Renewable Energy
RES-100

Core Technology

Quick View
- Provides an overview of solar cells, fuel cells and thermoelectricity
- Flexible and Modular Curriculum

The conservation of environmental resources is one of today's hot topics. As our natural resources dwindle, finding alternative, or eco-friendly, solutions to energy and consumption has become the cornerstone in the conservation effort. Solar panels, hybrid cars, thermoelectric watches and hydro-powered machines are just a few examples of this effort. The concept behind all of these products is renewable energy. Heathkit Educational Systems' Renewable Energy course introduces students to the principles of thermoelectricity, solar cells and fuel cells (renewable energy). Through a series of hands-on experiments, students will learn the fundamentals and applications of renewable energy, and how it fits into the real world of today.

Hands-On Experiments
- Testing Broken Solar Cells
- Trainer Familiarization and Soldering
- Solar Cell Circuits
- Power Testing Solar Cells
- Electrolysis - Hydrogen from Water
- The Original Fuel Cell
- The Fuel Cell Car
- Inside a Fuel Cell
- More About Fuel Cells
- Using Renewable Energy
- Resistance, Ohm's Law, and Electrical Power
- Batteries
- Battery Chargers
- TE (Thermoelectric) Module Basics
- TE Module and trainer Familiarization
- Testing a TE Module Power Generator
- Circuits and Loads

System Components
- Textbook
- Workbook
- Parts Pack
- Instructor's Guide
- Trainer

Classroom Hours
- 35 hours

Prerequisites
- None

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Renewable Energy

Course Objectives

After you complete this course, you will be able to:

- Test solar cells to determine their voltage and current outputs.
- Demonstrate how to properly use a soldering iron to solder a connection.
- Install alligator clips and insulators on the ends of a test lead.
- Solder electrical connectors onto solar cells.
- Demonstrate how to use a DMM to test cables you have assembled.
- Calculate the voltage and current of simple series and parallel circuits.
- Calculate the voltage and current of a simple parallel circuit.
- Calculate the voltage and current of a simple series -parallel circuit.
- Tell what happens to voltage and current output when a solar cell's load resistance is increased or decreased.
- Draw a graph showing a solar cell's power curves.
- Discuss the effects of circuit loading on solar cells.
- Discuss the purpose of a voltage regulator.
- Demonstrate the production of hydrogen using electrolysis.
- Describe the chemical process of electrolysis.
- List several ways of producing hydrogen.

Course Objectives

(continued)

- List several benefits of using hydrogen as fuel.
- Describe Sir Robert Grove's first fuel cell experiment.
- Describe how a simple fuel cell operates.
- Discuss why there is so much interest in fuel cells today.
- Assemble and operate an Intelligent Fuel Cell Car.
- Explain the basic operation of Fuel Cell Car.
- Describe the major parts of a fuel cell.
- Fuel one fuel cell with the hydrogen produced from another fuel cell.
- Explain the operation of one fuel cell being powered by another fuel cell.
- Describe how increasing or decreasing the catalyst will affect the power output of a fuel cell.
- Describe how varying the volumes of input gasses affects the power of a fuel cell.
- Tell what factor internal resistance plays in fuel cell output power.
- Describe how metal can move through a liquid from one location to another.
- Explain why a DC to DC converter is needed.

Course Objectives

(continued)

- Explain how a voltage regulator can be necessary.
- Tell how to measure resistance with a multimeter.
- Define what electrical current is.
- Define voltage and what its purpose is.
- Describe resistance and how it affects voltage and current.
- Tell what electrical power is and how to calculate it.
- Describe how a battery works.
- Describe how to make a battery.
- Describe how to properly charge a battery.
- List the dangers of improperly handling or using a battery.
- Describe what PWM is and how it applies to battery charging.
- Describe several heat measuring standards.
- Describe how TE modules work.
- Tell how TE modules can be used for electrical power generation.
- Perform and describe a TE module short circuit current and voltage test.
- Discuss why higher temperatures can produce more electrical power using TE modules than lower temperatures can.
- Discuss the purpose of a voltage regulator.

CT-RES-100-5/2006-SM