

SUGGESTED REFERENCES

- *American Solar Challenge*
www.americansolarchallenge.org/
- *NREL, National Renewable Energy Laboratory*
www.nrel.gov/
- *US Department of Energy*
www.energy.gov
- *Oakridge National Laboratory*
<http://www.ornl.gov/>

NATIONAL SCIENCE EDUCATION STANDARDS

Grades 9 - 12
Science & Technology
Abilities of technological design
Understandings about science & technology

Grades 9 - 12
Science in Personal & Social Perspectives
Natural resources
Environmental quality
Natural and human-induced hazards
Science and technology in local, national, and global challenge

**Source: National Science Education Standards, 1996, National Academy Press*

Grades 9 - 12
Life Science
Matter, Energy and Organization in Living Systems

Grades 9 - 12
Physical Science
Interactions of energy and matter
Motions and forces
Conservation of energy and the increase in disorder

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Science Screen Report

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ENERGY - Transforming Renewable Resources PART-2

SYNOPSIS

This program stresses the importance of caring for our environment and provides an overview of multiple energy sources such as biomass and solar energy. This second part of Transforming Energy documents how some states are trying to enact laws that require local power plants to increase their power provided by renewable energy. To preserve our planet's health, scientists explore green projects involving ecologically friendly architecture and sustainable communities with solar homes and green housing developments.



CURRICULUM UNITS

- ECOLOGY
- ENGINEERING
- ENVIRONMENTAL SCIENCE
- PHYSICAL SCIENCE
- PHYSICS

RUNNING TIME

18 minutes

BACKGROUND

For the first time in U.S. history, a renewable energy portfolio standard was put directly before voters rather than processed through a state's legislature. The initiative requires Colorado's largest utilities to harvest 10 percent of their electricity from renewable energy resources by 2015. It also calls for the state to establish a standard net metering system for homeowners and ranchers with small photovoltaic, or PV systems to connect to the power grid. The measure requires that 4 percent of the mandated amount of renewable energy will come from solar resources.

Biochemical engineers propose that biomass is the technology we need to invest in. Other renewable resources will help with energy demands, but biomass can help create fuels, materials, and chemicals. Corn stover is the above ground residue after you harvest the corn plant. Corn happens to be the most abundant crop growing in the United States, making it a prime candidate for biomass ethanol production. Corn stover serves many purposes in today's agricultural economy and will continue to do so in the future.

As the simplest and most abundant element, hydrogen is rarely found alone in nature because it is usually bonded with other elements. It is found in water, hydrocarbons, and other organic matter. Engineers have developed fuel cells that are powered by hydrogen. Fuel cells are electrochemical devices that convert chemical energy into electrical energy. Hydrogen fuel cell vehicles are highly efficient and their only emissions are heat and water.

CRITICAL THINKING EXERCISES

1. Why are scientists interested in searching for alternative energy sources?
 2. Predict how biomass may change the agricultural industry in the future. Outline the pros and cons of using corn as a source for biomass
 3. Judge the value of different alternative energy sources. Do you agree with biochemical engineers that biomass fuel is the most promising for future fuel needs? Explain which alternative energy source you would choose to support if you were deciding which to fund as a priority.
1. Colorado's Amendment 37 provides several the first historical effort for a state to allow voters to decide environmental policy in the state in which they live. Justify, with clear examples, why some voters may choose to vote no on this issue.

CAREER POSSIBILITIES

- CIVIL ENGINEER
- ELECTRICIAN
- ENGINEER
- ENVIRONMENTAL ENGINEER
- PHYSICIST

ADVANCED ORGANIZERS

Prior to viewing this program, students should have some understanding of the following Benchmarks for Science Literacy, Oxford University Press which are excerpted and, in some cases, abbreviated below. Refer to the Benchmarks for more information.

Benchmark 3. The Nature of Technology

Section A: Technology & Science, Grades 9-12

- Technological problems and advances often create a demand for new scientific knowledge, and new technologies make it possible for scientists to extend their research in new ways or to undertake entirely new lines of research. The very availability of new technology itself often sparks scientific advances.
- Mathematics, creativity, logic, and originality are all needed to improve technology.
- Technology usually affects society more directly than science does because technology solves practical problems and serves human needs (and also creates new problems and needs).

Benchmark 8. The Designed World

Section B: Materials and Manufacturing, Grades 9-12

- Manufacturing processes have been changed by improved tools and techniques based on more thorough scientific understanding, increases in the forces that can be applied and the temperatures that can be reached, and the availability of electronic controls that make operations occur more rapidly and consistently.

Benchmark 8. The Designed World

Section C: Energy Sources and Use, Grades 9-12

- The useful energy output of a device—that is, what energy is available for further change—is always less than the energy input, with the difference usually appearing as thermal energy. One goal in the design of such devices is to make them as efficient as possible—that is, to maximize the useful output for a given input.
- During any transformation of energy, there is inevitably some dissipation of energy into the environment. In this practical sense, energy gets "used up," even though it is still around somewhere.
- Sunlight is the ultimate source of most of the energy we use. The energy in fossil fuels such as oil and coal comes from energy that plants captured from the sun long ago.

**Benchmarks can be found at www.project2061.org/tools/benchol/bolintro.htm*

VOCABULARY

Biomass Organic matter, especially plant matter, that can be converted to fuel and is therefore regarded as a potential energy source.

Ethanol An alcohol obtained from the fermentation of sugars and starches or by chemical synthesis. It can be used as an additive to or replacement for petroleum-based fuels.

Fuel Cell A device that produces electricity by combining a fuel, usually hydrogen, with oxygen. In this reaction, electrons are freed from the hydrogen in the fuel cell by a catalyst, and gain energy from the chemical reaction binding hydrogen and oxygen; this provides a source for electric current. The exhaust of hydrogen fuel cells consists of only water. Fuel cells are currently used in spacecraft and increasingly in ground transportation

Photovoltaics Photovoltaics - a semiconductor technology involving the direct conversion of sunlight (electromagnetic radiation) into electricity.