Renewable Energy Initiative

Annual Report 2007/08

Current REI Members (Spring 2008)

Student Members

- Ged Moody – Chair
- Nikki Rezvani – Vice Chair
- Crystal Simmon – Grant Master
- Phil Stoltz – Secretary, SGA Director of Environmental Affairs
- Alan Watts – PR
- Jonathan Pierson– Treasurer
- Bryan Johnson (nonvoting)
- Gernon Harvery (nonvoting)

Faculty and Staff

- Patrick Beville
- Dr. Chris Badurek
- Dr. Brian Raichle
- Jeannie Mercer
- Jerry Marshal
- Jennifer Maxwell

Executive Summary (including all work done by previous REI committees)

Student-organized, student-funded, student-led Renewable Energy Initiative
The ASU Renewable Energy Initiative (REI) was conceived and approved by students with a 93% majority. Through this organization, each student gives an additional $5 per semester (~$150,000 annually), that is then managed by the student-run REI committee. The REI selects appropriate RE projects and then manages their installation.

Solar Thermal System @ Biodiesel Processor
4-panel Solar Thermal Glycol-based system. Provides 100% of the heat transfer necessary to support the production of Biodiesel at our research facility.

Photovoltaic System @ Biodiesel Processor
10-Panel, 1.7 kW System designed/sized to meet 100% of the electricity demand at our Biodiesel research center. First Grid-Tied RE system in Boone and for the local utility.

Photovoltaic System @ Harper Hall
1.4 kW PV system. Direct Grid tie system allows students in the Appropriate Technology Department to get hands on learning with PV array systems. Combined financial effort between the REI and Department of Technology.

Photovoltaic System in Raley Hall Parking Lot
4 kW grid-tied system was installed during in the summer of 2008. This design of this PV array integrates the natural landscape with PV technology. This system was installed in the front of one of the university's busiest parking lots. This uniquely designed PV array will catch the attention of students, faculty, staff, community members, and visitors in hopes of raising awareness of the benefits of renewable energy.

Solar Thermal on Plemmons Student Union
30-Panel Drainback system designed to offset 2/3 of the hot water usage of the two biggest users within the union. This system is currently being redesigned. Estimated goal of installation is summer 2009.

Broyhill Wind Turbine
The 100kW wind turbine will be the largest wind turbine in the state of North Carolina when installed. This project is currently being negotiated with installers and the university. This project serves as an example of financial collaboration between the students of ASU and the physical plant.

Renewable Energy System Monitoring Kiosk in Student Union
A kiosk was custom designed by students and built with recycled materials. In addition to providing RE education, this kiosk will stream real-time data from the various RE systems that have been installed by the REI.

Harper Hall PV Array (Complete)

- The REI collaborated with the Department of Technology to install a 1.4 kW PV system on the roof of the Technology Building.
- REI allocated $5,000 to help cover the cost and to pay for system monitoring for the system.
- This system gives students the opportunity to work with a direct grid-tied system.
- Project Manager for this project was Ged Moody. Student installation performed by Matt Fedorko and Stony Oswald (AT graduate students)

Raley Hall Photovoltaic Array (Almost Complete)

- The Raley PV array was installed during the summer of 2008. This array focused on the aesthetics of the design in order to integrate the natural mountain landscape with PV technology. It is grid tied and provides an educational opportunity for students and visitors to campus.
- A Request for Qualifications (RFQ) was published at the end of spring semester 2007. It was requesting portfolios from companies willing to work with the REI to design and build an aesthetic PV array in front of the ASU business school. Six companies responded and by using the RFQ's published evaluation criteria, Southern Energy Management (SEM) from Raleigh was chosen; Sundance Power Systems was second.
- Mary Baker, Joe Smith, and Jonathan Pierson served as project Managers for this project. Meetings were held with Southern Energy Management, New River Light & Power (NRL&P), ASU grounds keeping, business school representative, and ASU design & construction. The energy produced and sold to NC Green Power is returned to the REI as discretionary funds. This does not create a tax burden for the REI, because the REI is under the university, the university will be responsible for any tax liability. As of 12/1/2008, the REI has yet to receive the necessary utility statements from NRL&P to receive money.
- Remaining work for project includes ensuring REI receives money from NRL&P in avoided cost and money from NC Green Power

Plemmons Student Union Educational Kiosk (complete)

- This Kiosk was installed during the spring semester of 2008.
- Currently, the kiosk has information about energy conservation, energy efficiency, and renewable energy. This serves as an educational opportunity for the ASU community.
- Also available at the kiosk is an information packet about the REI with updated project status and background information.
- Nikki Rezvani was the project manager for the REI kiosk. Students from the Interior Design department helped to design the kiosk. This system was constructed by ASU Staff.

• System Monitoring (Incomplete)

  - The REI is currently in the process of ordering real time energy monitoring equipment form Fat Spaniel. This will provide information at the kiosk about energy being produced using student money. Estimated date for system monitoring is at the end of the 2008/09 school year.

Current REI Projects

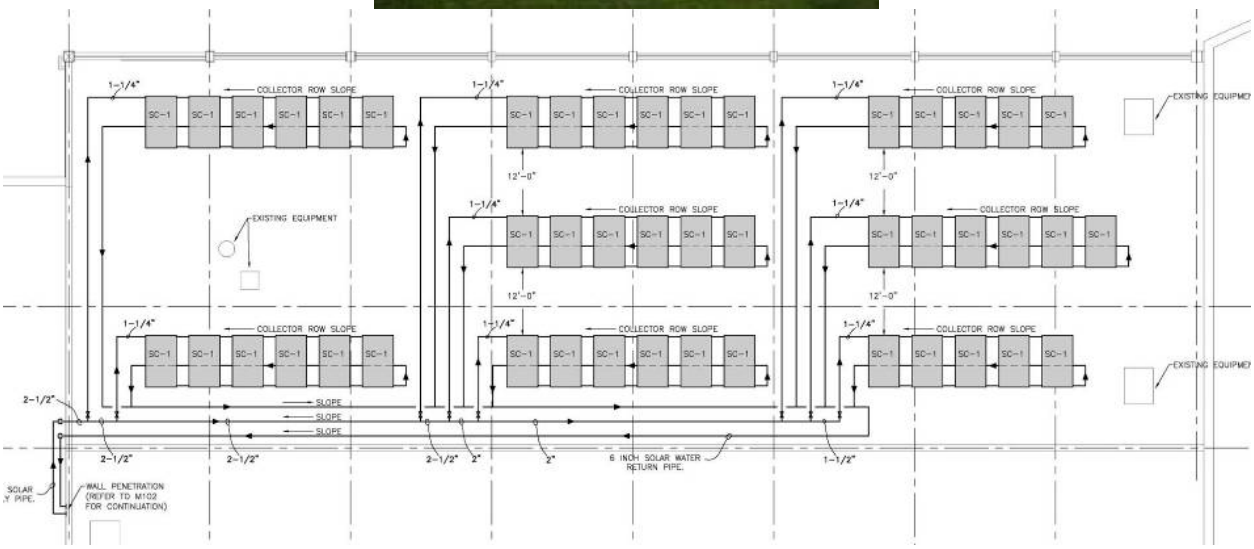
Broyhill Wind Turbine

- The installation of a NorthWind 100 kW wind turbine will serve as an example to Western North Carolina about the advancements in wind energy over the past 20 years since NASA's installation of (at the time) the largest wind turbine. The 100kW machine will also be the largest wind turbine installed in North Carolina.
- Crystal Simmons has been the project manager since detailed planning for the project began. Staff support from Patrick Beville.
- The project has been designed and currently the Request for Proposals (RFP) has been sent out. The REI awaits estimates for total installed cost. Once a more firm price has been established, NRL&P will meet with the REI to discuss how much money will be spent by both parties.

Figure 1 - Photo imposed by Joe Smith

Plemmons Student Union Solar Thermal System

- The Plemmons solar thermal system is still in design phase. Elm engineering has completed reworking the design. However, initial bids came back over the allocated amount by nearly $50,000. The REI is currently seeking other financial options.
- There have been several project managers; the current was Alan Watts. Prior to Alan, Adam Milt and Alyssa Rudolph also served as the project managers. The student union was chosen after a solar thermal project on the student recreation facility was denied. The feasibility study was completed in September 2006, which included several locations on campus. The student union was ideal because student fees pay for the utilities and Dave Roberson, the building manager, is very supportive of the REI. In addition to Elm Engineering's original solar thermal design engineer moving on, there design has been lacking in some respects.
- This was a point of concern and has required additional meetings and design iterations. After the bids came in too high, the project has had to be revaluated.
- Alan Watts continued to meet with ASU financing officials to figure out what steps are necessary in order to secure complete funding for project. Projects managers are advised by Dr. Raichle (solar thermal professor) and Patrick Beville (project advisor).
- Bryan Johnson agrees to become Project Manager at the end of the school year.



REI Special Events

REI Fall Forum – planned by Alan Watts

REI Projects that were discussed but have not currently been allocated any money or are not being currently perused.

ASU and BB&T Solar Powered Clock/Thermometer –

prepared by Jonathan Pierson
Panhellenic Residency Hall
949 Blowing Rock Road (Intersection of US 321 and HWY 105)

Renewable Energy Initiative Project Idea:

With a campus-wide commitment towards sustainability, Appalachian State University (ASU) and the Renewable Energy Initiative (REI) have the opportunity to publically display how renewable energy technologies are being incorporated on campus.

The proposed intersection of US 321 and HWY 105 is a highly visible location for ASU to promote the use of renewable energy to ASU students, staff, and faculty as well as to other community members. The installation of a photovoltaic (PV) system would use the sun's energy to produce electricity that will operate the ASU and BB&T sign.

The REI would like to provide the necessary funds to ensure that this electronic sign advertises for both the university and BB&T using electricity generated from the sun.

Photovoltaic System Characteristics

The location of the sign is ideal for a photovoltaic system. With an unobstructed southern exposure, a PV system would be installed in nearly ideal conditions. The design of the PV system depends on the design of the ASU and BB&T sign.

Assuming that the sign will be placed diagonally so that all four directions of traffic will see the sign form one side or the other, there are two system options:

1.) **A direct grid-tie PV system.**

- A direct grid tie system will sell all of the electricity that is generated to the utility grid. While not directly powering the ASU & BBT sign, the PV system could easily be generating more electricity than ever used by the clock. Also, electricity follows the path of least resistance. This means that it would be accurate in saying that the PV system would be supplying electricity to run the sign.
- Benefits of a grid tie system include: possibility of a larger PV array (more visible), excess electricity generated sold to the grid (income), and if PV system malfunctions, sign would continue working uninterrupted

2.) A battery-based PV system

- A battery-based PV system would be designed more specifically to the electricity demand of the sign. Requiring several additional balance of system components, the battery-based system would be more expensive in terms of price per watt and would require more maintenance with regards to the batteries.

The location of where the proposed PV system would be mounted has three possible options:

1.) On the actual sign.
   - This option would be visible but has one major flaw. The size of the PV system will be limited if mounted directly on top of the sign. This will be true especially if the sign is oriented diagonally so that the end closest to the intersection is facing Wendy's (south).
   - In this case the PV panels would have to be mounted in rows. Depending on how large the sign is will dictate the number of panels that can be mounted on top of the sign.

2.) **Pole mount, behind the sign**.
   - Mounting the PV array to a pole behind the sign at the end that is points in between Panhellenic Residency Hall and the BB&T building is another viable option. This would allow for more flexibility in the size of the PV system and would still provide passer byes a chance to see the sign unobstructed.
   - In this case the sign would be blocking (visually) the pole that the PV array would be mounted on. The panels would be fully visible and would be unobstructed by the sign.

3.) Ground mount, in front of the sign
   - Mounting the PV array in a semi circle around the sign area would ensure visibility to people passing through the intersection. The low level of The PV array would introduce two threats to the PV system. The first of which is shading. Any plants would have to be monitored to ensure that no growth will shade any of the PV panels. As well as shading issues, a ground mounted system would be more susceptible to damage from foot traffic or projectiles from moving vehicles.

The size of the PV system would be determined by the type of PV system that is decided upon. If the system is a direct grid tie system, The REI could allocate funds for a PV system that would provide more than the required amount of electricity. This would allow for more visibility of the PV system due to the increased size.If it is determined that the size of the PV system should be equally matched to the electricity demands of a sign with an electronic display (presumably using LED) lights, a direct grid tie system may not be appropriate.

Estimated Budget for Direct Grid Tie PV System. Load Requirements: 2, 150 watt Electronic Signs. Total Daily kWH required: 7.2 kWH (7.2 kWH/day) / (4.46 sun hours/day)
= **1.6 KW PV System**