Final Scientific/Technical Report
COVER PAGE

Federal Agency to which Report is submitted: DOE EERE – Wind & Water Power Program

Recipient: Southwest Applied Technology College (Cedar City, UT), DUNS Number: 130085509
Award Number: DE-EE0000541
Project Title: Utah Wind Power Educational Consortium for Workforce Development (PI:Andy Swapp)
Project Period: 12-02-2009 through 11-30-2011

Principle Investigator: Andy Swapp, SWATC Instructor, andy.swapp@beaver.k12.ut.us , 435-463-2288
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Working Partners: Southwest Applied Technology College, Southern Utah University, Brigham Young University, Snow College, Beaver County School District, First Wind, Utah Clean Energy

Cost-Sharing Partners: Southwest Applied Technology College (Cedar City, UT)

Signature of Submitting Official:

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ACCOMPLISHMENTS

A wind energy training program that prepares students for careers in the manufacturing, installation, operation, and maintenance of wind turbines is an important step in preparing to meet our nation's current and future wind industry needs. The Southern Utah Wind Power Educational Consortium for Workforce Development project is fostering the next generation of trained wind energy workers while providing the dual benefit of attracting more projects and bringing more jobs and economic development to Utah. The Consortium members recognize that workforce development is a critical piece to continued success of the wind industry in Utah and are strategically working together to grow Utah's clean energy workforce so that the current and future wind energy projects have skilled workers.

The funds from this project were used to purchase tools and instrumentation to help replicate actual on-the-job wind energy scenarios which provided the students with the practical or applied components of wind energy jobs. This project enhanced the educational experiences provided for the students in terms of engineering and science components of wind energy by using electronics, control systems, and electro-mechanical instrumentation to help students learn standardized wind-specific craftsman skills. In addition the tools and instrumentation helped the students learn the safety necessary to work in the wind industry.

GOAL 1: Purchase equipment
Task 1: All equipment money allocated

i. **Major activities:** Purchase of equipment
ii. **Specific objectives:** Acquired equipment that can be used in wind energy training labs
iii. **Significant results, including major findings, developments or conclusions (positive or negative):** Students gained competencies using the equipment
iv. **Key outcomes, milestones and other achievements:**
    - Students trained in climbing safety and gained the safety knowledge and confidence to work in a variety of wind energy conditions. In addition, the students learned the proper wear and care of personal protective instrumentation, fall arrest, and rescue items in order to be safe on the job site.
    - Students trained in wind energy tool practices and usage; learning the proper names of tools, how to safely deploy the correct tool for the job, and followed wind energy industry guidelines that would meet specific job requirements.
    - Students trained in electronics, basic hydraulics, compressed gases, and wind energy electrical test equipment; learning how to use electrical measurement safety, work with fiber optics, how to solder, use multimeters, amp clamps, voltage pens, megohmmeters, infrared testers, and oscilloscopes.
    - Students trained in wind turbine basics using wind turbine safety and maintenance techniques. They learned about wind turbine mechanical and electrical systems, tensioning, torque, fasteners, algorithms, substations and transformers, rectifiers and inverters, troubleshooting, service reporting, rotor construction and airfoils, fiberglass, blade pitch and balancing, data analysis, meteorology, and power curves.

Goal 2: Develop renewable energy industry education and training.
Task 2.1: Develop hands-on activities for wind energy modules

i. **Major activities:** Activities were developed for the wind energy modules for the SWATC-WindTech Fundamentals training

ii. **Specific objectives:** Found activities which helped students learn about wind energy

iii. Significant results, including major findings, developments or conclusions (positive or negative): Activities helped students apply what was learned in the classroom to the lab-simulated work environment

iv. Key outcomes, milestones and other achievements: Activities were developed for: a. Climbing safety; b. Basic hand tools usage; c. Basic power tool usage; d. Basic electrical test equipment usage; e. Electricity Safety and Hydraulics; f. Electronics; g. Wind Turbine Basics; h. Wind Turbine Maintenance; i. Wind Turbine Repairs. These activities helped students learn about wind power.

Task 2.2: Use hands-on activities in the wind energy modules developed

i. Major activities: Using the lab equipment, students demonstrated what they had learned in the classroom about wind energy and had opportunities outside the classroom to demonstrate the skills they learned.

ii. Specific objectives: Used activities to help students learn about wind energy

iii. **Significant results, including major findings, developments or conclusions (positive or negative):** Students were able to take what they learned in the classroom and apply what they learned to scenarios in and outside the lab.

iv. **Key outcomes, milestones and other achievements:**

- A wind energy workshop was held during the SWATC Open House-2010 in which over 400 community members attended. Andy Swapp, SWATC instructor, and four high school students from his alternative energy course presented the basics of wind energy and occupations involved with both commercial scale and home size wind installation and maintenance. Before and after the workshop tours of the alternative energy lab at the College were given.
- Fifteen high school students and four adult students demonstrated competency-based learning and received wind energy fundamentals certificates.
- Four students had the opportunity to take what they learned in the classroom and participate in a hands-on activity in which they went to a local elementary school and fixed the school's Skystream wind turbine so it began producing power to the school again; most of their troubleshooting was done through a U.S. Instruments SCADA system.
- On April 28, 2011 at the Renewable Energy Fair in Milford, Utah 472 high school students from 13 different high schools participated in the Milford Renewable Energy Fair and designed and built miniature wind turbines. The students competed against each other to determine which design produced the most voltage using a box fan as the wind resource; the most voltage produced was 1.236 volts.

Task 2.3: Consortium hold regular wind energy program assessments and continuing improvement sessions.

i. **Major activities:** Consortium meetings were held throughout 2010 and 2011 with the exception of the summer months.

ii. **Specific objectives**: Developed and continuously improved the consortium's and SUTREC's organizational effectiveness and recognition in the region and the State.

iii. **Significant results, including major findings, developments or conclusions (positive or negative):** The SUTREC Coordinator has been able to travel around the region presenting information about the SUTREC organization and gathering

support from local county commissioners, city councils, industry leaders, academic administrators, state leaders, and community leaders. SUTREC gathered momentum and recognition in the region and in the State.

iv. **Key outcomes, milestones and other achievements:**

- The Consortium met consistently throughout this project and was able to increase the community and state awareness of using wind as a renewable energy resource, add partnerships, and develop as an effective organization.
- Two members of the consortium, Andy Swapp and Jake Hardman, conducted yearly reviews of the wind energy program's content and made continuous recommendations on information and updates to add to the program.

Goal 3: Develop articulated advanced renewable energy educational pathways to degree programs.

Task 3.1: Identify the advanced renewable energy educational pathways to degree programs.

i. Major activities : Dana Miller, SWATC Campus President participated in meetings with Southern Utah University officials to discuss renewable energy educational pathway connections to Southern Utah University's degree programs

ii. Specific objectives: Create educational pathways from SWATC to Southern Utah University.

iii. Significant results, including major findings, developments or conclusions (positive or negative): Advanced renewable energy educational pathways were not completed at the local level (between SUU and SWATC) but other advanced degrees at other universities were identified and are being shared with the SWATC wind energy students so they are aware of the advanced renewable energy educational pathways available at other universities. As SWATC and SUU worked to identify advanced renewable energy educational pathways, it was acknowledged that it would take a long time (beyond this project's timeline) to add or change curriculum and programs at the university level and the differences between a non-credit and credit educational institution created challenges in designing articulation agreements between these institutions.

iv. Key outcomes, milestones and other achievements:

- One achievement toward developing an articulated advanced renewable energy pathway to a degree program was the creation of an articulation agreement with Southern Utah University (SUU) so Southwest Applied Technology College (SWATC) students can receive 30 credit hours for a completed SWATC 900 clock hour program toward a SUU General Technology Associates Degree.

Task 3.2: Share renewable energy pathways with K-12 students and adult students

i. **Major activities:**

ii. **Specific objectives:** share information on the renewable energy pathways with K-12 students and adult students

iii. **Significant results, including major findings, developments or conclusions (positive or negative):** raised awareness within the schools in the region

iv. **Key outcomes, milestones and other achievements:**

- On April 29, 2010 at the Renewable Energy Fair in Milford, Utah, over 560 people attended; the high school students attending the fair learned about renewable energy career pathways.
- On Feb. 4, 2011 students from Milford High School accompanied Andy Swapp, SWATC Renewable Energy Instructor, and Jake Hardman, SUTREC Coordinator, to the Rural Utah Day at the Utah Legislature. Opportunities

were provided for the students to interact with legislators to discuss renewable energy career pathways and the impact of renewable energy in the rural areas of the state. The students met a lot of people, took tours, and got the chance to meet legislators and talk about renewable energy. Andy met with Rep. Cosgrove who has a desire to work with SUTREC on possible legislation

- The Southern Utah University Engineering Fair was held on Feb. 23-25, 2011 and had a renewable energy theme to it. All participants were exposed to renewable energy pathways. SUTREC participated with a booth display on Wed. 23 from 9am – noon. On Feb. 25 Andy Swapp, SWATC Renewable Energy instructor, and some of his students attended the fair and got chances to interact with professors and participate in activities.
- On April 28, 2011 at the Renewable Energy Fair in Milford, Utah, several wind companies ranging from large commercial applications to residential wind companies to turbine manufacturers were present and over 500 students and community members spent time with each company to discuss the particulars of their areas of expertise which gave students and community members a feel for the wind industry as a whole and the types of careers available in the wind industry.
- On August 23, 2011 Jake Hardman, SUTREC Coordinator, and Senator Hatch's aide Jared Brown, Legislative Assistant for Natural Resources, Environment, and Agriculture, visited the First Wind wind farm and spoke with the students in Andy Swapp's renewable energy classroom in Milford, Utah; touring the facilities and viewing the wind energy training equipment.
- October 5-7, 2011, Andy Swapp of Milford High School and instructor for the Southwest Applied Technology College's Energy Academy volunteered some of his high school students to show the 6th graders from Milford, Minersville, and Beaver Elementary Schools the basics of wind energy. After a presentation by the Milford High School Wind students, educational materials on wind energy were passed out and teams of 3 or 4 students developed a blade design. The performance was then measured by turning an electric motor to see what the output voltage would be. Five classes of 25 students went through this program for a total of 125 students.
- After completion of the renewable energy course and wind tech fundamentals, twenty-three students have worked on First Wind's local wind farm.
- The Utah Office of Education approved SWATC instructor, Andy Swapp's, renewable energy curriculum to be used as the curriculum for the only accredited high school level renewable energy course in the state of Utah.
- During the annual high school career days over 1,000 students across southwestern Utah, learned about the careers in wind energy and the overall job outlook for the wind industry.

Task 3.3: Identify where there are articulation opportunities between educational institutions.

i. **Major activities:** Southern Utah University approved a General Technology Associates Degree in which Southwest Applied Technology College (SWATC)

students can receive 30 credit hours for a completed SWATC 900 clock hour program.

ii. Specific objectives: Create a pathway for SWATC students into a SUU degree program

iii. Significant results, including major findings, developments or conclusions (positive or negative): It is difficult to create and get approval for new pathways at the university level

iv. **Key outcomes, milestones and other achievements:**

- A General Technology Associates Degree was created to create a pathway for SWATC students into a SUU degree program

Goal 4: Increase Minority Participation in Wind Energy Training Programs.

Task 4. Create marketing plan with strategy for recruiting Hispanics and Native Americans into wind energy.

i. Major activities: Created a brochure, flyer and information booklet on wind energy training in conjunction with the DOL State Energy Sector Partnership grant

ii. Specific objectives: Attract more Hispanic and Native Americans into our wind energy program

iii. Significant results, including major findings, developments or conclusions (positive or negative): There are not many jobs in Utah and many of the potential students do not want to go out-of-state for work so they are hesitant to enroll in our program

iv. **Key outcomes, milestones and other achievements:**

- Marketing plan and materials created to help recruit Hispanics and Native Americans.
- The participation of Hispanic and Native American populations in renewable energy events, workshops and courses represented the same or similar % as are in the general local population in SWATC's service region. The Hispanic student population was 6% with the Hispanic general population in SWATC's service region at 3.9%; the Native American student population was 4% with the Native American general population in SWATC's service at 1.8%.

Goal 5: Project Management and Reporting

Task 5.1: Manage Project

i. **Major activities:** Documented hands-on activities and coordinating activities

ii. **Specific objectives:** Effectively and efficiently managed the project

iii. **Significant results, including major findings, developments or conclusions (positive or negative):** No significant results besides management of this project

iv. Key outcomes, milestones and other achievements: Effective and efficient management of the project with proper reporting

Task 5.2: Disseminate results of project.

i. **Major activities:** This is the final report to disseminate the results of the project.

ii. Specific objectives: Effective communication of results of this project

iii. **Significant results, including major findings, developments or conclusions (positive or negative):** Regional and state recognition of the wind power in southern Utah

iv. **Key outcomes, milestones and other achievements:**

- On April 19, 2011 at the Utah Renewable Energy Conference in Salt Lake City and at the renewable energy fair in Milford on April 28, Jake Hardman, SUTREC Program Coordinator, showcased and promoted SWATC Wind Tech training program and the wind energy industry. A key outcome was getting Senator Hatch's support of SUTREC and the organization's renewable energy initiatives.

Task 5.3: Create website dedicated to renewable energy

i. **Major activities** The website is up and running and the SUTREC Program Coordinator updates the site.
ii. **Specific objectives:** A renewable energy website
iii. **Significant results, including major findings, developments or conclusions (positive or negative):** Website created
iv. **Key outcomes, milestones and other achievements:**
    - Reports and other deliverables as required by the DOE Project Officer were provided in a timely manner.
    - Project results were disseminated through a website and at wind energy events.

PRODUCTS / DELIVERABLES

Products / Deliverables:
Presentations:

- In 2010, the Secretary of the Interior, Ken Salazar, visited SUTREC and the renewable energy classroom in Milford, Utah. High school students had the opportunity to present what they had learned about renewable energy to the Secretary.
- Andy Swapp, SWATC Renewable Energy Instructor, and two high school students were invited by AWEA to participate in the Washington, DC wind energy events on Feb. 21-23, 2011. They met with AWEA's Vice President of Public Affairs and Marketing and toured many sites including the D.C. metro station where pictures of people from Milford supporting the benefits of wind energy hung on the wall for thousands to see. They met with legislative staff and Senator Mike Lee to discuss wind energy; getting an opportunity to explain the advantages of using wind energy. In addition, they had the opportunity to meet with AWEA President
- On May 3, 2011 Jake Hardman, SUTREC Program Coordinator, attended the Southwest Utah Planning Authorities Council (the Council consists of federal, state, local, and tribal planning authorities) and presented the SWATC Wind Tech training program and discussed renewable energy outreach planning.
- At the SWATC Job Success event on May 9, 2011, the Utah Department of Workforce Services (DWS) Specialist, presented the wind career pathway available within the SWATC Wind Energy training program which was designed in conjunction with SWATC's designation as an Energy Academy as part of the U.S. Department of Labor's State Energy Sector Partnership grant.
- On June 14, 2011, Andy Swapp, PI and instructor, presented renewable energy educational pathways to local county commissioners, city councils, industry leaders, academic administrators, state leaders, and community leaders attending the First Wind's wind farm in Milford, Utah phase 2 ribbon cutting.
- On August 11th, 2011, Jake Hardman, SUTREC Coordinator, moderated the "Renewable Energy Opportunities in Rural Utah" breakout session at the Utah Rural Summit held at Southern Utah University in Cedar City, Utah. He presented to 40

participants what SUTREC is accomplishing to support the renewable energy sector and the renewable energy training offered at the SWATC before turning the time over to the other panelists who were:
    - Samantha Julian- Director, Utah Office of Energy Development
    - Sara Baldwin- Senior Policy & Regulatory Associate, Utah Clean Energy
    - Rob Adams- Director of Property Development, REDCO
    - Brian Harris- Development Manager, First Wind
- In October, 2011, Jake Hardman, SUTREC Coordinator, met with the six Beaver County Commissioners at the Beaver City Hall to update them on SUTREC activities and to gain their full support and signature on SUTREC's official MOU.
- In November, 2011- Jake Hardman, SUTREC Coordinator, met with the Southern Utah Planning Authority Council (SUPAC) in Kanab, UT to discuss local activities by various government agencies. Samantha Julian, Director of the Office of Energy Development presented the Governor's 10 year Energy Plan and all discussed local efforts with regards to that plan, especially SUTREC's efforts and position within the plan.
- In December, 2011- Jake Hardman, SUTREC Coordinator, met with SUTREC Partners to discuss SUTREC's involvement with the Office of Energy Development and SUTREC's goals and strategy for 2012 regarding education, economic development and other opportunities in our region.

Publications:
Andy Swapp, PI and instructor, had an article published in the Technology and Engineering Teacher publication

Patents: none

PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS

Individuals: Lynette Bujack, Andy Swapp, Jake Hardman, and AmeriCorps VISTA member

For each individual, include the following:

- Name & role in the project**:**
    Lynette Bujack- SWATC Project Director who managed the project
    Andy Swapp- PI and SWATC Instructor who identified the tools and equipment needed for wind energy training, created and delivered wind energy training, and interacted with community members and state officials.
    Jake Hardman- SUTREC (Consortium) Coordinator who communicates statewide the training offered at SWATC
    AmeriCorps VISTA - worked with Andy Swapp to formally document wind energy activities into lesson plans.

- How the individual contributed to the project & with what funding support
    Lynette Bujack- managed this project; SWATC funding support
    Andy Swapp- see above contributions; SWATC funding support

Jake Hardman- see above contributions; SUU Appropriations and SWATC funding support
AmeriCorps VISTA- see above contributions; AmeriCorps VISTA and SWATC funding support

Organizations: The following organizations have been involved in this project:

- Southwest Applied Technology College, Cedar City, Utah. Contributions to the project included: financial support, in-kind support, facilities, personnel exchanges
- Southern Utah University-Cedar City, Utah. Contributions to the project included: financial support, in-kind support, personnel exchanges
- Beaver County School District – Beaver, Utah. Contributions to the project included: in-kind support, facilities, personnel exchanges
- Utah's Office of Energy Development-Salt Lake City, Utah. Contributions to the project included participating in meetings with SUTREC to presented the Governor's 10 year Energy Plan and support SUTREC's local efforts with regards to that plan
- Brigham Young University-Provo, Utah. Contributions to the project included: consultation and guidance for this project's PI, Andy Swapp
- Snow College- Price, Utah. Contributions to the project included: suggested wind energy curriculum
- First Wind-Milford, Utah. Contributions to the project included: facilities, use of equipment, and consultation on curriculum development
- Utah Clean Energy- Salt Lake City, Utah. Contributions to the project included consultation and guidance on wind energy curriculum