Appalachian
STATE UNIVERSITY
BOONE, NORTH CAROLINA 28608

Research Institute for Environment, Energy and Economics

Annual Report, 2009 - 2010

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Appalachian State University
Research Institute for Environment, Energy and Economics
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December 3, 2010

Formed in November 2008, the *mission* of the Research Institute for Environment, Energy and Economics (RIEEE) is to build internationally recognized competitive multi-disciplinary research initiatives that enhances Appalachian State University's academic programs, institutional services, our region and fosters interdisciplinary discovery, creative activities, and research that addresses environment, energy and economic issues. We believe that by integrating environmental, energy and economic research initiatives with academic, outreach, operational, and co-curricula programs involving faculty, students, staff and the public we will create a broader understanding and appreciation of the inter-dependence of natural, social, economic, constructed and technological systems.

Because of its setting, Appalachian State University has drawn faculty and students who have a strong commitment and interest in environmental issues, our use of energy and public policy. This interest is expressed in many forms from energy conservation and innovative technologies to environmental economic policies. The RIEEE provides a means for integrating research initiatives from diverse academic, operational, and student units and enhancing ASU's reputation of strong academic programs, community outreach and interdisciplinary research initiatives. The RIEEE thus allows faculty, students and staff members across colleges and multiple disciplines to focus on research at the intersection of energy, the environment and economic policy.

The 2010 academic year for the RIEEE has been one of organization and clarification of the nature and scope of the Institute. Directors of the three centers that compose the Institute are in place and actively collaborating to focus the scope of their center programs, structure and processes that will nurture and support multi-disciplinary research collaborations. The Center directors include:

> Appalachian Energy Center: Dr. Jeff E. Ramsdell, Professor, Department of Technology, College of Fine and Applied Arts
>
> Center for Economic Research and Policy Analysis (CERPA): Dr. Todd E. Cherry, Professor, Department of Economics, Walker College of Business

Southern Appalachian Environmental Research and Education Center, Proposed (SAEREC): Dr. Howard S. Neufeld, Professor, Department of Biology, College of Arts and Sciences.

The following report provides a detailed description of the programs of the centers, the current status of their facilities, people engaged in the operations of the centers, major accomplishments including external funding, publications and presentations and public engagement, center development efforts and finally problems and needs for each center.

The RIEEE through its centers, associated faculty, students and community partners are committed to:

- The highest quality research initiatives that acknowledge the value of the natural environment, our cultural heritage, mutual respect and diversity.
- Applying our research resources to promote sustainable economies, natural systems, cultural prosperity and quality of life throughout our region and state.
- Fostering critical analysis through the interface of multiple disciplines in an open setting.
- Extending research outcomes to our community, region and state in support of economic development needs.
- Engagement in the local, regional, national and international community by extending our research beyond our boarders.
- Sustain Appalachian, where we will support our university in exploring and adopting policies, practices and programs that address our present needs without compromising our ability to meet long term needs and those of future generations.

We acknowledge that our university has well-qualified, committed, and available faulty, students, and off-campus partners. We have research laboratories, campus facilities, a comprehensive library, museums and off campus natural and constructed areas that provide a sound base for our research initiatives. Academic undergraduate and graduate programs associated with the environment, energy and economics bring talented students to the ASU campus and are critical in our research initiatives. Appalachian has outstanding institutional sponsored program resources that support the proposal solicitation and fiscal management. Further, we have broad-based collaborations with public, private and non-profit entities that support and are actively engaged in our research initiatives.

Research Priorities and Activities

1. Foster interdisciplinary research that examines the linkages between our natural, constructed, economic, technological and human systems. The Institute and Centers support faculty research through financial administration for research projects, funding development, logistics, and promotion and dissemination of research results.

   Our multi-disciplinary research is targeted to address the following areas:

1. The linkages between public policy, economic development, and science and technology.
2. Environmental systems including interrelationships between ecology, water, air, and geology, as well as the linkages between energy use, public policies, business decisions, and building structures.
3. Enhancing Renewable Energy (biofuels, wind, solar, building performance, and energy policy)
4. The use of our environmental resources and systems, and impacts on our economy and Appalachian Culture and Heritage.
5. Environmental Education and Outreach

2. Enhance Appalachian's outreach initiatives to our local communities, our region, nation and internationally.
3. Acknowledge the global nature of our economy and environment and expand international research and outreach initiatives that extend Appalachian's research efforts to new environments, cultures, and economies.
4. Expand external support in the form of gifts and endowments for research in the areas of the environment, energy and economics.

Our key accomplishments for the 2009 2001 fiscal year include the recruitment of leaders for our three research centers, collaboration with academic units in the development and expansion of campus research laboratories (Solar Training & Research Facility; Bio-diesel Research & Testing Facility; Alternative Fuels Research Labs, Photovoltaic Materials and Device Characterization Facility, the Landfill Gas Research Laboratories, the Survey Research Laboratory and Experimental Economics Laboratory, and the full implementation of the APPALAir environmental monitoring facilities on the Appalachian campus at Grandfather Mountain and the Watauga County Landfill.

Staff and faculty associated with our centers have had a very productive year with over $5 Million in external support from federal, state and private foundation entities. These projects were made possible with the engagement and support from both staff from the Energy Center and SAEREC and faculty from academic units representing three Appalachian colleges. Further, the projects reflect engagement in international research with our federal agency partners. Key collaborations include the development of an off-campus alternative fuels research lab with Catawba County and the Golden Leaf Foundation; an environmental monitoring research site in partnership with the Grandfather Mountain Stewardship Foundation, NASA, NOAA and the N.C. Department of Environment and Natural Resources, the College of Arts and Sciences; the development of a landfill gas demonstration site in Brazil in collaboration with the U.S.

Environmental Protection Agency; and the expansion of both a Survey Research Lab and Experimental Economics Lab with support from both the Walker College of Business and the College of Arts and Sciences.

The Institute center faculty and staff have had a very productive year in the dissemination of their research in the form of project reports, publications in academic journals and both academic and public presentations. The contribution of the research to our state and region is illustrated by the Transforming North Carolina Faculty Research Award to Dr. Todd Cherry for his work in "Rural Economic Opportunity: Barriers, Resources and Best Practices." Todd and his research team (Todd Hartman – Government & Justice Studies; Jammie Price – Sociology; Rich Crepeau – Geography & Planning; and Mke McKee – Economics) provided very broad and deep portraits of different segments of North Carolina. The N.C. Rural Center that sponsored the study believes that this study will impact state policy and economic development at the local and regional levels.

It should be noted that faculty and staff have been successful in obtaining external research funding and conducting research projects even when they carry heavy teaching loads. Their productivity reflects their extensive commitment, talents and determination to make a difference on and off our campus, and to our professions. Without the engagement and support from our faculty and academic units, our ability to compete for external funding and support would be marginalized.

We believe that we have had a productive year especially in establishing leadership in our centers and pulling together resources on and off our campus that provide the framework for our research initiatives. We anticipate that these efforts will continue to produce positive results in terms of external funding support, representation of faculty in our center research areas, and engagement of students in our projects.

Sincerely,

John C. Pine

Director

Appalachian Energy Center

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.

HISTORY

Appalachian Energy Center at Appalachian State University was established in 2001 to conduct energy research and applied program activities in a multi-disciplinary environment. It focuses on energy efficiency, renewables, policy analysis, forecasting, and economic development. The Center ties together faculty and staff from many different programs, departments, and colleges of the University including: Building Science, Appropriate Technology, Geography and Planning, Economics, Biology, Chemistry, Physics, and Political Science. The AEC also facilitates partnerships with the private sector as well as local, state, regional and federal governments.
AEC operates under the umbrella of Appalachian's Research Institute for Environment, Energy, and Economics (RIEEE) which was established in November 2008 to enhance research opportunities for faculty and students whose interests are associated with environmental science, renewable energy and economics.

Appalachian State University has long been a home for renewable energy, sustainable development and an environmentally aware campus community. Appalachian State is home to one of the nation's first degree programs in renewable energy technology, and remains one of a handful of schools in the world that offers a Masters-level degree in renewable energy technology.

Because of its expertise and setting, Appalachian has drawn faculty and students who have a strong commitment and interest in environmental issues as expressed in many forms from energy conservation and innovative technologies to environmental economic policies. The University has built a reputation from its strong academic programs, community outreach and interdisciplinary research initiatives. Today, many faculty members across colleges and multiple disciplines focus on research at the intersection of energy, the environment and economic policy.

PROGRAMS

Appalachian Energy Center represented by a broad range of staff, ASU faculty, graduate students, and partners has pursued a diverse mix of over 30 activities during the July 2009 through December 2010 period. As a Center within the Research Institute for Environment,

Energy, and Economics, AEC will continue to involve more disciplines and interested parties as we pursue our interdisciplinary outreach and research efforts. Our current work is collected within four general categories which are Building Energy Efficiency, Renewable Energy, Alternative Fuels, and Policy, Markets, and Economic Analysis. Core funding is provided by an Appropriation from the North Carolina Legislature with a large amount of additional funding provided by Federal, State, and private sources.

Building Energy Efficiency

Focus topics within this section include Low Income Housing, High Performance Residences, High Efficiency Existing Homes, Commercial Buildings, and Policy Analysis.

The Energy Center working through retail outlets participated in encouraging 20 families to step beyond the purchase of a standard manufactured home by providing Upgrade and Save ENERGY STAR Rebates. This NC industry has experienced a substantial drop in units sold over the last 10 years. In 2000 there were 27,000 NC units sold but that dropped to only 3000 units by 2009.

On a bolder note was the very successful combined NC ENERGY STAR and RESNET national conference in which there were over 950 attendees. North Carolina benefited from hosting the national 2010 RESNET Building Performance Conference within the statewide NC ENERGY STAR Conference. Participating NC businesses had the opportunity to present their information or show their products to a national audience and also were able to attend sessions lead by national trainers or see products from national businesses. The conference was a showcase for the NC building energy efficiency network of businesses and the NC State Energy Office.
Stakeholders in the shelter industry and consumers alike continue to benefit from the provision of workshops, direct consulting, and from both the publication and presentation of the results from applied research. One such publication and presentation was the Revised Duct Design presentation and power point within the RESNET national conference in Raleigh earlier this year. It is always an uphill struggle to have building trade members adapt new construction procedures as well as gain consumer acceptance. However this revised duct design has in its initial explorations demonstrated that comfort can be retained while reducing installation costs and saving space. The major potential benefit for two story homes with open stairwells would be the option to move the air handler from the attic into the space that currently is used to provide a chase for a return duct from the attic down to the first floor. Removing the air handler from the hostile environment of the attic would provide a noticeable energy efficiency gain.

A previously completed Radiant Barrier case study continues to be of interest, including at the national level as requests for electronic copies of the study have occasionally been received with the latest being in July 2010 which is a year and a half following it completion and publication.

Several Energy Center activities blend well into the growing national interest to establish a robust national energy efficiency effort for existing buildings. One item is the preliminary exploration into a Micro Injection Technique that would air seal the top of stud cavities from inside the home with limited cosmetic impact. With regard to practical air sealing techniques to improve a home's energy efficiency, air sealing the ceiling plane is of primary importance [second only behind duct system air sealing]. A central element in this air sealing is to seal from the attic side both edges and all penetrations in stud wall cavity top plates. For existing homes this can be a challenge [floored attics, storage of goods, low attics, lots of ducts and equipment, existing ceiling insulation, and it is very hot during the summer]. This challenge is both costly to address and access for application is often limited. Air sealing at the ceiling plane has been measured and often equals 25% of the original building air leakage. Additionally, the physics of hot air rising out of the building is interrupted adding to this technique's impact on building energy efficiency.

A second related activity is the development of Quality Indoor Environment Protocols for assessing the impacts of energy efficiency measures. We are interested in exploring the impacts on Quality Indoor Environments when buildings have energy efficiency measures applied to them. We are curious about positive, negative, and neutral impacts. We want to create and apply solutions to negative outcomes and learn to understand positive outcomes. A supplemental finding based on one medium sized case study was that 25% to 30% of existing heat pumps are operating with substantial inefficiency. Consumers were substantially unaware of this dismal performance and the wasted energy.

A third related activity is beginning the process of becoming knowledgeable about Behavior Facilitated Efficiency. When we understand the barriers to and encouragements for individual property owners to actually participate in purchasing efficiency upgrades we have "buyers." With buyers we can begin to significantly reduce the numbers of existing energy inefficient properties. This can reduce the overall growth in demand for energy and also reduce the size of the demand at peak. It would slow the growth in the amount of funds paid to out of state energy resources. For some properties it would make the purchase of 100% sustainable energy a practical financial option. Substantial economic development and jobs creation would grow out of the business development necessary to provide a significant number of properties with efficiency upgrades.

At the beginning of this section we mentioned the Upgrade and Save program. Additional work in the manufactured home field includes a Review of Market Opportunities for High Efficiency Manufactured Homes. As mentioned, the manufactured home industry has been in steep decline over the last decade. If the new more energy efficient models can improve on the perception of these homes, they could help spur the industry and economic growth in the state, while also providing home buyers in North Carolina both an affordable home and an energy efficient home. In support of developing real world field performance data, preparations are underway for a combined energy study and indoor conditions case study comparing the performances of an ENERGY STAR manufactured home versus a standard manufactured home.

Included in this effort will be the enhancement of our ability to remotely monitor and down load our logged data from homes through the internet.

Structural Energy Panels is a new effort. The primary objective of this project is to carry out exploratory experimental work that could allow solar energy technologies to be integrated with structural insulating panels. These panels will be referred to as structural energy panels or SEPs. The aesthetic integration of renewable energy technologies into new and existing building "skins" is an attractive option from the standpoint of energy independence, carbon foot-print reduction, and the development and/or enhancement of renewable energy manufacturing in the State. Any technologically successful and economically viable results of this work can be used to improve current renewable energy product development and develop new products.
With regard to commercial buildings we continue our effort to revise SB 668 presentations and provide related training. The General Assembly of North Carolina implemented Senate Bill 668 and other legislation, which became State Law in 2007. The legislation requires that new state buildings improve efficiency by at least 30% above the ASHRAE 90.1-2004 requirements. The PowerPoint presentations show designers and building owners and operators how to comply with the state requirements. They also provide recommendations for achieving increased efficiency. The benefits will be to improve compliance with the state law and improved efficiency of our state's buildings.

Finally in our energy efficiency activities section is our work in Policy Analysis to look at the Impacts of High Performance Buildings. The ACEEE report submitted to the Energy Policy Council includes results of analysis prepared by Appalachian State over the past several years, with updated information from this year's efforts. The ACEEE report also includes up-to-date information on energy code development in the state. The report will serve as the basis for policy recommendations by the Energy Policy Council, which will establish a portion of the agenda for future energy policy in the state. The energy code policy analysis has resulted in successful integration of recommendations into the energy code, which was approved by the state's Building Codes Council at its December 2010 meeting.

Renewable Energy

Focus topics within this section include Solar Thermal and Photovoltaics, Wind Energy, and Renewable Energy Resources.

We continue to collaborate with the Department of Physics and Astronomy in their development of an extensive photovoltaic materials and device characterization facility which will provide the tools and training for ASU students and faculty to develop, fabricate and characterize PV devices. These facilities will serve as a user facility where PV researchers, fabricators, and users can have their PV materials and devices fabricated and tested. It is hoped and expected that the results of this work will serve as a resource for others who will need to use the tools we are developing to aid in their pursuit of fabrication and/or characterization of PV materials and devices. Appalachian can provide critical PV device measurements and characterizations at little or no cost to NC based companies and researchers.

Construction of our Solar Training and Research Facility on the Appalachian campus is near complete, greatly enhancing our solar research program. Testing and reporting on performance of available solar equipment will allow homeowners and businesses to adopt these technologies with confidence and make the best decisions about what technology to adopt. In addition, when complete, the facility will provide educational opportunities for future employees of the regional Green Economy.

Our activities in Wind Energy fall into four major work areas:

1. Manage the Small Wind Testing & Demonstration Facility on Beech Mountain and further develop our small wind turbine testing program
2. Continue Research on Key Wind Issues in Western NC
3. Technical Assistance & Website
4. Track wind energy and document wind energy facilities in North Carolina

Most of the wind turbines being installed in western NC and throughout 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. We also assist in connecting those interested in installing a wind turbine with companies who can install a turbine. We are also working with counties and state officials to assist them in developing ordinances which would provide for orderly and appropriate wind energy development. Substantial economic development and jobs creation would grow out of the business development necessary to construct wind turbines in the state.

Microhydro Analysis for Residential Energy takes a look at another NC energy resource. Microhydro is of great interest to the state's renewable energy community as it is listed as a viable renewable energy resource eligible for renewable energy financial incentives. However, there is limited research on microhydro resources at the national and state level. The only prior research on microhydro resources in western North Carolina was done in 1983 with collaborators from Appalachian State. Our current project will update this study by using higher quality data and more advanced GIS methods to provide information on microhydro as a viable renewable energy source. This project will also provide information on microhydro resources that can be directly mailed to residents of North Carolina. This project will therefore help to better inform North Carolina residents on microhydro resources as well as potentially increase the number of residents using it as a renewable energy source. In addition, the technical report will be one of the very few research reports available nationally and the first on small scale systems at a state level. This makes this report a valuable contribution to citizens, energy policy researchers, and policy makers in North Carolina as well as other states.

Alternative Fuels

Focus topics within this section include Cell-Free Ethanol Production & NIR Monitoring of Biodiesel, Appalachian Biofuels and Biomass Initiative, Emissions Analysis for Different Biodiesel

Feedstocks, Algae Oil Production, Harvest, & Extraction, Microwave-Assisted Synthesis of Biodiesel & Materials for Making Solar Cells, and Landfill Gas Research and Development.

Dr. Eric Allain's lab in the Department of Chemistry has been focusing efforts on two main research areas: cell-free ethanol production and NIR monitoring of biodiesel production. We are also collaborating with Dr. Nicole Bennett's lab on a project studying the potential for microwave enhancement of enzymatic biodiesel production. Perhaps the biggest potential impact of this work in North Carolina will come from economic improvements in the fuel alcohol production process. Currently, most of the US ethanol production is carried out in the Midwest and is based on corn as a feedstock. Other regions of the country that are less ideal for corn growth are forced to consider alternative feedstocks for local ethanol production. The problem with this is that processing of other feedstocks is often more expensive. If a cell-free process for ethanol production is developed, economic efficiency gains through production rate increases could offset the added feedstock processing cost thus allowing states like North Carolina to grow non-corn energy crops for fuel ethanol production.

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. Additionally, we aredeveloping a system for B20 usage in off-road equipment at Blackburn Landfill in Catawba County. Emissions work that is being pursued will benefit the state by improving the understanding of combustion properties and life cycle analysis from alternative feedstocks grown and processed in NC. This work will become increasingly important with the trend towards quantifying carbon intensity of fuels. The Biofuels Center of North Carolina's *Strategic Plan for Biofuels Leadership* states that *by 2017, 10% 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 feedstocks. 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.

There is widespread interest in growing algae for Algae Oil Production, Harvest, and Extraction and ultimately biofuel production. This has not yet become an industrial reality because of inefficiencies in the process. First, algae do not reliably make large amounts of oil. By understanding the process better we hope to be able to better control their metabolism and increase yield. Second, algae are a microscopic crop grown in water. Harvesting methods are both expensive and energy intensive. Through work by Dr. Mark Venable's laboratory (Biology) we hope that by growing algae on a solid substrate that we can efficiently harvest them at low cost. Third, oil extraction is somewhat inefficient. Dr. Venable's lab has designed an extraction

process that we feel will increase yield by 10-20%. With these improvements we hope to discover a system that will make the overall process both productive and efficient. This may lay the groundwork for a new component of biofuel industry for the state.

Another Appalachian State initiative in the Biofuels arena is Microwave-Assisted Synthesis of Biodiesel & Materials for Making Solar Cells. Once completed, the biodiesel research could be expanded into a collaborative effort with state wide biodiesel production facilities. The catalysts developed could be used with both industrial scale microwave reactors and standard industrial-scale batch reactors that use conventional heating. The prophyrin work is basic research that will be used by scientist in the field of photoconductivity to develop more robust solar cells.

Our final area of activity in the alternative fuels section is Landfill Gas Research and Development. This activity is to assist counties, especially rural economically challenged communities with smaller landfills, to develop landfill gas projects for community-based development, renewable energy implementation, and reduction of greenhouse gas emissions. Some of the benefits derived from our work include the following items.

- Local government educated on the value of landfill gas for fuel and carbon credits at 34 landfills in North Carolina.
- Local governments linked with resources for landfill gas development, project financing, incentives, and providers of landfill gas equipment, supplies and services.
- At least 15 projects in planning and development stages.
- Potentially several hundred thousand tons per year of CO_2 equivalent emissions reduced.

Policy, Markets, and Economic Development

Focus topics within this section include Assess Carbon Market Opportunities in North Carolina, New Policy Developments and Analysis, State Energy Plan, Economic Development Analysis and Outreach – Parts A & B, Hydrogen & Fuel Cell Industry Development & Commercialization, and Student Energy Research Development.

Our first activity was to Assess Carbon Market Opportunities in North Carolina. Activities under this Task include monitoring developments in national carbon-emissions policies and market development for potential impacts on North Carolina's economy, development of carbon offset supply from North Carolina, and examining characteristics of the current market for voluntary carbon offsets.

North Carolina will benefit from these activities by:

- Farmers, landowners, and local governments receiving income from GHG reductions prior to incurring costs associated with a federally imposed cap on GHG emissions;

- Leveraging the value of voluntary pre-regulated carbon emission reductions into investment, economic development and green energy project development;
- Developing strategies to manage the changing competitive economic environment in a post-carbon-regulation timeframe, i.e. stakeholders within the state will know of and be prepared for both opportunities and threats that future carbon constraints will present.

New Policy Developments and Analysis has provided several outputs. We have completed a working paper and two policy briefs related to 'cash for clunkers' research. We completed a working paper on Delaware's Sustainable Energy Utility. And, we completed an article in the Economic Developer's guide discussing swine and poultry set aside and feed-in tariff policy issues. Working papers will be submitted to academic journals. Additionally, Dr. Jason Shogren gave a lecture to the University community on Climate Policy. This research is contributing to current policy debates and preparing good resources to be cited in attempts by policy makers to improve policy outcomes in the state. It is also further educating student and university populations at Appalachian State University.

Revisions to the State Energy Plan have been completed. This work, caught in the transitions from the previous Governor's administration to our current Governor's administration, has been renamed the State Energy Report and submitted to the State Energy Office. There were extensive revisions involved in this effort. The total length of the report was reduced by about 60%, and the recommendations from a lengthy series of meetings with three Task Forces and the Energy Policy Council were removed. The State Energy Report shows the current energy situation in North Carolina regarding energy supplies and energy demand from the residential, commercial, industrial, transportation, and electrical generation sectors. The plan will serve to inform policy makers and others about the state's energy situation. It includes analysis of the potential contribution of energy efficiency and renewable energy in reducing the state's need for fossil fuel and nuclear resources.

Economic Development Analysis and Outreach has involved multiple efforts, including the production of the Economic Developer's Guide to the Renewable Energy Industries, Volume 4, Spring 2010. Additional benefits to the state from our focused expertise include: increased awareness and understanding of opportunities and strategies for capitalizing on the economic growth potential in the green economy; access to analysis and unbiased third-party financial reviews for local governments seeking to tap into the value of new markets for renewable energy and carbon offsets; and through stakeholder interactions the state benefits from increased economic activity, more productive economic development investments, and lower transaction costs resulting from stakeholder progress along the experience curve.

Our work in this type of analysis includes several other outcomes. We have produced a report on the technical and economic potential for wind development in North Carolina. Produced a paper that details how costs and benefits of wind development can be modeled and predicted to help determine site and turbine selection. Produced a policy brief and paper that details the hurricane threat to offshore wind development for North Carolina. And produced a report on supply chain problems associated with green buildings and communities. As a result of our

analyses, developers and policymakers should be able to better assess the potential for economic development related to wind development and green building and community development in the state.

Our work on Hydrogen & Fuel Cell Industry Development & Commercialization reaches beyond the state and national arenas and onto the international stage. The Sixth International Hydrail Conference was held in Istanbul, Turkey on 1-2 July 2010. The conference is funded by the United Nations, through Istanbul-based International Centre for Hydrogen Energy Technologies (UNIDO-ICHET). Representatives from over a dozen countries were in attendance and a special information session for the Director of the Turkish State Railways was included. Of specific interest within North Carolina is that Charlotte has incorporated hydrogen-fueled mass transit technologies into their infrastructure planning and cost-benefit analyses. A manufacturer of hydrogen vehicles, Proterra LLC, engaged the state in an attempt to locate 1,000+ jobs in the Charlotte area (though eventually decided on the Greenville, SC area). North Carolina benefits from these activities through increased international recognition as a globally engaged state and source of high-technology innovation. These activities have brought new green transportation technology OEM's to the doorstep, and will likely result in growth in supplier industry jobs in batteries, textiles, plastics, and reinforced composite materials production. Furthermore, these activities bring attention to a resource that will be vital to future energy systems, hydrogen.

The final initiative in our review is the Student Energy Research Development. In it we assist students at Appalachian State University to complete energy related research by providing seed funds to be used to carry out research activities mentored by an advisor. The program will help significant and important research to be completed within the state and provide students within the state an opportunity to significantly improve their research skills that they will carry with them into the workplace.

FACILITIES

Solar Training and Research Facility is in development at the University's State Farm Road location, with construction nearing completion. This facility provides a site for testing and research on performance of available solar equipment. This work will allow homeowners and businesses to adopt these technologies with confidence and make the best decisions about what technology to adopt. The facility provides educational opportunities for future employees of the regional Green Economy.

Small Wind Testing & Demonstration Facility on Beech Mt provides a site for the testing small wind turbines. Most of the wind turbines being installed in western NC and throughout 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.

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 feedstocks 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.

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

Photovoltaic Materials and Device Characterization Facility in the Department of Physics and Astronomy is under development. This site will provide the tools and training for ASU students and faculty to develop, fabricate and characterize PV devices. This facility serves as a user facility where PV researchers, fabricators, and users can have their PV materials and devices fabricated and tested. It is hoped and expected that the results of this work will serve as a resource for others who will need to use the tools we are developing to aid in their pursuit of fabrication and/or characterization of PV materials and devices. We can provide critical PV device measurements and characterizations at little or no cost to NC based companies and researchers.

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.

I. MAJOR ACCOMPLISHMENTS

Major development items for the Appalachian Energy Center for this period include facility enhancements and expansions, organizational structure improvements, and expansion of internal and external collaborations.

A. FACILITY ENHANCEMENTS AND EXPANSIONS

As discussed in more detail in the facilities section above, the Appalachian Energy Center has continues to expand and enhance our facilities both on campus and off. Major expansions and additions include: 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 EcoComplex, and Landfill Gas Research and Development Lab at the Watauga County Landfill. While these facilities are currently operating on a limited basis and offering some data, all three will be complete and fully operational by the end of 2011.

B. ORGANIZATION STRUCTURE IMPROVEMENTS

Ongoing improvements in the organizational structure of the Appalachian Energy Center include the formalization of our program areas, staff titles and reporting hierarchy, and development of titles and responsibilities of associated faculty. These efforts are being completed in collaboration with the other two centers of the Research Institute for Environment, Energy, and Economics (RIEEE).

C. EXPANSION OF COLLABORATIONS

Both internal and external collaborations have greatly expanded in the current reporting period. Significant additional collaborations include the development of an NSF I/UCRC with UNC Charlotte, Carnegie Mellon University, and City College of New York (part of the CUNY system), the development of renewable energy engineering programs with UDLAP in Peubla, Mexico and The University of the Free State in Bloemfontein, South Africa. Internal collaborations have expanded greatly as shown in the faculty participation section above.

D. EXTERNAL FUNDING ACTIVITY

SUMMARY

Appalachian Energy Center receives core funding through an Appropriation from the North Carolina Legislature. In addition, AEC supported 16 proposals that have remained active over the past year. One submitted proposal is currently under review and six additional were rejected. Of the 18 active funded projects, at least 14 provide indirect funds to the university. The total funds secured exceed $6,250,000. AEC staff have worked with 9 county governments to develop Landfill Gas proposals and thus far 7 have been funded with total funds secured equaling $6,367,280.

AEC Proposals	Total Number	Number w/ Indirect	Total $
Appropriation	1	1	$1,125,090
Total Submitted	24	14 of 18 active	**$10,336,780**
Awarded	16	12	$5,125,348
Under Review	1	1	$999,881
Rejected	6	n/a	$3,086,461

Proposals With Counties			
County Landfill Gas Proposals	9	n/a	$7,067,282
Awarded	7	n/a	$3,492,435
Additional leveraged funds from other sources		n/a	$2,874,845
		Total Funded	**$6,367,280**
Under Review	2	n/a	$700,000

PROPOSALS AWARDED

1. Green Economic Asset Mapping
Researchers: Jason Hoyle
Funding Agency: Z. Smith Reynolds Foundation, Inc.
Amount: $34,602
Dates: 7/1/2010 – 6/30/2011 Indirect: NO

2. Student Energy Internship and Fellowship Program
Researchers: Marie Hoepfl, Jeff Ramsdell, Jeff Tiller, Dennis Scanlin
Funding Agency: ARRA – US DOE thru NC State Energy Office
Amount: $485,857
Dates: 4/30/2010 – 6/30/2012 Indirect: Yes

3. NC Home Energy Efficiency Marketing Development and Implementation Program
Researchers: Jeff Tiller, Jamie Russell, Lee Ball, and Bruce Davis
Funding Agency: ARRA – US DOE thru NC State Energy Office
Amount: $2,550,000
Dates: 5/1/2010 – 4/20/2012 Indirect: Yes

4. 2011 Solar Decathlon *
Researchers: Jamie Russell and Chad Everhart
Primary Funding Agency: National Renewable Energy Laboratory
Amount: $100,000
Secondary Funding Agency: Lowes
Amount: $350,000 (Cash and Equipment and Materials)
Dates: 5/1/2010 – 12/31/2011
Indirect: the Energy Center is providing financial management support for funds provided for this project by Lowes

5. Appalachian State University Wind Application Center – APPWAC
Researcher: Dennis Scanlin
Funding Agency: National Renewable Energy Laboratory
Amount: $59,951
Dates: 9/1/2010 – 8/31/2011
Indirect: Yes

6. Watauga County Energy Analysis Project
Researcher: Jason Hoyle
Funding Agency: Watauga County
Amount: $1,975
Dates: 9/1/2010 – 10/31/2010
Indirect: No

7. Community-based Landfill Gas Utilization In Brazil - Phase I
Researcher: Jeff Ramsdell and Stan Steury
Funding Agency: U.S. Environmental Protection Agency
Amount: $120,000
Dates: 9/1/2009 – 3/31/2011
Indirect: Yes

8. Community-based Landfill Gas Utilization in Brazil - Phase II and Extension
Researchers: Stan Steury, Jeff Ramsdell, Jeremy Ferrell, Patricia Cornette
Funding Agency: U.S. Environmental Protection Agency
Amount: $120,000
Dates: TBD
Indirect: Yes

9. ASU Western North Carolina Wind Energy Initiative, NC Solar Center
Researcher: Dennis Scanlin
Funding Agency: US Dept of Energy
Amount: $25,870
Dates: 7/1/2009 – 6/30/2011
Indirect: Yes

10. NSF Planning Grant: Sustainable Integrated Buildings and Sites (SIBS)
Researcher: Jeff Ramsdell
Funding Agency: NSF- Industry/University Collaborative Research Centers
Amount: $10,000
Dates: 2/1/2010 – 1/31/2011
Indirect: Yes

11. Wind Powering America – NC Mountain Outreach
Researcher: Dennis Scanlin
Funding Agency: US DOE Wind Powering America – National Renewable Energy Lab
Amount: $75,321
Dates: 3/19/2008 – 11/30/2010
Indirect: Yes

12. Improved Energy Code for NC

Researcher: Jeff Tiller
Funding Agency: US Dept of Energy thru NC State Energy Office
Amount: $254,546
Dates: 4/22/2009 – 12/31/2011
Indirect: Yes

13. Extraction & Refinement of Oils from Biodiesel Feedstocks
Researcher: Nicole Bennett
Funding Agency: Biofuels Center of NC
Amount: $129,133
Dates: 7/1/2009 – 11/30/2010
Indirect: Yes

14. Technical Assistance – City and County Energy Efficiency
Researcher: Jamie Russell
Funding Agency: ARRA – US DOE thru NC State Energy Office
Amount: Reimbursement for expenses
Dates: 9/24/2009 – 5/31/2010
Indirect: Yes

15. Watauga County Green Business Certification Program
Researcher: Laurel Elam
Funding Agency: Watauga County Economic Development Commission
Amount: $58,093
Dates: 8/1/2007 – 6/30/2011
Indirect: ?

16. Optimization of North Carolina Biodiesel Production through Data Regulated Processing of Variable Alternative Feedstocks
Researcher: Jeff Ramsdell, Nicole Bennett, Eric Allain
Funding Agency: The University of North Carolina Research Competitiveness Fund
Amount: $275,000
Dates: 3/1/2008 – 8/30/2008
Indirect: No

17. Modular Biodiesel Testing Facility – Combustion Analysis
Researcher: Jeff Ramsdell
Funding Agency: U.S. Department of Energy
Amount: $295,200
Dates: 5/1/2008 – 9/30/2010
Indirect: Yes

18. Biodiesel Testing Facility
Researcher: Jeff Ramsdell
Funding Agency: Golden Leaf Foundation
Amount: $750,000
Dates: 7/1/2007 – 12/31/2010
Indirect: Yes

19. AEC Core Funding – NC Legislature Appropriation
Researchers: Jeff Ramsdell + all associated faculty and staff
Funding Agency: MOA NC Dept of Commerce and ASU
Amount: $1,125,090
Dates: 7/1/2009 – 6/30/2011
Indirect: Yes

PROPOSALS AWARDED – to Counties With AEC Assistance

1. Landfill Gas Proposals for Counties Supported by AEC
Researcher: Stan Steury, Jason Hoyle, Joey Mosteller
Funding Agency: ARRA – thru NC State Energy Office

The following grants were recently approved for our cooperating counties in response to proposals we helped develop.

- Columbus County -- $544,500 to install landfill gas generators to produce electricity and to develop on-site greenhouses to use waste heat from the generators - Total cost of the project is $951,500
- Edgecombe County -- $325,000 to install generators to produce electricity and develop uses for the waste heat from the generators - Total cost of the project is $825,000
- Robeson County -- $1 million to capture, condition, and compress methane gas and use it to produce thermal energy for adjacent business use - Total cost of the project is$1,549,900
- Rockingham County -- $814,300 to install and operate a methane collection system carbon credit verification equipment and electricity generators and electricity interconnect upgrades -Total cost of the project is $1.9 million
- Scotland County -- $250,000 to build a gas collection system and use the methane to run an engine/generator for electricity generation - Total cost of the project is $336,045
- Wilkes County -- $358,635 to complete a gas collection system and use the gas for electricity generation and thermal heat for a greenhouse project
- Gaston County -- $200,000 to install landfill gas generators – Total project cost is $446,200

PROPOSALS UNDER REVIEW

1. What Are People Breathing? Establishing Baselines Before and After Home Weatherization Measures

Researchers: Susan Doll and Bruce Davis
Funding Agency: US HUD – Healthy Homes Technical Studies
Amount: $999,881
Date: 11/8/2010
Indirect: Yes

2. Landfill Gas Proposals for Counties Supported by AEC
Researcher: Stan Steury, Jason Hoyle, Joey Mosteller
Funding Agency: ARRA – thru NC State Energy Office
Caldwell County -- $300,000 to install landfill gas generators to produce electricity
Rutherford County -- $400,000 to install landfill gas collection system and generators and greenhouses heated with waste heat from the generators

PROPOSALS REJECTED

1. Energy Code Training
Researcher: Jeff Tiller
Funding Agency: ARRA – US DOE thru NC State Energy Office
Amount: $998,236
Date: 8/2/2010
Indirect: Yes

2. Passive Energy & Building Systems: Finance, Design, Engineering, Construction, and Operations
Researcher: Jeff Ramsdell – ASU and Volker H. Hartkopf – CMU
Funding Agency: NSF – EFRI SEED Grant
Amount: $606,390
Date: 4/6/2010
Indirect: Yes

3. Closed Loop Biodiesel Technology Transfer; from Appalachia to the Nordeste Phase I
Researcher: Jeremy Ferrell, Martin Mezner, & Jeff Ramsdell
Funding Agency: USDA (International Science and Education Grants)
Amount: $60,743
Not Funded

4. Appalachian State University - Testing of Small Wind Turbines at Regional Test Center - Small Wind Test Center
Researcher: Dennis Scanlin
Funding Agency: National Renewable Energy Laboratory
Amount: $636,458
Not Funded

5. Bio-char Cost-Benefit Analysis
Researcher: Jason Hoyle
Funding Agency: NC Farm Center for Innovation and Sustainability
Amount: $34,717
Not Funded

6. STEMulating Appalachia
Researchers: Brian Raichle, Jerianne Taylor, Laura England, & Carla Ramsdell
Funding Agency: Golden LEAF Foundation, Inc.
Amount: $749,917
Not Funded

II. PROBLEMS/NEEDS

Important needs include proper salaries for permanent staff, research space on campus, and an increase in the number of full-time technical staff.

A. PROPER STAFF SALARIES

Salaries of a few Appalachian Energy Center staff are currently well below market rate. Even with the current state budget crisis these salaries should be increased to market rate in order to retain these important employees and continue our current success. These employees have performed exceptionally well and are experts in their field.

B. ON-CAMPUS RESEARCH SPACE

The Appalachian Energy Center continues to operate with no real research space on campus other than that of a few collaborating faculty. This lack of space greatly reduces our ability to expand important research programs, especially in the area of high performance buildings. We are currently turning away external funding opportunities due to this lack of on-campus space.

C. FULL-TIME TECHNICAL EMPLOYEES

The Appalachian Energy Center is also in great need of further full-time technical researchers. This need is most apparent in the lack of any full-time staff dedicated to renewable energy technologies. This deficiency greatly reduces our ability to apply for large external grants.

III. PERSONNEL

A staff member Laurel Elam resigned from her position in February 2010. Dr. Jeff Ramsdell joined the staff of the Energy Center as Director in January 2010. Staff who joined the Energy Center include Kelly Stokes, Brian Witmer, and Joey Mosteller.

Director Dr. Jeff Ramsdell

Staff

Amanda Perry	Kellie Stokes
Brian Witmer	Joey Mosteller
Bruce Davis	Stan Steury
Jason Hoyle	Laurel Elam
Jeremy Ferrell	Quint David
John Lehman	

AEC staff and associated faculty developed a multiple discipline initiative plan through which to apply funding from the North Carolina Legislature Energy Centers Appropriation and received a MOU to proceed from the NC Energy Office. Work has been being pursued by 11 Center staff, more than 34 project staff, and 24 faculty.

AEC competed for additional externally funded projects which involved 6 additional faculty.

Campus Researchers	Total Number
Total	24
Department/College	
Technology/FAA	11
Chemistry/CAS	4
Physics/CAS	3
Geography & Planning/CAS	2
Biology/CAS	1
Economics/COB	1
ORSP/Grad School	1
Sustainable Development/UC	1

AEC's efforts entailed collaborations with many other research institutions (e.g., subcontracts, co-PIs, etc.)

Off-Campus Collaborations
University of North Carolina Charlotte
Carnegie Mellon University
North Carolina Solar Center at NCSU
Catawba County EcoComplex
Southern Energy Management
Center for Energy Research & Technology at NC A&T
City College of New York
NC Fuel Cell Alliance
Advanced Energy Corporation
County Governments – Multiple for Landfill Gas Initiatives

V. STAFF AND FACULTY ACTIVITY

A. RESEARCH REPORTS

Taylor, Marcus, 2010, Public Opinion of Wind Turbines in Watauga County, North Carolina (report in progress)

Scanlin, Taylor & Kersey, 2010, Public Opinion of Wind Development in Western North Carolina (report in progress)

Scanlin, Taylor & Flynt, 2010, Wind Resources of Western North Carolina (report in progress)

Scanlin, Taylor & Flynt, 2010, Potential Economic Impacts of wind energy development in Western North Carolina (report in progress)

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

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

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

Tiller, Jeff, Bruce Davis, Sean Gray, Erica Porras. 2009. "Preliminary Report: Revised Duct Design Performance." Appalachian Energy Center Report.

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.

Lehman, John. 2010. Trends in the Manufactured Home Industry. Draft report for the Appalachian Energy Center.

Erwin, Anna. 2010. Implementing a PACE Program Using Community-Base Social Marketing. Draft report for Appalachian Energy Center.

Scanlin, Dennis. 2010. Development and completion of three surveys on attitudes toward wind energy in western NC (Watauga Co., 24 counties of WNC, and owners of windy land).

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., 2010. Using GIS for Microhydro Assessment for Residential Energy in Ashe County, NC. *North Carolina Arc Users Group Conference, Carolina Beach, NC, Sept. 2010.*

Hyman, A., and Badurek, C.A., 2010. A GIS Approach to Estimating Microhydro Energy in Western North Carolina. *North Carolina Arc Users Group Conference, Carolina Beach, NC, Sept. 2010.*

Anthony, M., Saunders, B., and Badurek, C.A., 2010. Potential Residential Users of Microhydro Power in Western North Carolina. *North Carolina Arc Users Group Conference, Carolina Beach, NC, Sept. 2010.*

Hyman, A., Badurek, C.A., Anthony, M., and Saunders, B., 2010. GIS Methods for Estimating Potential Residential Users of Microhydro Energy in Western North Carolina. *Southeastern Division of the AAG Annual Conference, Birmingham, AL, Nov. 2010.*

Ferrell, J. (2009). Testing Modular Biodiesel Processing, Oilseed Feedstocks, and Combustion Emissions at the EcoComplex in Catawba County, North Carolina. Proceedings from 1st Biofuels Technology Shortcourse, Fulbright Commission-Brazil, Sao Paulo.

Sanderson, Matthew C., Mark E. Venable. A Novel Assay of Acyl-CoA: Diacylglycerol Acyltransferase Activity Utilizing Fluorescent Substrate. Under second review in the journal Lipids, Springer Life Sciences

Schwab, A. D. (Author Only), Kanupp, A. (Presenter & Author), Sears, T. (Author Only), Conway, M. (Author Only), Casey, B. (Author Only), Cauthen, L. (Author Only), Miller, J. (Author Only), Bennett, N. S. (Author Only), State of North Carolina Undergraduate Research Symposium, "Synthesis of tetra(4-sulfonatophenyl)chlorin from tetra(4-sulfonatophenyl)porphyrin," North Carolina, Wilmington, NC. (November 21, 2009).

Bennett, N. S. (Author Only), Lopez, M. (Presenter & Author), State of North Carolina Undergraduate Research Symposium, "USE OF MAGNETITE TO REMOVE FATTY ACIDS FROM WASTE OIL: APPLICATION TO BIODIESEL SYNTHESIS," Wilmington, NC. (November 21, 2009).

Steury, Stan – Edgecombe County Sweet Potato Processing Feasibility Final Report 7/8/2009

Steury, Stan – Wilkes County Germantown LFG Pump Test & Demo Final Rpt 9/2/2009

Steury, Stan – Watauga County LFG to Energy Analysis 9/8/2009

Steury, Stan – Electricity Generation at Small Landfills 9/15/2009

Steury, Stan – A Strategy for Landfill Gas Development At The East Carolina Regional Landfill 3/2/2010

Steury, Stan – Golden LEAF Community TIES Final Report 3/14/2009

Hoyle, Jason. *Carbon Credit Purchasing in the Local Decision Context*. Presentation to EPA LMOP Conference. Baltimore, MD. Jan. 12, 2010.

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

Lehman, John. 2009 Cash for Clunkers: The Good, the Bad and the Ugly. Working paper for Appalachian Energy Center and CERPA

Lehman, John. 2009 Cash for Clunkers: Should Ownership be required. Policy Brief for Appalachian Energy Center and CERPA

Lehman, John. 2009 North Carolina and U.S. Impacts from Cash for Clunkers. Policy Brief for Appalachian Energy Center and CERPA.

Lehman, John. 2010. Contracting Out the Energy Utility. Working paper for The Appalachian Energy Center and CERPA

Lehman, John. 2010. Policy Matters. Economic Developer's Guide. The 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.

Lehman, John and Joey Mosteller. 2010. The Hurricane Threat for North Carolina Offshore Wind Development. Policy Brief for Appalachian Energy Center and CERPA.

Lehman, John and Quint David. 2010. Choosing a Wind Site. Working paper for Appalachian Energy Center and CERPA.

Lehman, John. 2010. Supply chain problems in the delivery and sale of green buildings and communities. Draft report for Appalachian Energy Center.

B. RESEARCH PRESENTATIONS

Tiller, Jeff, Bruce Davis, Sean Gray, Erica Porras, Andrew Windham. 2010. "Performance of Revised Duct Design, Save Money and Cool Customers." Presentation delivered at the national RESNET conference, Raleigh, NC. February 24.

Three presentations for Building Code Mechanical Inspectors on the NC Energy Code

One presentation for Council of Educational Facility Planners International conference on Building Envelope Failure Examples

Two, hands-on, In the Field Building Diagnostic and Performance Measurement Workshops

Completed revisions of the following PowerPoints, with presenter notes for presentation:

1. Intro to SL 1946 and 668
2. Complying with SL 1946 and SB 668
3. Architectural-Engineering Design Strategies
4. Lighting, Controls, Daylighting
5. HVAC Systems and Controls
6. Commissioning and Measurement and Verification
7. Energy Modeling and Life Cycle Cost Analysis
8. Water Efficient Strategies
9. Operations for Energy Efficiency

Completed a day-long presentation on Energy Modeling for Architects

Conducted workshops on Energy Modeling for Architects for the North Carolina chapter of the American Institute of Architects on March 17th in Charlotte and March 31st in Raleigh. 2010.

Presentation "AIA Commercial Code Presentation 9_30_09" for the North Carolina American Institute of Architects Annual Board Meeting, Greenville, SC, September 30, 2009.

Presented economic analysis of the proposed energy code to the NC Chapter of the American Institute of Architects in Spartanburg, SC at their 2010 annual meeting.

C. PUBLIC ENGAGEMENT (BY FOCUS AREA)

High Performance Buildings

On February 21 – 24, 2010, over 950 building performance professionals gathered in Raleigh, North Carolina to participate in the combined NC Energy Star and 2010 RESNET Building Performance Conference. The conference provided a unique opportunity for participants to share the latest information on successful business models, program delivery, technical innovations and policy initiatives. Not only did this year's conference top all previous conference attendance records, it also offered the most break-out sessions, 70, plus 8 preconference sessions. There were also 62 vendors in the exhibit hall.
Conference keynote addresses were presented by:
Donna McIntire of the United Nations Environmental,
David Goldstein of the Natural Resources Defense Council, and
Philip Fairey of the Florida Solar Energy Center.

Hydrail Conference

The Sixth International Hydrail Conference was held in Istanbul, Turkey on 1-2 July 2010. The conference is funded by the United Nations, through Istanbul-based International Centre for Hydrogen Energy Technologies (UNIDO-ICHET). Representatives from over a dozen countries attended and a special information session by the Director of the Turkish State Railways was included in the schedule.

Wind Initiatives

Approximately 1000 people have attended our wind energy workshops over the last 7 years. Participants have come from more than 30 US states and 10 different countries. Many more have visited the small wind turbine site at Beech Mountain, which is open to the public.

Biofuels

We have had multiple successful workshops on oil extraction with press demonstrations. The first workshop was part of the Western North Carolina Renewable Energy Series and demonstrated the technology to 14 participants including community members, and students. The second workshop was for the Unifour Cooperative Extension Advisory Council. This group consisted of 40 participants from Catawba, Alexander, Burke, and Caldwell Counties.

Public Policy Polling, 2010, Wind Energy Survey Results report, completed and placed on wind.appstate.edu website

Produced a map of 174 schools in North Carolina with average annual wind speeds greater than 10 mph at 30 meters and a data base of contact information

1 small wind workshop developed, advertised and conducted

10 presentations given at conferences and meetings

Developed an updated factsheet on wind energy

Developed a new informational kiosk on Wind Energy for the Beech Mt test facility

Center for Economic Research and Policy Analysis (CERPA)

MISSION

The Center for Economic Research & 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 & energy, and experimental & survey research.

PROGRAMS

The Experimental Economics Program 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 wind tunnel 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 6 experimental economists that constitute one of the largest and strongest experimental groups in the country. A recent ranking placed Appalachian's Experimental Economics group among the top 20 in the country.

The experimental program was extremely active during 2009-2010. CERPA's experimental lab supported eight research projects funded by the National Science Foundation, Internal Revenue Service, Office of Naval Research, World Resources Institute, among others. Over 1000 subjects participated in the sessions. Over $20,000 in funds were paid to student subjects.

The Economic Development Program 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. 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, time 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.

The Survey Research Program is a newly formed program that 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 just an investment of $1300, the new survey lab supported 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. Over $30,000 was paid to students for interviewing and supervising.

Environment & Energy 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.

FACILITIES

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 wind tunnel that reveals the response and outcomes associated with alternative policies. AppEEL is directed by 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. AppSRL is directed by Todd Hartman.

I. MAJOR ACCOMPLISHMENTS

A. A New Survey Research Lab

We developed a new survey research lab based on interest and talent of faculty. CERPA provided initial funds for the facility. Todd Hartman provided the faculty expertise. The Appalachian Survey Research Lab (AppSRL) has provided valuable new capacity for research. It has been a vital element in securing two externally funded projects, and interest is growing.

B. Addition of a new program: Survey Research Program

We developed a new CERPA research program: Survey Research Program. This new program coincides with the new capacity (AppSRL) and interest (faculty and external agencies). Todd Hartman, Department of Government Studies, has been designated the director.

C. Updates for Experimental Economics Lab: Database Management

The Experimental Economics Research Program depends on a sizable database of students that participate in the experimental sessions. This database must be updated on a regular basis to keep up with the departure of graduating students. This was done begun this past Spring and will be completed this Fall.

D. Collaboration with Center for Entrepreneurship

CERPA collaborated with the Center for Entrepreneurship to investigate the needs, risks and opportunities of local businesses. We teamed up with area Chambers of Commerce to conduct an internet survey, which generated data on a diverse set of issues. The data will support a set of 3-5 reports, each will be released by the university via a press release. We hope for continued collaboration.

E. Elimination of program: Public Finance

We eliminated CERPA's Public Finance Research Program because of shifting funding opportunities. CERPA, via Mike McKee, previously received considerable funding from the Internal Revenue Service to conduct research on tax policy. Funding from the IRS was expected to continue on a regular basis. The funding has continued, but Mike McKee has decided to administer the funds through the University of Tennessee because of the research limitations on Appalachian's campus.

F. Website

The website is regularly updated and improved, but a substantial revision was made to add a page that lists CERPA projects and the corresponding details.

G. EXTERNAL FUNDING ACTIVITY

Summary

CERPA supported 10 proposals over the past year, with 7 of them being awarded. Of the 7 funded projects, 4 provided indirect funds to the university. The total funds secured exceeded $250,000—a very strong number for an economics and public policy unit, *particularly one without a budget or staff*.

Proposals	Total Number	Number w/ Indirect	Total $
Total Submitted	10	4	$1,901,038
Awarded	7	2	$277,091
Rejected	2	2	$629,095
Under Review	1	1	$994,852

Proposals Awarded

1. Rural Economic Opportunity
Researchers: same as (2)
Funding Agency: North Carolina Rural Economic Development Center
Amount: $10,000
Dates: Summer 2010-Fall 2010
Indirect: NO

2. Rural Economic Opportunity
Researchers: Todd Cherry (PI), Todd Hartman (co-PI), Jammie Price (co-PI), Richard Crepeau (co-PI) and Mike McKee (co-PI); subcontract with UNC School of Government
Funding Agency: North Carolina Rural Economic Development Center
Amount: $90,000
Dates: July 2009-January 2010 (extended September 2010)
Indirect: NO

3. Multi-mode Chesapeake Bay Menhaden Survey
Researchers: John Whitehead (PI), Todd Hartman (co-PI) and Tanga McDaniel (co-PI)
Funding Agency: Virginia Marine Resources Commission
Amount: $51,415
Dates: April 2010-December 2010
Indirect: YES

4. Economic Effects of State Research Funding Through the UNC System
Researchers: Todd Cherry (PI), Ash Morgan (co-PI), Mike McKee (co-PI) and Dave McEvoy (co-PI)
Funding Agency: UNC Research Competitiveness Fund, UNC General Administration
Amount: $79,630
Dates: March 2009-June 2010
Indirect: NO

5. Land Parcel GIS Database Development
Researchers: Chris Badurek
Funding Agency: Highland Mapping
Amount: $4,033
Dates: May 2010-August 2010
Indirect: NO

6. GIS Analysis and Mapping for Watauga County Tourism Authority
Researchers: Chris Badurek (PI) and Richard Crepeau (co-PI)
Funding Agency: Watauga County TDA
Amount: $3013
Dates: June 2009-August 2010
Indirect: NO

7. The Total Economic Impact of Mission Health on the Regional Economy
Researchers: Todd Cherry (PI), Ash Morgan (co-PI) and Mike McKee (co-PI)
Funding Agency: Mission Health
Amount: $39,000
Dates: May 2010-August 2010 Indirect: YES

PROPOSALS UNDER REVIEW

1. Climate Change and Southern Forest Management: Landowner Decisions and Valuing Ecosystem Services
Researchers: Mike McKee (PI), Todd Cherry (co-PI), Todd Hartman (co-PI), Dave McEvoy (co-PI), Ash Morgan (co-PI) and John Whitehead (co-PI)
Funding Agency: USDA; Texas A&M
Amount: $994,852
Dates: January 2011-January 2016 Indirect: YES

PROPOSALS REJECTED

2. The Effects of Voluntary Sleep Loss and Cicadian Mismatch on Controlled versus Automatic Thought Processes
Researchers: David Dickinson (PI) and Todd McEroy (co-PI)
Funding Agency: $353,110 Indirect: YES

3. Measuring the Effectiveness of Seafood Traceability Systems and Risk Information on Mitigating Consumer Losses from Harmful Algal Blooms
Researchers: Ash Morgan (PI), David McEvoy (co-PI) and John Whitehead (co-PI)
Funding Agency: NOAA PCM HAB Program
Amount: $275,985
Dates: July 2010-November 2010 Indirect: YES

II. PROBLEMS/NEEDS

CERPA's development was a faculty-driven process and had not received any support until the reassigned time provided this past year. Considering the level of investment and output, CERPA has been an incredible success. If we wish to maintain and grow this level of research activity, CERPA will require reasonable support and space. The lack of support is particularly

constraining for continued success and growth. Specifically, CERPA would benefit from the following items:

A. Support

Course releases: CERPA has a director for each of its research programs and has appointed research fellows. The objective of each position is for the individual to work towards building teams and capacity for new research proposals and opportunities. The effectiveness of these positions is severely limited because it is completely voluntary, which means the position and the work is very low on their priority list. Compensation is needed to validate the position and motivate the work, while also signifying that research is a priority on campus. Course releases appear to be the easiest and least cost method of compensation. The person in each position can then be held accountable to increasing research activity and external funds, which will largely or entirely recover the cost of the course release. In other words, the course releases would be an investment in efforts to generate more research and external funds.

Budget for public engagement: One goal of CERPA is to disseminate knowledge to the general public on current social and policy issues. The lack of any funds is a significant constraint for our ability to pursue this goal. Currently, faculty members spend their own money to travel for engagement events, and we must solicit donations to hold such events on campus. Again, this does not facilitate an on-going program of engagement. Faculty cannot be expected to donate their own money and time indefinitely, and while soliciting funds and recruiting sponsors is warranted, seed money is required to provide a baseline and avoid uneven levels of activities. Again, the funds would be an investment in efforts of public engagement, preferably ones that generate visibility for CERPA and the university.

B. On-campus Research Space

Office space: CERPA has no office space, which has led to difficulties when trying to meet with people, facilitate collaborations, etc. Office space is not the goal; rather, effective office space—i.e., office space that facilitates collaboration and productive efforts, while also enabling RIEEE and the affiliated centers to effectively use the available support and manage the paperwork. It would be wonderful for RIEEE and the three centers to be located together in Duncan when the College of Education moves to the new building.

C. Research and Administrative Positions

Research Staff: CERPA depends totally on faculty time, which is difficult to recruit. The effect is more than an under provision of research activity, but also an uneven provision. Dedicated research position will serve to attract faculty participation by providing research assistance, but also serve to provide a baseline level of time available to support the various on-going projects. Currently, the on-going or 'permanent' programs depend on faculty donating time, which undermines the effectiveness and productivity of the programs.

Administrative Staff: As is true across campus, administrative support for research is thin. The support staff are excellent, but they are overworked and do not have sufficient 'back up' when people are already committed, out of the office, or leave a position.

III. PERSONNEL

There were no changes in personnel for the Center.

Director Todd L. Cherry

Program Directors Richard Crepeau, Economic Development Program
Brian Ellison, Environmental and Energy Program
Todd Hartman, Director of Survey Research Program
Michael McKee, Director of Experimental Economics Program

Research Fellows Ash Morgan
John Whitehead

Research Associates Chris Badurek
David Dickinson
David McEvoy

Research Affiliates Calvin Blackwell, College of Charleston
Michael Jones, Bridgewater State University

CERPA externally funded projects involved 12 researchers across campus, representing 5 different departments. Half of the proposals involved multi-disciplinary teams of researchers, and CERPA was instrumental in developing these opportunities.

Campus Researchers	Total Number
Total	12
Department/College	
Economics/COB	7
Government Studies/CAS	1
Geography & Planning/CAS	2
Sociology/CAS	1
Psychology/CAS	1

CERPA's efforts entailed collaborations with many other research institutions (e.g., subcontracts, co-PIs, etc.)

Off-Campus Collaborations
Kentucky State Government
UNC School of Government
Texas A&M
Dartmouth College
CICERO-University of Oslo
Georgia State University
University of California-San Diego
Bridgewater State University
NC Rural Center
University of Houston Clear Lake
University of Wyoming

VI. FACULTY ACTIVITIES

A. RESEARCH REPORTS

The WNC Economy: A Decade in Review, John Dawson and Todd Cherry

Billet Assignment and Resource Allocation Experiments, submitted to US Office of Naval Research

The Economic Effects of Mission Health System on the Local and Regional Economy, submitted to Mission Health System

Rural Economic Opportunity, submitted to the NC Rural Economic Development Center

UNC System Research: The Annual Economic Impact on the North Carolina State Economy, submitted to the UNC General Administration

Collaboration with Center for Entrepreneurship entailing a survey of local businesses and a series of accompanying reports

WNC Economic Index and Report (12 reports)

B. RESEARCH PRESENTATIONS

Mission Health System, Asheville NC, May 2010

Mission Health System, Asheville NC, August 2010

NC Rural Economic Development Center, Raleigh NC, October 2009

NC Rural Economic Development Center, Boone NC January 2010

NC Rural Economic Development Center, Winston-Salem NC May 2010

Center for International Climate and Environmental Research-Oslo, University of Oslo, Norway June 2010

C. PUBLIC ENGAGEMENT

Public Lecture: Jason Shogren, Univ of Wyoming, IPCC Lead Author, White House Advisor

Interview: with NC Business on WNC economy (leading statewide business magazine)

Media Appearances: Numerous appearances in local, regional and statewide newspapers, such as Winston-Salem Journal, Asheville Citizen-Times, Alleghany News, McDowell News, Wilkes Journal Patriot, Watauga Democrat, etc. Examples include:

• Region's Economy Continues its Rocky Ride, High Country Press, August 26, 2010.

•Asheville-area Road out of Recovery Slow and Bumpy, Asheville Citizen-Times, Aug 24, 2010.

•New Buyers, Unexpected Places Fuel Home Sales, Asheville Citizen-Times, Feb 28, 2010.

•WNC Index Ends 2009 on an Upswing, Alleghany News, February 17, 2010.

•Slight Improvement Found in WNC Economy, Winston-Salem Journal, February 11, 2010.

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

MISSION

The mission of the Southern Appalachian Environmental Research and Education Center (SAEREC) is to promote interdisciplinary environmental research and educational outreach in the southern Appalachian region. Through these efforts SAEREC will contribute to an increased understanding of the critical challenges facing natural ecosystems in this region due to human activities.

Specific Objectives 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, and
4) actively engage and mentor students in environmental research and educational outreach

This mission statement was approved by the SAEREC Board of Advisors on July 21, 2010.

PROGRAMS

SAEREC is in its first year of existence, and is still developing its research programs. The first organized group within SAEREC was AppalAIR, which is an interdisciplinary atmospheric research initiative. The Director of SAEREC, with the assistance of John Pine, RIEEE Director, is also working to organize several other research "clusters", defined as groups of faculty who share particular interests in environmental research and who may work together to develop new research programs that address the mission and goals of SAEREC.

The approach being taken at these early stages is to create research clusters centered on atmospheric processes (AppalAIR), water resource issues (quality and quantity), earth systems (land, soil, hydrology, nutrient cycling, etc.), and conservation ecology (which would include biodiversity issues). A diagrammatic view of the interaction of these clusters, both within SAEREC, and among the other RIEEE Centers, is shown in Figure 1 below.

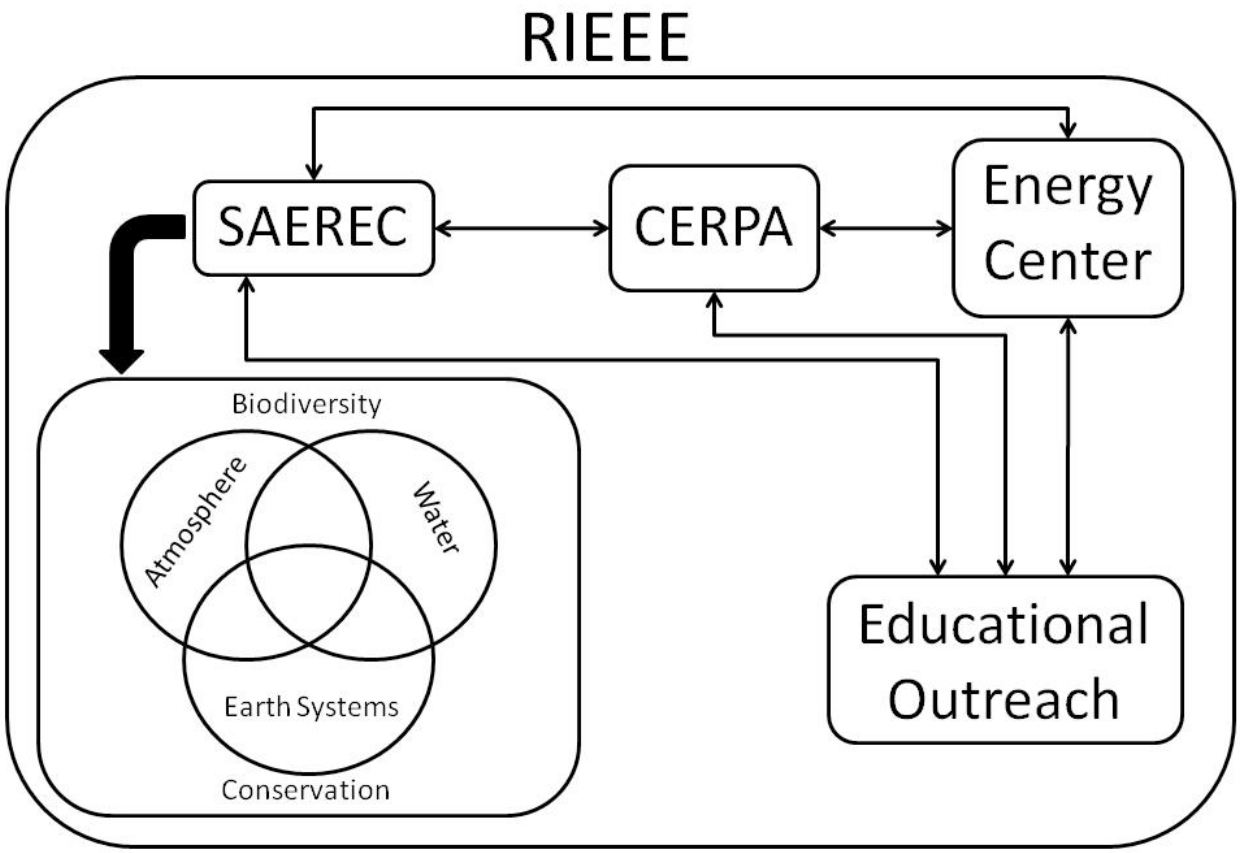

Figure 1. Tentative organizational structure of SAEREC as embedded within the larger framework of the RIEEE.

A. Atmospheric Issues

AppalAIR is the ***Appal***achian ***A***tmospheric ***I***nterdisciplinary ***R***esearch Group 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. A second goal is to educate the public about the importance of atmospheric research and climate change.

The members of AppalAIR include:

Howard Neufeld, Chair	(BIO)
Brett Taubman	(CHE)
Jim Sherman	(A&P)
Baker Perry	(G&P)
Rahman Tashakkori	(CS)
Ryan Emanuel	(NCSU, adjunct member)
David Miller	(UNC-A, adjunct member)

B. 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, but no particular research initiatives have been started that pertain to SAEREC. However, the group is informed about SAEREC, and future proposals are anticipated.

C. Earth Systems

The Earth Systems Group is not yet formed, but a meeting is planned for the spring semester of 2011 to introduce faculty to each other, to determine if there is enough interest to make this a formal working group, and if so, to elect people to lead and manage this cluster. One goal would be to create a mission statement for this cluster, along with specific research objectives.

D. Conservation Ecology

This research cluster is not yet formed either, and as with the Earth Systems Group, a meeting will be held in the spring to formalize this research cluster.

It should be noted that 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 not the role of SAEREC to "push" science onto any faculty as a top-down measure. Rather, it is the hope that SAEREC will facilitate faculty collaborations that arise from the bottom-up collaborations, both within ASU 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.

FACILITIES

The AppalAIR group has a research building and sampling tower located on the ASU campus behind the Broyhill Inn & Conference Center. The 16' x 20' building houses numerous instruments used to sample the air and to measure meteorological parameters. A second facility is being readied for occupancy some time in 2011 in a climate-controlled shed located behind the Top Shop at Grandfather Mountain. A separate set of instruments are located on the roof of the Broyhill Inn for measuring various aspects of incoming solar radiation.

There are no other facilities at this time in SAEREC.

I. MAJOR ACCOMPLISHMENTS

SAEREC is working to develop research clusters (see above), as well as to get its webpage online soon. Gangloff is coordinating website development and requests that affiliate faculty provide him a brief (1-2

paragraphs) overview of their SAEREC-related research activities. A working website template (non-public) can be found at (http://saerec.appstate.edu).

A. Projects

There were no active projects in the 2009-2010 fiscal year, but there are several in various stages of development that were begun during the summer of 2010, some after the close of the 2009-2010 fiscal year. The first involves establishing a tree inventory for the ASU campus, and is a collaboration with the ASU Physical Plant and Dr. Michael Madritch, along with a graduate student, Jason Harkey. This project has been given the green light by the Physical Plant, and will begin in spring semester of 2011.

The second project is to explore the feasibility of restoring the trail system in the ASU Nature Preserve, and creating entrance ways for the public. The Director attended a trail teleconference in Belk Library on Wednesday, October 6th to explore various ways of funding trail restoration. Additional avenues for funding are currently be investigated.

The third project is a collaborative effort with Drs. Beverly Collins from Western Carolina University, and Jonathan Horton from UNC-Asheville, for organizing a southeast regional phenology meeting, to be held in the Research Triangle area in May or June of 2011. Financial support has already been promised from the USGS National Phenology Network and the US Forest Service in Raleigh, and additional support is currently being sought from other agencies, including NOAA (National Climatic Data Center in Asheville) and from the U.S. Fish & Wildlife Service.

Dr. Mike Gangloff has a number of active grants that have gone through SAEREC, although most of these occurred after the end of the fiscal year. One involves examining a 40 year legacy of environmental devastation at the hands of the Army Corps of Engineers. His research group is surveying relict habitats on the East Fork Tombigbee River that were severed by the construction of the Tenn-Tom waterway. This waterway has directly contributed to the extinction of three freshwater mussel taxa. The second project has two foci; one involves conducing a survey of the western Florida panhandle (three river systems) for a suite of mussels that are nearly extinct and will soon be protected as Threatened & Endangered species. The second is working with USFWS to assess impacts of water demand and flow variability on endangered mussel populations in the Apalachicola River. Both projects have strong potential for multiple years of additional funding. Gangloff has been working on the Apalachicola since 2005 and have been funded by several agencies.

Dr. Gabriele Katz, in Geography & Planning, has submitted two contracts (one to the USGS and one to the Three Rivers Alliance) to study ways to control the invasive Russian Olive Tree in Arizona. These too were submitted for the next fiscal year (2010-2011), but are mentioned here just to show that the current fiscal year has much more activity than the previous one.

B. EXTERNAL FUNDING ACTIVITY

SAEREC administered 2 proposals over the past fiscal year of 2009-2010 totaling $918,213 in requests. Three AppalAIR researchers obtained a NASA educational outreach grant for $499,970 which will provide a total of $22,928 indirect for RIEEE, of which $17,196 will come to SAEREC (over 3 years). An additional 10 proposals have been submitted since July 2010 and 8 were awarded a total $182,893. The

remaining 2 grants are still under review. There will be some indirect to SAEREC for the 2010-2011 fiscal year from these grants and that amount will be included in the 2010-2011 annual report. Table 1 summarizes our external support activities for this first year of existence for SAEREC.

Table 1. Number of Proposals Submitted, Awarded, Rejected, and Total Funding Amounts

Proposals	Total Number	Number with Indirect	Total Dollars
Total Submitted	3	2	$580,240
Awarded	2	2	$580,240
Rejected	1		$418,243
Under Review	0		

PROPOSALS AWARDED

1. Title: Climate Action Network through Direct Observations and Outreach (CAN-DOO): Promoting Climate Science Awareness through Public Outreach, STEM Education, and Citizen Science
PIs: Brett Taubman, James Sherman and Baker Perry
Funder: NASA SMD Education and Public Outreach
Amount: $499,970
Indirect: RIEEE gets $22928.20, of which $17,196 comes to SAEREC
Duration: April 2010 – March 2013

2. Title: RUI: Acquisition of a Mobile Tower System for Interdisciplinary Atmospheric Research
PIs: Ryan Emanuel*, Howard Neufeld, Brett Taubman, James Sherman and Baker Perry
Funder: NSF-MRI
Amount: $191,397, but since Emanuel has moved to NCSU, ASU will get a subcontract for $77,880
Indirect: RIEEE gets $985, of which $739 comes to SAEREC
Duration: November 2010 – November 2011

PROPOSALS UNDER REVIEW

There are no proposals under review from the 2009-2010 fiscal year, but there are two for the 2010-2011 fiscal year.

1. Title: Request for a Postdoctoral Fellow from US Department of Commerce
PIs: James Sherman and Brett Taubman
Funder: NOAA
Amount: $168,259
Indirect: unknown
Duration: unknown

2. Title: Collaborative REU Site: High Elevation Outcrop Communities as Sentinels of Climate Change
PIs: Howard Neufeld, Michael Madritch and Eva Gonzales
Funder: NSF
Amount: $140,800
Indirect: $10,800
Duration: May 2011 – August 2013

PROPOSALS REJECTED

1. Title: NSF-MRI: Acquisition and Set Up of a Controlled Environment Growth Facility to Enhance Biological Research at Appalachian State University
PIs: Howard Neufeld, Guichuan Hou, Annkatrin Rose, Michael Madritch and Eva Gonzales
Funder: NSF
Amount: $418,243

II. MAJOR PROBLEMS / NEEDS

A. SUPPORT

The greatest impediment to implementing the goals of SAEREC are:

- finding enough time for faculty to write research grants,
- to provide course releases for those who are funded to do research, and
- to provide financial support to allow faculty to attend meetings, buy equipment, or fund graduate and undergraduate students to do research with them.

SAEREC would greatly benefit by having full-time staff researchers. Currently, Dr. Mike Gangloff is serving 0.25 FTE as assistant director for SAEREC. His duties are to assist the Director in organizing SAEREC, in facilitating outreach and education, to upgrade the webpage, and to write grants. The opportunity to provide course releases would encourage faculty to write grants and submit them through SAEREC as well as allow them carry out that research if they are funded. Incentives such as course releases and providing additional indirect back to the PI of a grant serve as investments of resources that will bolster the productivity of faculty in each of our proposed research clusters, and that should generate even more external funding for SAEREC.

This funding model is particularly relevant for the Educational Outreach initiative that RIEEE is pursuing. We have identified a core of faculty members and part-time employees who have interests in this topic, and we will be holding a meeting in the fall to coordinate activities for

this group. These people will need seed money and time to get operational before they begin writing for external grants.

All the Center Directors would like to have some funding to support programs within the RIEEE, including the establishment of a seminar series. Once we have a regular income from indirect, we will be able to support such activities internally, but for now, we need some seed money to get things going.

B. SPACE

At this point, we are using the Biology Conference Room for meetings of SAEREC personnel. This appears to be adequate for the time being. However, it would be preferable if all RIEEE personnel could be clustered in a suite of offices in order to facilitate communication and to better interact with support people, such as Amanda Perry.

C. ADMINISTRATIVE SUPPORT

It is important for SAEREC to get recognized as a formal center so as to get an organization code. This will make tracking grants much easier, as well as the allocation of indirect.

The development of SAEREC has been possible only with the support and encouragement provided by John Pine, Director of RIEEE, and the resources that he has made available to the Center. The recent hiring of Amanda Perry has greatly helped us to organize proposal submissions, awards and to get a hold on our finances, especially with regards to indirect funds.

Lastly, the functioning of SAEREC is also dependent on my interaction with Mike Gangloff, who is assisting me in getting this organization up and running. Such support will become even more necessary in the future as the number of proposals and awards goes up, and more faculty hopefully become involved with SAEREC.

III. PERSONNEL

Mike Gangloff was assigned to SAEREC to assist in the organization and administration of this center. He maintains his academic appointment in the Department of Biology. Dr. Howard Neufeld was appointed Director of SAEREC.

SAEREC Staff

Director – Howard Neufeld
Assistant Director – Mike Gangloff

SAEREC Board of Advisors

Biology – Robert Creed
Chemistry – Carol Babyak
Geography & Planning – Pete Soule
Geology – Bill Anderson
Physics & Astronomy – Jim Sherman

A. FACULTY PARTICIPATION AND COLLABORATIONS

SAEREC administered projects in the 2009-2010 fiscal year that involved 7 faculty researchers from 7 different departments. Two of these researchers were from two other UNC institutions (NCSU and UNC-A). The AppalAIR group has the most collaborations and these are detailed below.

SAEREC externally funded projects involving 15 researchers from across the ASU campus, representing 6 different departments.

Campus Researchers	Total Number
Total	**15**
Department/College	
Biology	Neufeld, Tuberty, Gangloff, Rose, Madritch, Gonzales and Hou
Computer Science	Tashakkori
Geography & Planning/CAS	Badurek, Perry and Katz
Physics	Sherman
Chemistry	Taubman, Babyak
Geology	Emanuel*

*now at NCSU

AppalAIR Collaborative Efforts

1. National Oceanic and Atmospheric Administration (NOAA) (http://www.esrl.noaa.gov) - AppalAIR is the only participating site east of the Mississippi River in NOAA's global aerosol monitoring network. Dr. Pat Sheridan, of NOAA, is the contact for this collaboration.
2. Grandfather Mountain (http://www.grandfather.com) - AppalAIR monitors the weather at the summit of Grandfather Mountain and will be operating a second atmospheric monitoring station behind the Top Shop in the coming months.
3. North Carolina Division of Air Quality (http://daq.state.nc.us) - The NC Division of Air Quality is assisting AppalAIR in the maintenance and calibration of their trace gas instruments.

4. MRI: Mountain Research Initiative (http://mri.scnatweb.ch) - AppalAIR is a member institution of the Mountain Research Initiative, which functions to coordinate and disseminate information about atmospheric research in mountains around the world.
5. State Climate Office of North Carolina (http://www.ncclimate.ncsu.edu) - This office maintains climatic records for the state and supports some of our meteorological monitoring.
6. Watauga County Schools (http://www.watauga.k12.nc.us) - Through the NASA-CANDOO grant, school kids can join science clubs and learn about the atmosphere.
7. Pisgah Astronomical Research Institute (http://www.pari.edu) - AppalAIR participates in a summer science camp for kids through this institute.
8. National Aeronautics and Space Administration (NASA) (http://www.nasa.gov/home/index.html) - A recent grant from NASA supports educational outreach for public school children in the surrounding region.
9. Department of Atmospheric Science, UNC-Asheville (http://www.atms.unca.edu/atms.shtml) - AppalAIR collaborates with faculty member Dr. Doug Miller on atmospheric modeling efforts.
10. Department of Forestry and Environmental Resources, NC State University (http://cnr.ncsu.edu/fer/index.html) - Founding AppalAIR member Ryan Emanuel has recently accepted a position with NC State University, but remains a member of the AppalAIR research group. Ryan's specialty is ecohydrology, the measurement of mass fluxes of water and carbon dioxide between the atmosphere and the ecosystem.

VI. FACULTY ACTIVITY

A. RESEARCH REPORTS

Perry, L. Baker, Charles E. Konrad, David. G. Hotz, and Laurence G. Lee. 2010. Synoptic classification of snowfall events in the Great Smoky Mountains, USA. *Physical Geography* 31: 156-171.

Konrad, Charles E., and **L. Baker Perry**. 2009. Relationships between tropical cyclones and heavy rainfall in the Carolina region of the United States. *International Journal of Climatology* 30: 522-534.

Keighton, Stephen, Laurence Lee, Blair Holloway, David Hotz, Steven Zubrick, Jeffrey Hovis, Gary Votaw, **L. Baker Perry**, Gary Lackmann, Sandra Yuter, Charles Konrad, Douglas Miller, and Brian Etherton. 2009. A collaborative approach to better understanding northwest flow snowfall in the Southern Appalachians. *Bulletin of the American Meteorological Society* 90: 979-991.

B. RESEARCH PRESENTATIONS

Year 2009 - (*bolded names refer to people affiliated with SAEREC*)

Bowman, D., J. Pope, A. Accursio, K. Adair, P. Sheridan, B.F. Taubman. 2009. Quantitative Analysis of Volatile Organic Aerosols in the Atmosphere. 5th Annual State of North Carolina Undergraduate Research and Creativity Symposium (SNCURCS), Wilmington, NC, November.

L'Heureux, John, **L. Baker Perry**, **Douglas K. Miller**, and Sandra E. Yuter. 2009. *Atmospheric influences on new snowfall characteristics associated with northwest flow snowfall in the southern Appalachian Mountains.* Southeastern Division of the Association of American Geographers (SEDAAG) Annual Meeting, Knoxville, TN.

Perry, L. Baker, **Douglas K. Miller**, Sandra E. Yuter, John L'Heureux, and **Ginger Kelly.** 2009. *Snowfall patterns and processes in the southern Appalachian Mountains: Preliminary results from an interdisciplinary field campaign, 2006-2009*. Southeastern Division of the Association of American Geographers (SEDAAG) Annual Meeting, Knoxville, TN.

Taubman, B.F. 2009. Determination of the Aerosol Direct Radiative Forcing in the Southern Appalachian Mountains, US-Korea Conference on Science, Technology and Entrepreneurship, Raleigh, NC, July 16-19.

Taubman, B., J. Sherman, P.J. Sheridan, L.B. Perry, H. Neufeld, R. Emanuel, R. Tashakkori, D. Bowman and C. Long. 2009. Aerosol Direct Radiative Forcing in the Southern Appalachian Mountains: Initial Results from the Appalachian Atmospheric Interdisciplinary Research (AppalAIR) Facility. American Geophysical Union Meeting, San Francisco, CA. December 14-18.

Year 2010

Fuhrmann, Christopher M., Dorothy K. Hall, **L. Baker Perry**, and George A. Riggs. 2010. Spatial patterns of snow cover in North Carolina: surface and satellite perspectives. 67th Eastern Snow Conference, Hancock, MA.

Hall, Dorothy K., Christopher M. Fuhrmann, **L. Baker Perry**, George A. Riggs, David A. Robinson, and James L. Foster. 2010. *A comparison of satellite-derived snow maps with a focus on ephemeral snow in North Carolina*. 67th Eastern Snow Conference, Hancock, MA.

Kelly, Ginger M., L. Baker Perry, and **Brett F. Taubman.** 2010. *Southeast flow precipitation in the southern Appalachian Mountains: topographic influences and aerosol-precipitation interactions*. Association of American Geographers (AAG) Annual Meeting, Washington, D.C.

L'Heureux, John M., **L. Baker Perry**, **Douglas K. Miller**, and Sandra E. Yuter. 2010. *Comparison of the 2008-2009 cold-phase ENSO winter and the 2009-2010 warm-phase ENSO winter*. 67th Eastern Snow Conference, Hancock, MA.

Neufeld, Howard S. Brett Taubman, Jim Sherman, L. Baker Perry, Rahman Tashakkori, David Bowman, C. Long and Pat J. Sheridan. 2010. AppalAIR: The New Atmospheric Interdisciplinary Research Group at Appalachian State University. Air Pollution Workshop, Asheville, NC, April 12-15.

Perry, L. Baker, David G. Hotz, Stephen J. Keighton, Laurence G. Lee, Charles E. Konrad, J. Greg Dobson, and Dorothy K. Hall. 2010. *Overview of the 2009-2010 snow season in the southern Appalachian Mountains*. 67th Eastern Snow Conference, Hancock, MA.

C. PUBLIC ENGAGEMENT

The AppalAIR group has had several public engagement events, mostly associated with the NASA-CAN DOO grant. This has involved forming science clubs at local elementary schools, and providing instruction to environmental teachers at Grandfather Mountain.