

Appalachian Energy Center Appalachian State University Work Plan July 1, 2019 – June 30, 2020

The Appalachian Energy Center (AEC) at Appalachian State University conducts research, education and extension activities in the domains of energy efficiency and renewable energy technologies in a multidisciplinary environment. Our University setting allows us to leverage the expertise of faculty, staff, and students as a resource for private industry, local, state and federal governments, and non-profits. The Appalachian Energy Center strives to provide benefits to communities and citizens across the State of North Carolina by fostering and facilitating interdisciplinary research, education and extension activities that positively impact North Carolina's clean energy economy.

The AEC has aligned its work more directly with the efforts of the State Clean Energy Plan. These work areas from the North Carolina State Energy Plan (NC SEP) include activities which fit within I3, K4, L1 and L2. Our work in these areas will be partially supported by current funds, but additional, external funding is required and will be sought to support activity completion. We were counseled to retain our previous year's work plan during the state budget stalemate, thus this budget retains many categories of work from the FY 2017-2019 work plan while adding in new strategic directions as mentioned above. This has led us to develop this current work plan for the first fiscal year only of the state budget biennium. A detailed budget for the second fiscal year of the biennium will be provided in the coming months.

A. Extension, Education, and Outreach

This work seeks to disseminate knowledge related to energy efficiency and renewable energy through education, outreach, and extension programming. Specific areas of work by Appalachian Energy Center staff and Appalachian faculty members include:

Extension Services and Development Assistance

NC SEP I3 Expand Energy Efficiency and Clean Energy Programs: Our Energy Center has been working to develop the personnel, systems, and equipment required to offer energy efficiency audits and renewable energy assessments for underserved markets in Western North Carolina through our [Energy Extension Program](#).

When fully developed, the Energy Extension Program will serve the public and private sectors in Western North Carolina and beyond. We will engage Appalachian students in hands-on learning experiences by conducting low cost site assessments, economic feasibility studies and energy audits. We will also conduct product performance evaluations for industry partners utilizing existing Appalachian facilities such as the Solar Energy Research and Demonstration Laboratory and Small Wind Research and Demonstration sites. We see this as an exciting area for growth for the AEC. Funding from the

Appalachian Chancellor's office was acquired in the previous cycle for the development phase, but we must secure additional funds to support the program going forward.

Workforce Development and Continuing Education

The annual Appalachian Energy Center Workshop Series offers continuing education and training opportunities for experienced professionals looking to stay competitive and those seeking to broaden their knowledge base or transition into the energy field. Our workshops are appropriate for those already working in directly related fields such as architects, engineers, contractors and code inspectors and those working in fields that impact energy decisions such as appraisers, realtors, lawyers, and accountants. Each year the workshop series has approximately 200 attendees, providing education to the enrollees and exposing a larger constituency to the work and resources available within the AEC.

The workshop series focuses on the areas of solar PV system design, installation and maintenance, building performance, small wind energy, and micro-hydro power. Continuing education can be earned (AIA, Appraisers, CLE, GBCI, NABCEP, NCBEEC, NCBI, NCDOT, PDH) with approximately 10 workshops available each year. AEC staff coordinate, manage, and develop the workshop topics in conjunction with Appalachian faculty members. Organizational / logistical considerations will be made to increase the number of available seats for this popular program.

Outreach and Community Engagement

NC SEP K4 Clean Energy Education for K-12: Our Energy Center is currently exploring the development of a Renewable Energy for Schools program and will seek synergies with Energy Efficiency Everywhere projects as appropriate.

Through outreach and community engagement activities, we serve as a resource for community members and educators to increase awareness and understanding of energy issues and support energy conservation and renewable energy adoption. This effort provides information via a website, quarterly newsletter, and offers workshops and facility tours to community members, students and K-12 educators. The AEC will continue to use staff expertise in these areas to acquire additional funding to support the work. Local schools will be assisted in preparing grant proposals for energy related projects on their campuses. Staff will assist in planning and participate in the annual ASU STEAM Expo (STEAM = Science Technology Engineering Arts Mathematics) which is part of the larger NC Science Festival.

Engagement with the community will continue to be a focus area. Development of a few community workshops and events will benefit the citizenry and expose the broader community to the work of the AEC. Staff will be encouraged to serve on one or more University, local, state or regional board, committee, task force, working group, etc. that is pertinent to their work. This sort of engagement will not only keep the AEC abreast of current happenings, but also provides the opportunity for us to be of service to a broader purpose, one that might result in a productive collaboration.

B. Clean Energy Conversion and Supply

This work seeks to support design, manufacturing, and implementation of renewable energy systems in North Carolina. Specific areas of work by Appalachian Energy Center staff and Appalachian faculty members include:

- Continued support of the Appalachian Solar Energy Research and Demonstration Laboratory. The solar lab actively supports outreach, education, and applied research projects. Applied research projects aim to identify and characterize solar technologies that perform well in North Carolina conditions. Verification and dissemination of solar system performance will allow North Carolina citizens to choose the technologies that offer the best return on investment. The facility allows potential solar adopters the chance to see first-hand installed modern technologies. The solar lab also offers Appalachian students valuable hands-on experience with a range of solar technologies. These students will likely join the North Carolina workforce and contribute to the growing renewable energy sector in the State. Partnerships with solar equipment manufacturers may be pursued.
- Continued support of the Appalachian Small Wind Research and Demonstration Facility on Beech Mountain. This facility provides valuable information about wind turbine performance and durability to small wind manufacturers and utilities, while providing students and the community with hands-on experience with small wind technology. Appalachian faculty and students are actively engaged in education, outreach, and research projects that utilize the facility. These projects benefit businesses and citizens of North Carolina interested in design, manufacturing, and implementation of wind energy systems. Research activities may include topics such as blade design, noise levels, impact on local bird populations, relationship of wind turbine performance to utility loads, storage technologies, etc. This work will also continue to include the monitoring and reporting of estimated output of wind energy facilities in North Carolina as installations expand in number and size.
- Support ongoing efforts to develop on-farm bioenergy systems and the use of beneficial co-products. This work includes education, outreach, and research activities that lead to an increase in the production and use of biofuels and bio-products in North Carolina. Workshops and other technical assistance will be provided to support the adoption of these technologies in Western North Carolina. This work will utilize the NEXUS Research and Demonstration Site and the Biodiesel Research, Development, and Production Facility at the Catawba County EcoComplex. The EcoComplex Facility provides biofuels and emissions testing lab space for Appalachian faculty, and its operation is augmented by a lease arrangement with Blue Ridge Biofuels, a private company that produces biofuels in the balance of space at the facility.

C. Energy Consumption and Efficient Infrastructure

This work seeks to improve the energy efficiency of both new and existing buildings as well as some transportation systems in North Carolina. Specific areas of work by Appalachian Energy Center staff and Appalachian faculty members may include:

- **NC SEP L2 Beneficial Electrification:** Analyze the impacts of electrification of various equipment and processes in both homes and buildings; transportation; and both small-scale agriculture and indoor / technology assisted agriculture. Support the development, commercialization, and deployment of efficient agricultural systems for extended growing seasons.
- Education, outreach, and research activities that lead to an increase in the number of high performance buildings constructed in North Carolina. This work includes promoting high efficiency program standards and conducting building science training for appraisers, realtors, and building professionals.
- Support of improved North Carolina building codes and their implementation through education, outreach, and research. This work includes building performance analyses that support decisions regarding inclusion of particular energy related items in the code, as well as outreach to and education of North Carolina building professionals related to the building science of the code requirements.
- Thermal characterization of building materials and systems that can lead to improved wall and roof system designs. This work could lead directly to a reduction in installation costs and improved resistance to heat transfer for buildings in North Carolina and beyond. Intermittent industry contracts support this work.
- Support the development, commercialization, and deployment of emerging transportation technologies, such as electric vehicles, through analysis of the state's competitive position and potential to benefit from both supply and demand side approaches, and through participation in education and outreach activities related to these technologies.

D. Emerging Issues, Policy, Economics, and Societal Impacts

Activities under this area of work support the pursuit of economic prosperity, new jobs, technological development and deployment, and the growth of business and industry with a focus on more productive use of natural resources, more efficient and efficacious use of energy, and increased activity by businesses in energy or environment related markets with activity and opportunities for North Carolina. This work will be accomplished through applied research, analysis, program and project development, and education and outreach in topic areas that include the following:

Greenhouse Gases

The Greenhouse Gases topic is focused primarily on two distinct but related areas – implementation of the EPA regulations on GHG emissions within North Carolina and greenhouse gas accounting (e.g., carbon footprint calculations, carbon offset protocol design, jurisdictional-scale aggregate accounting). Appalachian State recently assumed responsibility for annual updates to the Carbon Dioxide Information Analysis Center (CDIAC) data time series of global, regional and national carbon dioxide emissions from fossil fuel combustion and cement manufacture from 1751 on. The Appalachian Energy Center is co-located with the team responsible for CDIAC, enabling close collaboration. AEC staff also assist Appalachian's Office of Sustainability with climate, energy and water planning and implementation.

Environmental Asset Markets

The Environmental Asset Markets topic area includes work related to the markets for renewable energy certificates (RECs), carbon offsets, renewable fuel credits, and other intangible forms of commoditizing and monetizing attributes related to energy. We intend specific work in this area to consist of market analysis (including policy options impacting these markets), examining opportunities for these markets to support increased economic activity or income, and education and outreach efforts to facilitate participation and understanding of these markets.

Development & Deployment

The Development & Deployment topic area covers a broad range of subjects, all of which are focused in some way on growth and improved economic outcomes for citizens and businesses. Some specific focal points include: expansion, refinement, and continued application of community-based economic development models (particularly those that leverage energy in some way); development, facilitation, and adaptation of project development structures for both energy- and environmental asset-related projects; and the many facets related to the development, deployment, integration, and adoption of new energy-related technologies such as smart grid/smart home and energy management systems, energy storage, and other emerging technologies related to the energy field.

E. Efficient Distribution and Grid Integration

This work seeks to improve the efficiency of energy distribution across the State. Specific areas of work by Appalachian Energy Center staff and Appalachian faculty members include:

Distributed Generation & Emerging Power Systems

The Distributed Generation & Emerging Power Systems area covers activities that address renewable energy/distributed generation, smart grids, increased demand-side engagement, energy storage and related technologies. Specific focal points will include the policy, financial and economic aspects of rate structure design, net metering, avoided cost rates, integrated resource planning, third-party retail sales, government sales, novel mechanisms for financing and incentivizing, and similar issues.

Electric Utility Operations

NC SEP L1 Electric Vehicle Rate Pilots: Through collaboration with New River Light and Power (NRLP), the Appalachian Energy Center is part of a team that is working to innovate the operation of the electric utility. This presents a unique opportunity to quantify the potential impacts of variable rates to incentivize off-peak charging and evaluate other grid services of EVs can provide. Exploration in this topic area is underway, but additional funds must be secured to support a significant project.

F. Administration

Administration funds are required for administration staff support and general expenses. These funds will support one-half of the program specialist's salary and benefits (Appalachian's Research Institute for Environment, Energy and Economics (RIEEE) provides the other half), travel for the Center Director to attend meetings related to the work herein, and necessary office expenses. The program specialist and director are responsible for business operations of the center, including managing related, external research funds, administering an internal seed-funding program, and coordinating the use and development of aforementioned research facilities. Appalachian State University's Office of Academic Affairs provides funds for the AEC Director's salary and benefits and office space for all AEC staff.