

### DESCRIPTION

Fossil fuels and nuclear power are at the center of today's most divisive political and environmental issues. What are the alternatives to these polluting, nonrenewable fuel sources?

#### Renewable Energy

Renewable energy is defined as "energy derived from resources that are regenerative or for all practical purposes can not be depleted." Renewable energy sources contribute approximately 29.3 % of human energy use worldwide. A prime source of renewable energy is Wind.

Mankind's traditional uses of wind power are widespread in developed and developing countries. However, the mass production of electricity using renewable energy sources has become more common place only recently. This reflects the major threats of climate change due to pollution, exhaustion of fossil fuels, and the environmental, social and political risks of fossil fuels and nuclear power. Many countries and organizations promote renewable energies through taxes and subsidies.

The WSEM Wind and Solar Energy Module combines the alternate power source modules from both the WEM and the SEM modules to form a hybrid energy source. His program demonstrates how wind turbines and solar cells are beginning to transform the way the world is powered. In the Wind and Solar Energy module, students learn about today's two major forms of alternative energy and how technology is used to convert and transmit this energy. They explore solar and wind as an energy source that can be used to help reduce dependence on exhaustible, non-renewable fuel sources. Students will gain a global perspective when they understand the economics, efficiency, and low environmental impact of producing energy from non-polluting, renewable sources.

The Alternate Energy module includes everything required to function as a "turn-key" learning station; lesson plan, student guide, DVD video, training station with fault insertion and energy producing equipment. The module provides student instruction, in teams of two, for up to 25 hours.

The Lesson Plan includes an Instructor's Guide which provides instructions for installing, setting up, and implementing the module. It also includes learning outcomes, testing and evaluation procedures, answer keys, student skills response, inventory list and print CD.

The Student Activity manual guides students through 12 multi-disciplinary activities using the tools, and equipment included with the module package. It also contains optional enrichment and career exploration activities, daily activity response sheets and activity notes.

#### Computer Monitoring

The Renewable Energy Systems from Progressive Educational Systems are monitored through an interface component on each station called the Green Meter. The monitoring is connected through a stand alone computer, computer network/school network or through an optional on-line monitoring site which is assigned to the particular station. The monitoring enables individuals, classrooms of students or home study to participate in the curriculum. The monitoring not only provides the voltage, current and wattage of the Solar, Wind, Batteries and Inverter but also calculates savings based on the regional KWh costs. Co2 emissions savings is also calculated. All data can be seen over a period of one hour, day, week or year as a trend graph. Data can then be exported to different file types.



## Activities

Upon the completion of the Wind and Solar Energy Student Activity Manual, students should be able to deal with:

- Pre-Test/Introduction/ Safety Precautions;
- Renewable Energy Basics;
- Solar Energy;
- Wind Energy;
- Solar Siting;
- Wind Siting;
- Storage Devices and Monitoring;
- Voltage Regulation and Monitoring;
- Energy Conversion and Distribution;
- System Design;
- System Troubleshooting;
- Post-test and Wrap up;
- History Research;
- Careers in Renewable Energy;
- Design your own Hybrid System;
- Internet Research; and,
- Problem Scenario Build your own wind turbine!



## Optional Monitoring/Curriculum

The Progressive Educational Systems Web-Lab is an on-line monitoring system with optional on-line curriculum for both wind and solar energy. This system can be used to monitor any wind and/or solar renewable energy system including:

- Any Progressive Educational system trainer;
- Any Progressive Educational Systems Component board; and,
- As a stand-a-lone system monitoring a Progressive Educational Systems installation.



The WSEM-400 Training System includes the following:

### Wind Generator

Delivers 400W of power at wind speeds of 45km/h Carbon fibre composite blades sophisticated internal charge regulator. (Size varies with requirements)

### Power Inverter

Converts 12V DC battery power to 120V AC solid state control circuits provide a maximum 1 kW of power and 2 k W of surge capacity. (Size varies with requirements)

### Systems Monitoring

Voltmeter and Ammeter for both solar and wind generating systems. Audible alarm warns of low battery voltage. Auto shutdown protects against overload, short-circuit, over heating and low and high battery condition. Computer monitors solar and wind generators input for voltage and wattage as well as inverter and battery. Records system history from 1 hour up to 1 year. Produces a variety of graphs and determines costs savings.

### (2)130W Solar Panel

Delivers 130 W of power in peak sunlight. High-efficiency polycrystalline weatherproof design. Tempered glass and aluminum construction. (Size varies with requirements)

### 30A, 12V Solar Charge Controller

Prevents overcharging and discharging of batteries. Required for solar power systems. Handles up to 30A current or 450W of solar power. (Size and quantity vary with requirements)

### (2)12V Renewable Energy Deep Cycle Battery

Renewable energy deep cycle battery. 12V sealed deep cycle lead acid battery. 100 Ah at 100 hour rate (Size and quantity vary with requirements)

### Fault Box (panel rear):

Fault insertion device that enables failure or malfunction of WSEM components.

### Terminal Block (panel rear):

An insulating block equipped with terminal connectors for the electrical connections with other components.

### Load Device

Variable load device provides up to 240 watt maximum load at 60watts intervals.

### Curriculum

Student activity manual provides 12 regular activities with 5 enrichment activities for up to 25 hours of instruction. Includes DVD, Alternative Power Sources and Renewable Energy and Instructor Guide.

### Optional Mounting

Note: The Renewable Energy training systems are usually permanently installed. It is recommended that a licensed Renewable Energy Technician install this system. There are many methods of mounting the solar panel(s) used in the Progressive Educational Systems solar training systems. These include outside on ground, roof and pedestal as well as tracking systems. Inside mounting is also available. For further information on mounting options refer to the mounting and accessories data sheet.

