

Final Technical Report

Laramie County Community College: Utility – Scale Wind Energy Technology

DOE Award Number: EE0000538

Project Period: December 1, 2009 – November 30, 2011

Douglas P. Cook (author) 307-432-1647, dcook@lccc.wy.edu

Laramie County Community College, 1400 E. College Drive, Cheyenne, WY 82002

March 22, 2012

Acknowledgement, Disclaimer, and Proprietary Data Notice

Acknowledgement: This report is based upon work supported by the U.S. Department of Energy under Award No. EE0000538.

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Proprietary Data Notice: None.

Introduction

The Utility – Scale Wind Energy Technology U. S. Department of Energy (DOE) grant, EE0000538, provided a way ahead for Laramie County Community College (LCCC) to increase educational and training opportunities for students seeking an Associate of Applied Science (AAS) or Associate of Science (AS) degree in Wind Energy Technology. The DOE grant enabled LCCC to program, schedule, and successfully operate multiple wind energy technology cohorts of up to 20-24 students per cohort simultaneously. As of this report, LCCC currently runs four cohorts. In addition, the DOE grant allowed LCCC to procure specialized LABVOLT electronic equipment that directly supports its wind energy technology curriculum. The grant was instrumental in providing Cheyenne South High School; the district's recently opened high school, the means to acquire industrial maintenance training aids that are similar to that used by LCCC's Wind Energy Technology Program. Through the DOE grant, LCCC finalized a career pathway template that can be used by junior and senior high school teachers/counselors along with LCCC admissions representatives and faculty advisors. Throughout the grant's period of performance, LCCC was engaged with the University of Wyoming to explore articulation agreements for AS degreed wind energy technology graduates to pursue engineering degrees. While no LCCC wind energy courses can be transferred to the university's college of engineering at this time, two of LCCC's AS wind energy technology graduates are enrolled at the University of Wyoming to earn a Bachelor of Science Degree in Mechanical Engineering. The majority of LCCC's Wind Energy Technology Students are pursuing the AAS degree. Articulation discussions with the University of Wyoming will be an ongoing effort. With the help of the DOE grant, LCCC was able to accomplish its objectives and goals. This has enhanced the quality and reputation of LCCC's Wind Energy Technology Program of Study.

Background

Laramie County Community College began a Wind Energy Technology program of study in 2008 following approval of instruction by the Wyoming Community College Commission. The first class entered LCCC in the fall 2008 semester. Twenty-two students entered the program under the guidance and tutelage of one wind energy program director/instructor. Today, in 2012, LCCC's Wind Energy Technology Program offers the AAS or AS degrees and almost 80 students are enrolled in the program. Four cohorts are now operational. In addition, what makes LCCC's Wind Energy Technology Program unique are its faculty, wind energy laboratory, and a one-of-a-kind contract with F.E. Warren AFB located seven miles west of LCCC's campus. LCCC employs three wind energy instructors. Two of the three instructors possess deep and broad wind industry experience while the third one is a professional licensed master electrician. Most wind energy technology programs at the community college level do not employ experienced wind industry technicians. Having experienced wind energy

instructors with a background in the wind industry on staff provides realistic and applicable instructional moments for students. LCCC's wind energy technology laboratory contains a functional 1.0MW Mitsubishi nacelle and a functional 2.1MW Suzalon electric wind hub along with a climb safety and rescue operation area all under one roof and located in the same building. Again, the wind energy laboratory affords students near real-live diagnostic, servicing, and troubleshooting learning experiences on functional wind technology equipment. Finally, LCCC entered into a maintenance contract with F.E. Warren AFB to service and maintain three operational wind turbines that includes two VESTAS V-47 (666KW class) and one GAMESA G-87 (2.1MW class) wind turbines. LCCC students, under the supervision of wind energy technology instructors, learn to repair, service, and troubleshoot faults in live conditions while enrolled for the four semesters in the wind energy technology program. All of this adds up to a high-end quality LCCC Wind Energy Technology graduate who can successfully enter into the wind industry workforce or continue with his/her education to earn a Bachelor of Science degree in mechanical or electrical engineering.

Laramie County Community College was fortunate to have been a DOE grant recipient. The quality of LCCC's Wind Energy Technology program was furthered because of the objectives this grant sought to achieve. As previously mentioned, when LCCC's Wind Energy Technology program began in 2008, there was one program director/lead instructor for 22 students. The DOE grant funds enabled LCCC to hire a second wind instructor be a part of team that instructs multiple cohorts of wind energy students. Of note, the second wind instructor is now a LCCC-funded faculty member. The hire of the second instructor led to more wind enrollment and allowed LCCC to hire a third wind instructor. This is a success for LCCC. The dollars allotted for LCCC to purchase special equipment for the wind energy technology program is being used in advanced AC electrical and power generation classes—both wind energy specific core courses. The LABVOLT equipment is of the best quality and well-suited to create unique learning activities for the wind students. It is helping prepare students for employment into the wind industry following graduation. In addition to the previously mentioned purchase of industrial maintenance training aids for Cheyenne South High School, LCCC also developed an online version of its Introduction to Wind Energy Technology-WTT 1000. This online version was used in the fall 2011 semester with success. It is hoped the online version of WTT 1000 can be used for concurrent/dual enrollment with Wyoming's high schools in the future. The DOE grant allowed LCCC to offer summer seminars for junior/senior high school educators that helped them understand how to instruct wind energy technology topics. These seminars were 2-3 day events and took full advantage of LCCC's climb area, its nacelle and electric wind hub along with the introduction and use of wind experiment kits. The seminars also included presentations on the use of the wind energy technology career pathway template as well. It is anticipated the educator seminars will continue in the future.

Results, Discussion and Accomplishments

Laramie County Community College was able to use the \$198,594 DOE grant as advantageously as possible. Although small in dollar amount as compared to National Science Foundation and Department of Labor grants LCCC has received in the past, the DOE grant enabled LCCC's Wind Energy Technology program to achieve very positive results with the dollar amount it was awarded. It is important to acknowledge the oversight and guidance offered by Dr. Mimi Hull, LCCC Grants Facilitator, Ms. Deborah Weems, DOE Project Field Officer, and LCCC's Wind Energy Instructors, Mr. John Lamorie and Mr. Christian Winger for their dedication to fulfilling the grant's goals and objectives. Below are listed the objectives/results accomplished:

- 1) Laramie County Community College now successfully operates four (4) cohorts of wind energy technology students all pursuing the AAS or AS degrees. LCCC does not offer the certificate in wind energy because its Wind Energy Advisory Board has encouraged the program to advise students to seek the two-year degree. Each cohort began with no more than 24 students. Twenty-four (24) wind energy students is the maximum number of students that can enter each semester because of the size of wind energy classrooms and laboratory space. The wind energy technology industry is an inherently dangerous career field and safety is paramount in all laboratory activity and field exercises. That is another reason why enrollment is limited to no more than 24 students. Most wind energy technology students enrolled at LCCC are candidates for the AAS degree because of their desire to immediately enter the wind energy workforce following graduation. Only two (2) of LCCC's Wind Energy Graduates have been awarded the AS degree and are now pursuing their Bachelor of Science Degree in Mechanical Engineering from the University of Wyoming. On average, students entering into LCCC's Wind Energy Technology program are two-thirds non-traditional students who are changing careers or transferring from the University of Wyoming. The remaining one-third are traditional students or ones who have been less than one year removed from high school graduation. LCCC's Wind Energy Technology program students are still predominately male. However, every class has at least two-three females---mostly non-traditional female students. LCCC has made good efforts toward recruiting underserved populations in its serving area. As a result, LCCC works with the State of Wyoming Department of Workforce Services to recruit women, displaced workers, underserved populations and US Armed Forces Veterans. Because of a new cohort being started every semester and the three full-time wind instructors, LCCC has increased the size of the wind energy program without sacrificing the quality of its instruction.

- 2) Laramie County Community College has graduated two classes in 2010 and 2011. LCCC conducts only one graduation exercise in May. The school does not hold a winter commencement. Every graduate of LCCC's program who has not gone on to a four-year college/university and desires to be employed in the wind energy industry has been offered employment immediately following graduation. Thirty-seven (37) graduates of the 2010 and 2011 cohorts were offered entry-level wind energy technician positions at locations in Texas, North Dakota, Wyoming, Oregon, Washington, Colorado, California, and New Hampshire. As indicated above, the quality of instruction LCCC Wind Energy Technology students receive is a direct result of the exceptional wind energy instructors, the wind energy laboratory and classrooms, and a very unique, one-of-a-kind maintenance contract with F.E. Warren AFB located near LCCC. As of this writing, LCCC will graduate another 15 wind energy students in May 2012, and fully expect all to be employed as entry-level wind energy technicians.
- 3) The DOE Grant enabled LCCC's Wind Energy Technology Program to procure LABVOLT equipment for its advanced mechanical and motor control courses. Sixteen LABVOLT Trainers were purchased that enable students to enhance their diagnostic and troubleshooting skills for wind technology specific tasks. LABVOLT equipment is of the highest quality and fidelity to assist instructors in providing excellent educational and training activities in a controlled environment. This has prepared wind students to enjoy realistic laboratory experiences at LCCC's 1.0MW Nacelle and 2.1MW Electric Wind Hub. In addition, the LABVOLT equipment provides educational opportunities for wind students to table-top solutions prior to servicing and/or solving faults on the three operational wind turbines at F.E. Warren AFB. In addition to the LABVOLT equipment purchased for LCCC's Wind Energy Technology Program, industrial maintenance and LABVOLT Wind Energy Trainers were procured for Cheyenne South High School's technology laboratory. This equipment is being used to introduce South's students to the basic elements of renewable energy concepts and more specifically for wind energy. Because of LCCC's involvement with South High School, LCCC Wind Instructors and Dean of the Career and Technical Education Center have been very active briefing students at Cheyenne's Central, East, and Triumph High Schools. The briefings include the use of career pathway templates for wind energy that have been developed because of the DOE grant.
- 4) During the life of the DOE grant, LCCC developed an online wind energy technology course entitled, Introduction to Wind Energy Technology (WTT 1000). This online course has been used the past two semesters with some success. It is LCCC's desire to use the online course for articulation agreements with

Wyoming's other six community colleges and high schools for dual/concurrent enrollment opportunities. The online WTT 1000 is the companion course to the traditional in-class course. WTT 1000 is a required core course in the Wind Energy Technology curriculum at LCCC. LCCC continues to work with the University of Wyoming (UW) for future articulation agreements for wind energy courses. The intent is for selected LCCC wind energy courses to be transferrable to UW. This will be an ongoing effort because of the State of Wyoming's reluctance to aggressively offer incentives for wind energy developers to locate to Wyoming for wind production, and because of the lack of transmission lines to export wind energy to other parts of the nation. To be certain, as long as the fossil fuel and coal extraction industries continue to influence political and economic decisions in Wyoming, it may be difficult for wind developers to fully tap the wind potential in the state because of perceived competing interests. Unfortunately, mineral, coal, oil and gas industries greatly influence political and economic development decisions and outcomes in Wyoming. This in turn affects UW's ability to expand and offer new and exciting educational opportunities in renewable energy at the Bachelors and graduate degree level of education. This is reality and one LCCC recognizes as barriers to fully articulating its wind energy program with The University of Wyoming. Working with UW to articulate LCCC wind energy technology courses will continue to be a work in progress for the foreseeable future.

- 5) Laramie County Community College has offered summer/fall educational events for junior (middle) and high school educators that focused on wind energy curriculum and activities in 2009, 2010, and 2011. These events sought to introduce concepts in wind energy and renewable energy for secondary instructors to use in their classrooms. The events were 2-3 days long depending on the number of participants. At least seven educators attended the events. One of the benefits of hosting Wyoming educators to LCCC summer events is that more Wyoming residents (traditional and non-traditional) are enrolling in LCCC's Wind Energy Technology program of study. LCCC will continue to host summer events in the future. In July 2012, LCCC will conduct a week-long summer event that includes introduction to wind energy concepts for a collaborative program involving at-risk junior high aged youth from the community.

Conclusions

Laramie County Community College was very fortunate to have been given the opportunity to participate with the Department of Energy in pursuing objectives to further wind energy technology educational opportunities in Wyoming. As demonstrated above, LCCC benefitted from the DOE grant and successfully

accomplished its objectives. The biggest barrier LCCC encountered was the path toward achieving articulation agreements with The University of Wyoming. As was noted above, until the State of Wyoming's political and economic leaders see the benefits of aggressive wind development within the State's borders, LCCC will not achieve full articulation of its wind energy curriculum with UW. This will impact educational opportunities for Wyoming students and residents seeking to gain a Bachelors or graduate degree in renewable energy disciplines in the future.

Recommendations

Laramie County Community College's Wind Energy Technology program of study is unique and among the best at the community college level in the United States. Because there are no national educational standards or professional trade credentials for wind technicians, curriculum development must become more standardized and invite continuous improvement that meets industry's needs. LCCC's wind energy instructors have been involved with the National Science Foundation-Advanced Technology Education DACUM projects. This must continue to further improve curriculum development and delivery to meet the wind industry's needs at the technician level. Similarly, efforts must begin to ensure recurring training/educational opportunities are available for the current wind energy workforce.

Professional development opportunities for community college wind energy technology instructors is a must; especially, as the wind industry improves and/or invents new technologies to increase the wind production capacity at wind farms. Sabbaticals with industry that could afford wind instructors the opportunity to explore the latest technology advances with component design should be encouraged and funded by federal and state agencies. Similarly, community colleges must be encouraged to form consortiums to begin the process of standardizing curriculum development and delivery throughout the United States.

Finally, with the encouragement of the DOE, community colleges with quality wind or renewable energy programs located near Department of Defense (DoD) installations should actively seek opportunities to form partnerships for operations/maintenance agreements. Based on LCCC's contract with the 90th Civil Engineering Squadron at F.E. Warren AFB, WY to service and maintain three operational wind turbines, maintenance agreements between community colleges and DoD installations are a win-win situation for both parties. LCCC would be very honored to share its experiences with the DOE and other community colleges in the benefits of a contractual agreement with a DoD installation.