Appalachian Energy Summit Poster Contest

Abstract Submission

May 1st, 2015

The Electron Garden on the Green (EGG) Project for Western Carolina University

Written By: Chase Weddle (ECET), clweddle1@catamount.wcu.edu, 704-305-1466 (Undergraduate)

Robert Bianculli (EE), rabianculli1@catamount.wcu.edu, 347-426-8016 (Undergraduate)

Ross Heffley (EE), rjheffley1@catamount.wcu.edu, 404-405-7118 (Undergraduate)

Faculty Advisor: Bora Karayaka, hbkarayaka@email.wcu.edu, 828-227-2472

Staff Advisor: Lauren R. Bishop, lbishop@wcu.edu, 828-227-3562

Western Carolina University

Introduction

Western Carolina University would like to begin raising awareness of renewable energy and educating students and faculty on the importance of sustainable energy. WCU Facilities Management has enlisted our help in designing a project that will accomplish these goals. A 10 kW grid-tied PV system has been proposed that will be centrally located on campus. The system will serve as a living, learning laboratory for the campus community. The solar panels for the system will be mounted on three structures approximately 10 to 14 feet off the ground, which will also provide shade and shelter from the elements. Underneath the solar panels will be benches, tables, electrical outlets, and special hooks for students to hang hammocks. A small garden featuring native plant life will be planted around the solar panel structure. Small informational signage will be displayed throughout the garden informing visitors about the benefits of sustainable energy and how a PV system works.

Approach

Our team was responsible for researching, designing, and proposing a PV system for WCU. We first conducted shading analysis in multiple locations on campus to determine where the most sunlight hours occurred. We then used the National Renewable Energy Laboratory's PVWatts[1] Calculator to estimate how many kilowatt hours our system would generate per year and how much money our system would save the university. We also calculated greenhouse gas savings estimates to determine how much CO_2 emissions the EGG would reduce each year. Galen May, WCU's lead architect, provided assistance with the structural design of the EGG and estimation for the construction costs. Since the university must use a third party to install the PV system, SunDance Power Systems out of Weaverville, NC, was contacted to gather a professional opinion. We then submitted a proposal to the WCU Sustainable Energy Initiative (SEI) Committee detailing our project. After a formal presentation, the WCU SEI Committee has decided to move forward with our project.

Preliminary Results/Evaluation

Our preliminary research involved gathering information on exactly how a PV system works. We researched the necessity of Maximum Power Point Tracking in solar inverters and discussed the benefits of oversizing a PV system with a 1.25 array-to-inverter ratio[2]. A vital part of our research involved emissions reduction calculations and payoff estimates. Our emissions reduction calculations showed that the system would reduce CO_2 emissions of the school by approximately five tons annually. Payoff of the system was calculated to be approximately 39.25 years due to the fact that the university is unable to claim the 35% North Carolina solar energy tax credit because the credit cannot be claimed by public universities. Otherwise, the payoff would be reduced to approximately 12 years.

Conclusion/Future Work

Western Carolina University is situated in a fantastic location for solar energy to thrive, which makes the EGG a realistic and highly-desirable project. Our research determined that the best option for WCU to raise awareness and educate students about renewable energy is to implement a flagship project that would serve to accomplish those goals.

References

1. http://pvwatts.nrel.gov/
2. http://www.solarpowerworldonline.com/2013/06/supersize-it-oversize-your-array-to-inverter-ratio-to-improve-solar-system-performance/