http://journal.sjdm.org/10/10618/jdm10618.pdf)

**Dickinson, D. L., & McElroy, G. T.** (2011). FARCE: Flying Airplanes. Realizing Circadian Effects (1st ed., vol. 16, pp. 10-12). *The Annals of Improbable Research*.

**Dickinson, D. L., & Anderson, C.** (2010). Bargaining and Trust: The Effects of 36hr Sleep Deprivation on Socially Interactive Decisions." *Journal of Sleep Research*, 19, 54-63.

**Dickinson, D. L., & Hunnicutt, L.** (in press). Nonbinding suggestions: The relative effects of focal points versus uncertainty reduction on bargaining outcomes. *Theory and Decision*, 69(4), 615-634.

**Morgan, O. A., & Huth, W. L.** (in press). Measuring the Willingness to Pay for Fresh Water Cave Diving *Marine Resource Economics*, (vol. 26, issue 2).

**Morgan, O. A., & Hamilton, S. E.** (in press). Valuing Beach Access in Access-restricted Coastal Property Markets," *Journal of Agricultural and Applied Economics*.

Hamilton, S. E., & **Morgan, O. A.** (in press). Integrating Lidar, GIS, and Hedonic Price Modeling to Measure Amenity Values in Urban Beach Residential Property Markets *Computers, Environment and Urban Systems*.

Johnson, B., & **Whitehead, J. C.** (2011). Contingent Valuation of Sports In *Handbook of Sports Economics* Oxford.

Landry, C., Hindsley, P., Bin, O., Kruse, J., **Whitehead, J. C., & Wilson, K.** (in press). Weathering the Storm: Measuring Household Willingness-to-Pay for Risk-Reduction in Post-Katrina New Orleans *Southern Economic Journal*.

**Morgan, O. A., & Huth, W. L.** (2010). Using Revealed and Stated Preference Data to Value Large Ship Artificial Reefs: The Key West Vandenberg Sinking In J. C. Whitehead, T. Haab, & J.-C. Huang (Eds.), *Preference Data for Environmental Valuation* Routledge Taylor and Francis Group.

Morgan, O. A., & Huth, W. L. (2010). Using Revealed and Stated Preference Data to Value Large Ship Artificial Reefs: The Key West Vandenberg Sinking In **J. C. Whitehead**, T. Haab, & J.-C. Huang (Eds.), *Preference Data for Environmental Valuation* Routledge Taylor and Francis Group.

**Whitehead, J. C.,** Johnson, B., Mason, D., & Walker, G. (in press). Consumption Benefits of NHL Game Trips Estimated from Revealed and Stated Preference Demand Data *Economic Inquiry*.

### **Southern Appalachian Environmental Research and Education Center**

Thompson, A.M., G. A. Morris, J. E. Yorks, S. K. Miller, **B. F. Taubman**, G. Verver, H. Vömel, M. A. Avery, J. W. Hair, G. S. Diskin, E. V. Browell, J. M. Valverde-Canossa, T. L. Kucsera, C. A. Klich, D. L. Hlavka, Convective and wave signatures in ozone profiles over the equatorial Americas: Views from TC4 (2007) and SHADOZ, *J. Geophys. Res.*, 115, D00J23, doi:10.1029/2009JD012909, 2010.

Castellanos, P., L.T. Marufu, B.G. Doddridge, **B.F. Taubman**, S.H. Ehrman, and R.R. Dickerson, Evaluation of Vertical Mixing and Emissions in the CMAQ Model Using Measured Surface Concentrations and Vertical Profiles of CO and O<sub>3</sub>, *J. Geophys. Res.*, doi:10.1029/2010JD014540R, 2011.

Haase, K. B., C. Jordan, E. Mentis, L. Cottrell, H. R. Mayne, R. Talbot and **B. C. Sive** (2011), Changes in Monoterpene Mixing Ratios During Summer Storms in Rural New Hampshire (USA), *Atmos. Chem. Phys. Discuss.*

Mao, H., R. W. Talbot, **B. C. Sive**, S.-Y. Kim, D. R. Blake and A. J. Weinheimer (2011), Arctic mercury depletion and its quantitative link with halogens, *J. Atmos. Chem.*, DOI 10.1007/s10874-011-9186-1.

Talbot, R., H. Mao, D. Feddersen, M. Smith, S.-Y. Kim, **B. Sive**, K. Haase, J. Ambrose, Y. Zhou and R. Russo (2011), Comparison of Particulate Mercury Measured with Manual and Automated Methods, *Atmosphere*, 2, 1-20; doi:10.3390/atmos2010001.

Kaase, C. T. and **G.L. Katz**. In press. Effects of stream restoration on woody riparian vegetation of Southern Appalachian mountain streams, North Carolina, USA. *Restoration Ecology*.

**Kelly, Ginger M.** 2011. Aerosol-Precipitation Interactions in the Southern Appalachian Mountains. Masters Thesis, Department of Geography & Planning. **Baker Perry**, Thesis Advisor. 151 pgs.

## **APPENDIX 4:**

### **FACULTY ENGAGEMENT**

Johnny Waters, Geology, Internal Advisory Board

Steven Seagle, Biology, Internal Advisory Board, Earth Systems Research Cluster

Claudia Cartaya Marin, Chemistry, Internal Advisory Board

Michael Briley, Physics and Astronomy, Internal Advisory Board

James Wilkes, Computer Science, Internal Advisory Board, Agra-business Research Cluster

Eric Marland, Mathematical Sciences, Internal Advisory Board, PI, Earth Systems Research Cluster

Pat Beaver, Anthropology and Center for Appalachian Studies, Internal Advisory Board, Earth Systems Research Cluster / Natural & Human Systems

John Whitehead, Economics, Internal Advisory Board, PI.

Brian Ellison, Government and Justice Studies, Internal Advisory Board, CERPA Program Director

Jeff Tiller, Technology and Environmental Design, PI, Internal Advisory Board

Jesse Lutabingwa, International Education and Development, Internal Advisory Board

Janice Pope, Communication, Internal Advisory Board

Mary Sheryl Horine, Inst. For Health and Human Services, Internal Advisory Board

Ged Moody, Office of Sustainability, Internal Advisory Board

Paul Gaskill, Health, Leisure & Exercise Science, Internal Advisory Board

Kathalene Schroeder, Geography & Planning, Internal Advisory Board

Todd Cherry, Economics, CERPA Director, PI

Jeff Ramsdell, Technology and Environmental Design, Energy Center Director, PI

Howard Neufeld, Biology, SAEREC Director, PI

John C. Pine, Geography & Planning, RIEEE Director, PI

Brian Raichle, Technology & Environmental Design, PI

Joe Crocker, Technology & Environmental Design, PI

Mark Venable, Biology, PI

Brett Taubman, Chemistry, PI

Chris Badurek, Geography & Planning, PI

Dennis Scanlin, Technology & Environmental Design, PI

Marie Hoepfl, Technology & Environmental Design, PI

Lee Ball, Technology & Environmental Design, Co-PI

Nicole Bennett, Chemistry, PI

Eric Allain, Chemistry, PI

David Domermuth, Technology & Environmental Design, PI

Jamie Russell, Technology & Environmental Design, PI

Chad Everhart, Technology & Environmental Design, PI

Jim Houser, Technology & Environmental Design, PI

Jay Fenwick, Technology & Environmental Design, PI

Susan Doll, Technology & Environmental Design, PI

Phil Russell, Physics and Astronomy, PI

Carla Ramsdell, Physics and Astronomy, Co-PI

Jerianne Taylor, Technology & Environmental Design, Co-PI

Richard Crepeau, Geography & Planning, Co-PI, CERPA Program Director

Todd Hartman, Government and Justice Studies, CERPA Program Director

Mike McKee, Economics, PI, CERPA Program Director, Earth Systems Research Cluster / Natural & Human Systems

Ash Morgan, Economics, Co-PI

David Dickinson, Economics, PI

Jamie Price, Sociology, Co-PI

David McEvoy, Economics, Co-PI

Tanga McDaniel, Economics, Co-PI, CERPA

Jeff Colby, Geography & Planning, PI, SAEREC

Michael Madrich, Biology, Co-PI, Earth Systems Research Cluster / Natural & Human Systems, CERPA Research Associate, SAEREC

Saskia Gevel, Geography & Planning, CERPA Research Associate

Tatyana Ruseva, Government and Justice Studies, Co-PI, CERPA

Barkeley Sive, Chemistry, Co-PI, SAEREC

Jim Sherman, Physics and Astronomy, Co-PI, SAEREC

Baker Perry, Geography & Planning, PI, SAEREC

Rahman Tashakkori, Computer Science, Co-PI, SAEREC

Ryan Emanuel, Geology, Co-PI, SAEREC

Rene Salinas, Mathematical Sciences, Co-PI

Pete Soule, Geography & Planning, Earth Systems Cluster, Natural & Human Systems

Robert Creed, Biology, SAEREC Internal Advisory Committee

Carol Babyak, Chemistry, SAEREC Internal Advisory Committee, SAEREC Water Resources Research Cluster

Bill Anderson, Geology, SAEREC Internal Advisory Committee

Mickael Gangloff, Biology and SAEREC, PI, SAEREC

Gabrielle Katz, Geography and Planning, PI, SAEREC

Eva Gonzales, Biology, Co-PI, SAEREC

Martin Mezner, Walker College of Business, Co-PI, Energy Center

Guichuan Hou, Co-PI, Director Microscopy Facility, SAEREC

Annkatriin Rose, Co-PI, SAEREC

David Marlett, Finance, Banking and Insurance, Agra-Business Research Group

Karen Epermanis, Finance, Banking and Insurance, Agra-Business Research Group

Sandra Lubarsky, Sustainable Development, Agra-Business Research Group

Anne Fanatico, Sustainable Development, Agra-Business Research Group

Rosie Tighe, Geography and Planning, CERPA

Laura England, Biology and Sustainable Development, Environmental Education, SAEREC, PI

Kristan Cockerill, Interdisciplinary Studies, Co-PI, SAEREC

Chuanhui Gu, Geology, Co-PI, SAEREC

Linda Jencson, Anthropology, Co-PI (NIH Proposal 2012), Community Resilience Research Group

Scott Collier, HLES, PI, (NIH Proposal 2012), Community Resilience Research Group

Denise M. Martz, Psychology, Co-PI, (NIH Proposal 2012), Community Resilience Research Group

Marvin Hoffman, Government & Justice Studies, Community Resilience Research Group

Terence Milstead, Geography and Planning, Affordable Housing Research Group

Stan Steury, Energy Center, PI

Kellie Stokes, Energy Center, Technology & Environmental Design, PI

Jeremy Ferrell, Energy Center, PI

Quint David, Energy Center, PI

Mike Denslow, Biology, CERPA Research Associate

Patricia Cornett, Office of Sponsored Programs, Co-PI

Laurel Elam, Energy Center, PI

Joey Mosteller, Energy Center, Co-PI

Chuck Perry, Energy Center, Technology & Environmental Design, Co-PI

Bruce Davis, Energy Center, Technology & Environmental Design, PI

Jason Hoyle, Energy Center, PI