Wind Technician Certificate Overview

Description:

The Wind Technician Certificate Program will cover the basic knowledge areas of electricity, electronics, fluid power, and mechanics, and then expand into specific control systems of large wind turbine generator technology. This program incorporates a strong emphasis upon safety throughout the program standard in the industry.

The certificate program is offered at either the entry or skilled employee levels, with emphasis on fundamentals and practical applications for large scale wind energy production. This certificate program includes: five courses and an applied practicum component leading to a certificate pathway.

Before enrolling in this program:

Must be able to read and write in English at the proficiency level of that expected for college level work. For example, you must be able to test higher than RDG 090 on the compass assessment, or complete RDG 090 with a grade of C or better.

And understand that:

Wind energy technicians typically work in demanding physical and environmental conditions. Technicians may be working with heavy motors and gear drives in tight, confined spaces, electrical systems up to 600 volts, and/or advanced electronic control systems, all in the heat of summer or cold of winter, at heights approaching 300 feet.

What can I do with this certificate?

Career Options –Wind Turbine Technician:

Inspect, diagnose, adjust, or repair wind turbines. Perform maintenance on wind turbine equipment including resolving electrical, mechanical, and hydraulic malfunctions.

Academic Options:

Continue your studies by completing the Renewable Energy AAS Degree.

The Green Energy Subject Certificates

- NABCEP Small Wind Energy System Installer - http://www.nabcep.org/certification/small-wind/requirements-education

Required Core Courses	*A grade of C or better is required for graduation*	
MODULE	TOPIC	CREDIT HOURS
1	Introduction to Wind Energy **	**3**
2	Wind Safety Practices *	**2**
3	Wind Energy Delivery Systems *	**3**
4	Wind Electro/Mechanical Systems *	**3**
5	Wind Operation, Troubleshooting and Maintenance *	**3**
6	Wind Turbine Practicum *	**2**
		16

* *This course has a prerequisite, co-requisite, or recommendation (see course description section).*

***Recommended for tech prep credit.*

This workforce solution was funded by a grant awarded by the U.S. Department of Labor's Employment and Training Administration. The solution was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership. This solution is copyrighted by the institution that created it. Internal use by an organization and/or personal use by an individual for non-commercial purposes is permissible. All other uses require prior authorization of the copyright owner.

Credits:

- ✓ Material developed by Kirsten Benedick, Central Arizona College
- ✓ Modified and updated by Heidi Vasiloff, Heidi Vasiloff P.C.

Module 1: Introduction to Wind Energy

Description:

This course is the introduction to the wind energy industry and focuses on the role of the technician in the industry. This course will define wind energy, describe how wind energy systems work, and provide a basis for making decisions about the design, sizing, and location of wind energy systems.

Certification(s): Wind Energy Technician

Prerequisite: None

Required Materials: None

Community College Credit Hours: 3

Expected Outcomes:

Upon successful completion of this course a student would be able to:

1. Chart the history of wind turbine technology
2. Identify the components of a wind energy system and describe their function
3. Identify and describe
   - wind farm anatomy
   - general wind terminology
   - parts of the turbine, plant
4. Examine the various career opportunities in wind energy
5. Describe the evolution of wind turbine technology (include air flow technicians and blade efficiencies.)
6. Explain air flow as related to wind turbines
7. Use local and web-based data sources to define the wind resource in a given area
8. Examine site construction, foundation roads, and substation development
9. Discuss environmental, ethical and legal obligations of wind farm

Module1: Introduction to Wind Energy		
Expected Outcome	**Topic**	**Suggested Activities or Resources**
1-5	Introduction 1. Introduction 2. Wind history 3. Terminology 4. Careers in wind energy 5. Pros/cons of wind energy	
6, 7	Wind Characteristics 1. Air Flow 2. Power in wind 3. Height changes with speed 4. Wind Potential 5. Wind maps	
3	Design of Turbines 1. Aerodynamics 2. Drag Device 3. Lift Device	
8, 9	Site Performance A. Construction B. Support C. Environmental	

* **This course aligns with National Recognized Certifications in NABCEP Small Wind Energy System Installer.** For more information go to: The North American Board of Certified Energy Practitioners (NABCEP) http://www.nabcep.org/certification/small-wind

Credits:

- ✓ Material developed by Kirsten Benedick, Central Arizona College
- ✓ Modified and updated by Heidi Vasiloff, Heidi Vasiloff P.C.

This workforce solution was funded by a grant awarded by the U.S. Department of Labor's Employment and Training Administration. The solution was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership. This solution is copyrighted by the institution that created it. Internal use by an organization and/or personal use by an individual for non-commercial purposes is permissible. All other uses require prior authorization of the copyright owner.

Module 2: Wind Safety Practices

Description:

Introduction to safety procedures and practices relating to turbine towers. Course builds foundation for safety practices in the renewable energy industry, to include first aid training and CPR certification.

Certification(s): Wind Energy Technician

Prerequisite: None

Required Materials: None

Community College Credit Hours: 2

Expected Outcomes:

Upon successful completion of this course a student would be able to:

1. Demonstrate proficiency in basic first aid and CPR and completing certification process
2. Perform climb test
3. Explain rigging procedures
4. Demonstrate rescue procedures fundamental for wind turbine settings
5. Lock Out/Tag Out & Clearances
6. Safely work with electrical/electronic/mechanical equipment thru the knowledge of electric safety devices, such as switches, fuses, breakers, interlocks, isolating valves, and proper grounding techniques
7. Identify electrical safety practices
8. Describe safety regulatory agency standards
   a. Knowledge of OSHA 19.10 and NFPA 70E standards & regulations
   b. Technical reading of state and federal requirements

** These outcomes meet or exceed national industry recognized certification standards.*

Module 2: Wind Safety Practices		
Expected Outcome	**Topic**	**Suggested Activities or Resources**
4 -7	Hazards 1. Climbing and descending 2. Proper tie off practices and tie off points 3. Confined spaces 4. Pinch 5. Fire 6. Electrical 7. Eye, hand and ear 8. Excavation 9. Hazardous materials	
8	Regulations 1. OSHA 2. State 3. Federal 4. Other Agencies	
3	Personal Protective Equipment 1. Harness • Harness • Lanyards • Cable fall protection 2. Electrical	
1, 2	Applied Activity 1. CPR Training 2. First Aid 3. Tower Climb 4. Tower Rescue	

* **This course aligns with National Recognized Certifications in NABCEP Small Wind Energy System Installer.** For more information go to: The North American Board of Certified Energy Practitioners (NABCEP) *http://www.nabcep.org/certification/small-wind*

Credits:

- ✓ Material developed by Kirsten Benedick, Central Arizona College
- ✓ Modified and updated by Heidi Vasiloff, Heidi Vasiloff P.C.

Module 3: Wind Energy Delivery Systems

Description:

Course will focus upon basic energy, gears and control systems for production of electricity and the identification and analysis of the components, types, and energy output of a large scale wind energy production systems.

Certification(s): Wind Energy Technician

Prerequisite: None

Required Materials: None

Community College Credit Hours: 3

Expected Outcomes:

Upon successful completion of this course a student would be able to:

1. Successfully complete a tower climb test (real or virtual simulation)
2. Identify components of both AC and DC systems
3. Differentiate between wind energy system designs describing their benefits and drawbacks
4. Compare wind energy system types and variations
5. Demonstrate proper use of electrical testing equipment
6. Convert of units of measurement (metrics to US standards)
7. Demonstrate achievement of proper torque and tension on system wind components
8. Identify types of gear boxes (hybrid, planetary versus helical/parallel shaft) and probable causes of failure
9. Chart control systems in large scale wind energy production

Module 3: Wind Energy Delivery Systems		
Expected Outcome	**Topic**	**Suggested Activities or Resources**
3, 4	Wind Energy Systems 1. Types and uses • utility intertie w/o batteries • utility intertie w/ batteries • stand alone • wind/PV hybrid systems 2. Manufacturer Designs • Collector types • Speed controls • Tower types 3. Scale	
	Energy 1. Definitions, Terminology, and Calculations • Ohm's law, Kirchhoff's voltage and current law 2. Calculating power and energy	
5, 6	Electricity 1. Electrical safety 2. Fundamentals and terminology 3. Testing equipment • Use of digital multimeters (DMMs) to measure resistance, voltage, and current 4. Generation 5. Faradays law of Electromagnetic Induction 6. Phase angle and Power Factor 7. Generators 8. Induction Generators	
2	AC/DC 1. Concepts and components 2. AC drives 3. AC motors 4. DC drives 5. DC motors 6. Braking methods	

Module 3: Wind Energy Delivery Systems (continued)		
Expected Outcome	**Topic**	**Suggested Activities or Resources**
8	Heat Failure 1. Electrical 2. Mechanical	
7	Fasteners and Torque 1. Fastener types 2. Torque and tension	
8	Gear Box 1. Identification 2. Inspection 3. Lubrication 4. Failure Identification	
9	Control Systems 1. History 2. Identification	

* **This course aligns with National Recognized Certifications in NABCEP Small Wind Energy System Installer.** For more information go to: The North American Board of Certified Energy Practitioners (NABCEP) http://www.nabcep.org/certification/small-wind

Credits:

- ✓ Material developed by Kirsten Benedick, Central Arizona College
- ✓ Modified and updated by Heidi Vasiloff, Heidi Vasiloff P.C.

This workforce solution was funded by a grant awarded by the U.S. Department of Labor's Employment and Training Administration. The solution was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership. This solution is copyrighted by the institution that created it. Internal use by an organization and/or personal use by an individual for non-commercial purposes is permissible. All other uses require prior authorization of the copyright owner.

Intentionally Left Blank

Module 4: Wind Electro/Mechanical Systems

Description:

This course will cover the components and process of the electrical power generation and delivery systems for wind energy.

Certification(s): Wind Energy Technician

Prerequisite: None

Required Materials: None

Community College Credit Hours: 3

Expected Outcomes:

Upon successful completion of this course a student would be able to:

1. Understand electrical systems and mechanical systems of wind turbines.
2. Demonstrate the concepts of supervisory control and data acquisition (SCADA) systems and data communications related to wind turbines.
3. Explain the operation of power production
4. Describe power transmission components
5. Describe low voltage power distribution/transformers.
6. Identify the operational relationship between the generator and convertor
7. Explain the architecture of power electronics in frequency converters.
8. Identify electrical control system components such as circuit protection devices, sensors, relays, contactors, actuators, timers, counters, motors, and various types of DC and AC drivers.
9. Identify RPM, gear ratios and failure mechanisms
10. Describe the impact of heat generation on various materials and heat control mechanisms.
11. Define the effects of machining and heat treating on metals as it relates to predictable failures.
12. Identify electrical control system components such as circuit protection devices, sensors, relays, contactors, actuators, timers, counters, motors, and various types of DC and AC drivers.
13. Identify gel coats, UV characteristics, flexibility, impact resistance of various cooling and how they are applied.

Module 4: Wind Electro/Mechanical Systems		
Expected Outcome	**Topic**	**Suggested Activities or Resources**
	Introduction	
10, 11, 13	Materials 1. Historic 2. Materials 3. Manufacturing processes	
1, 4, 8, 12	Electrical Components 1. Safety 2. Electrical Power Transmission System Overview 3. Electrical Units 4. Alternating Current and DC Transmission 5. Three Phase Circuits (Delta and Wye) 6. Circuit Protection 7. Nationwide Electrical Transmission Issues and Grid Schematics	
1, 9	Mechanical Systems 1. History 2. Tools and measuring devices 3. Motors 4. Shafts 5. Bearings 6. Rpm/temperature 7. Coupling 8. Alignment 9. Loads	
9	Industrial Motor Controls 1. Fundamentals and tools 2. Electric Motor 3. Relays and Switches 4. Wiring Motors - DC motor, Single phase, Split phase, Three phase	
5	Transformers	
3, 6	Generators	
6, 7	Convertors	
2	SCADA	

* **This course aligns with National Recognized Certifications in NABCEP Small Wind Energy System Installer.** For more information go to: The North American Board of Certified Energy Practitioners (NABCEP) *http://www.nabcep.org/certification/small-wind*

Credits:

- ✓ Material developed by Kirsten Benedick, Central Arizona College
- ✓ Modified and updated by Heidi Vasiloff, Heidi Vasiloff P.C.

This workforce solution was funded by a grant awarded by the U.S. Department of Labor's Employment and Training Administration. The solution was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership. *This solution is copyrighted by the institution that created it. Internal use by an organization and/or personal use by an individual for non-commercial purposes is permissible. All other uses require prior authorization of the copyright owner.*

Intentionally Left Blank

Module 5: Wind Turbine Operation, Troubleshooting and Repair

Certification(s): Wind Energy Technician

Prerequisite: None

Required Materials: None

Community College Credit Hours: 3

Description:

This course will focus on the operation, maintenance, troubleshooting and repair of wind turbine systems.

Expected Outcomes:

Upon successful completion of this course a student would be able to:

1. Maintain and repair electrical systems and mechanical systems of wind turbines.
2. Demonstrate the concepts of supervisory control and data acquisition (SCADA) systems and data communications related to wind turbines.
3. Interpret grid schematics.
4. Describe impacts of heat generation on various materials; heat control mechanisms.
5. Understand importance of identification of equipment configuration and maintenance history to use as a predictive tool.
6. Inspect gears and gear ratios; scaling; rpm; different types of boxes (hybrid, planetary versus helical/parallel shaft) and failure mechanisms.
7. Demonstrate knowledge of effective techniques for troubleshooting electrical/electronic/mechanical/computer system problems by utilizing: manufacturers' documentation and software, schematics and wiring diagrams, flow charts and process diagrams.
8. Solve problems and build employability skills such as critical thinking, teamwork and work ethic.
9. Planning and scheduling maintenance. Planning your work and working your plan.

Module 5: Wind Turbine Operation, Troubleshooting and Repair		
Expected Outcome	**Topic**	**Suggested Activities or Resources**
	Introduction	
	Energy isolation and safety 1. Grounding 2. Electrical 3. Mechanical	
3, 7	Technical services documents 1. Manuals 2. Schematics 3. Research 4. Documentation	
8	Component Troubleshooting 1. Electrical 2. Combination starters 3. AC motors 4. DC motors 5. Power supplies and conditioners	
2	SCADA	
1, 4, 5, 6, 9	Preventative Maintenance 1. Technique 2. Maintenance plan	

* **This course aligns with National Recognized Certifications in NABCEP Small Wind Energy System Installer.** For more information go to: The North American Board of Certified Energy Practitioners (NABCEP) *http://www.nabcep.org/certification/small-wind*

Credits:

- ✓ Material developed by Kirsten Benedick, Central Arizona College
- ✓ Modified and updated by Heidi Vasiloff, Heidi Vasiloff P.C.

This workforce solution was funded by a grant awarded by the U.S. Department of Labor's Employment and Training Administration. The solution was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership. *This solution is copyrighted by the institution that created it. Internal use by an organization and/or personal use by an individual for non-commercial purposes is permissible. All other uses require prior authorization of the copyright owner.*