

Prepared by the Department of Natural Sciences & Life Fitness

Date of Departmental Approval: March 12, 2012

Date approved by Curriculum and Programs: September 24, 2012

Effective: Fall 2012

1. **Course Number:** ENV180  
**Course Title:** Small Wind Installation
2. **Description:** This course introduces students to the fundamentals of small wind-electric system installation and maintenance procedures. The class is divided between classroom based lectures/activities and project based activities that involve the installation of a residential-scale wind system. This course is based in part on the Task Analysis for the North American Board of Certified Energy Practitioners (NABCEP) Small Wind Energy Systems Installer Certification.
3. **Student Learning Outcomes (instructional objectives; intellectual skills):**  
Upon successful completion of this course, students are able to do the following:
  - Identify safety hazards associated with the installation, operation, and maintenance of small wind-electric systems.
  - Demonstrate safe, proper use of required tools, equipment, and personnel protection.
  - Explain proper permitting, interconnection, and inspection procedures for small wind systems.
  - Identify appropriate codes and standards concerning installation, operation and maintenance of small wind systems and equipment.
  - Explain the benefits, limitations, applications, and price ranges of various small wind turbine tower options.
  - Explain the procedures for excavating, forming, pouring and backfilling tower foundations.
  - Demonstrate and/or explain safe, proper, code compliant small wind tower assembly procedures and techniques.
  - Demonstrate and/or explain crane, winch, or other heavy machinery operation hand signals and communication protocols.
  - Identify and describe the purpose and operation of components specific to small wind-electric systems.
  - Determine the location of components, system layout and configuration of small wind electric systems.
  - Demonstrate and/or explain safe, proper, code compliant installation procedures and techniques of small wind system electrical components.
  - Demonstrate and/or explain safe, proper, code compliant procedures and techniques for proper grounding and lightning protection of small wind systems.
  - Demonstrate and/or explain small wind system commissioning procedures.
  - Describe wind turbine, tower, grounding, and electrical system inspection and maintenance procedures.
  - Describe typical system design errors.
  - Describe typical system performance problems and troubleshooting procedures.
4. **Credits:** 3 credits
5. **Satisfies General Education Requirement:** No
6. **Prerequisite:** ENV177
7. **Semester(s) Offered:** Varies
8. **Suggested General Guidelines for Evaluation:** Students are evaluated through homework assignments, quizzes, and project work.
9. **General Topical Outline (Optional):** See attached.

## **ENV180. Small Wind Installation**

### **Content Outline**

#### **Classroom Topics:**

- Review of basic principles
- Review of wind-electric applications, systems, and components
- Wind site analysis and selection
- Problem with roof mounting and building integration
- Wind measurement, power in the wind, and wind energy
- Importance of tower height and swept area
- Tower types and selection (tilt-up, fixed guyed, freestanding, lattice, monopole)
  - Footprints
  - Advantages & Disadvantages
  - Price Ranges
  - Installation, Maintenance, and Operability
- Tower installation methods
  - Foundation
  - Erection
  - Tools and equipment required
- Turbine types, models, specifications, and selection
  - Upwind vs. Downwind
  - Horizontal vs. Vertical axis
  - Number of blades
  - Manufacturer reputation and history
- Turbine parts and function
  - Airfoils & Rotor
  - Transmission
  - Generator
  - Governing Systems
  - Brakes
  - Weight and durability
- Homebuilt generators
- Electrical systems and components
  - Inverter
  - Charge Controllers
  - Batteries
  - Meters
  - Conductors
  - Disconnects
  - Grounding
  - Dump load
- Review of electricity basics
- Permitting requirements and procedures
- Interconnection requirements and procedures
- Inspection requirements and procedures
- Economics and incentives
- Policy and regulations
- Maintenance requirements and procedures

#### **Project Topics:**

- Site Orientation and Safety
- Foundation Work
- Tower Assembly
- Tower Erection
- Electrical System Installation
- Grounding
- Inspection and Commissioning