

# ELECTRICITY FROM THE SUN

TEXAS STATE DOCUMENT  
UNIVERSITY OF TEXAS PAN AMERICAN  
EDINBURG, TEXAS 79439-2999



**RENEWABLE ENERGY**  
THE INFINITE POWER  
OF TEXAS

**FACT SHEET 6** A RESOURCE FOR CLASSROOMS AND TEACHERS

## Highlights

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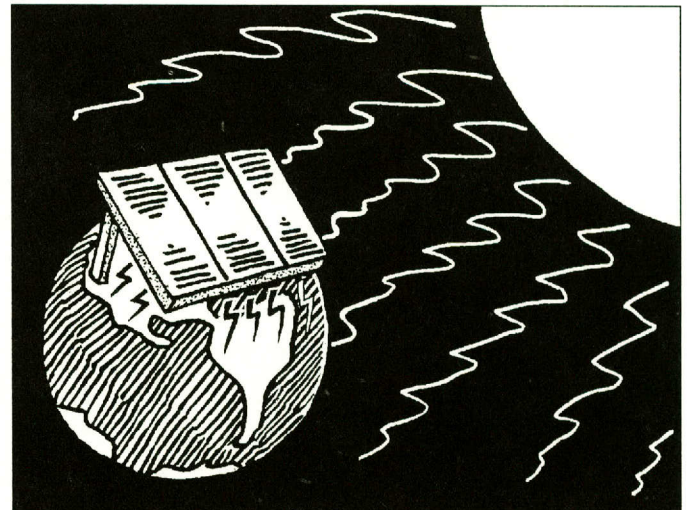
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- ◆ Earth: A huge solar collector
- ◆ Winds and wind turbines
- ◆ Plants store sunlight
- ◆ Falling water, heat and light into watts

## Using the Sun's Energy

Solar energy sustains life on earth for all plants, animals and people. The earth receives radiant energy from the sun in the form of electromagnetic waves, which the sun continuously emits into space. The earth is essentially a huge solar energy collector. This energy takes on various forms, from direct sunlight used through photosynthesis by plants to grow, to heated air that causes wind, to evaporation of the oceans that falls back as rain and becomes rivers. This energy can be tapped indirectly as wind, biomass and hydroelectric power, and directly as solar energy (thermal and photovoltaic).

Solar energy is a renewable resource that is inexhaustible and readily available, unlike fossil



**SUNLIGHT POWERS THE EARTH** The earth is like a huge solar collector that turns sunlight into natural forces such as wind, rain and growing plants.

fuels such as coal, oil and natural gas. It is a clean energy source that can be used pollution free and allows for local energy independence. The amount of power from the sun that reaches the earth at noon on a clear day is about 1,000 Watts per square meter. This is equivalent to a 100 Watt light bulb completely focused on a surface the size of a large notebook. Capturing solar energy often requires purchasing expensive equipment. Yet because renewable energy resources are free, the cost to use them is similar to or lower than other energy sources, such as fossil fuels. The envi-

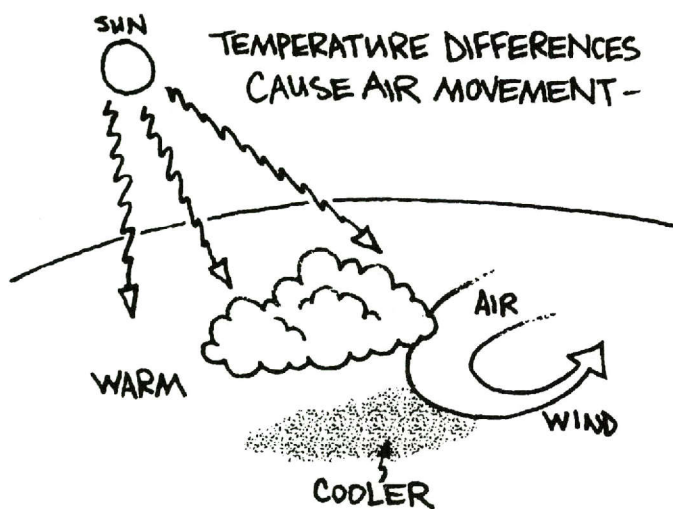


ronmental costs of renewable energy sources are much lower than conventional energy sources.

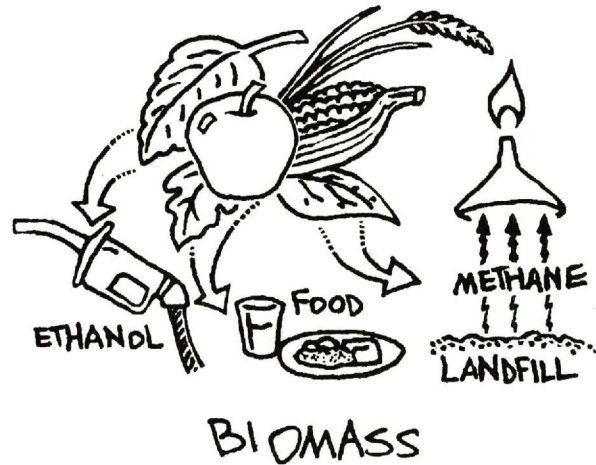
## WIND ENERGY

Wind is created because the sun heats the earth's surface and the atmosphere unevenly. This causes temperature differences that drive air masses around the planet. This air movement is aided by the earth's rotation.

Windmills use wind energy to pump water. But this energy can also be used to fulfill the energy needs of an electric company, community, or home. Modern wind turbines use the kinetic energy of the wind to produce electrical power. Today in the United States, wind turbines annually produce 3.5 billion kilowatt-hours of electricity, about 0.1% of the nation's electricity.



**WIND IS CAUSED BY THE SUN** Uneven solar heating of the earth's land, water and atmosphere causes air to move around as wind.



## BIOMASS

**BIOMASS IS STORED SOLAR ENERGY** Energy stored in plants can be used for many useful purposes such as fuels, food, clothing and paper. Biomass can change form naturally such as when old newspapers or food scraps turn into methane at a landfill.

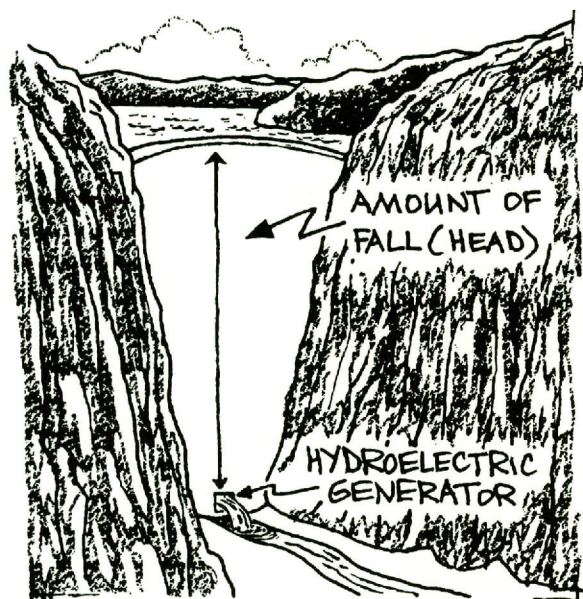
The largest wind farm in Texas is the Texas Wind Power Project in the Delaware Mountains, 90 miles east of El Paso. It is just south of Guadalupe Peak, the highest mountain in Texas. There are 112 wind turbines that can generate a total of 35 megawatts (MW) of electricity. A new wind turbine "farm" can produce electricity at prices competitive with any new power plant using nonrenewable energy. If wind turbines were placed in all the best spots in Texas to harvest the wind, it would produce five times more electricity than Texans now use.

## BIOMASS ENERGY

Biomass is solar energy that has been stored as plant and animal material. When you eat vegetables you are consuming the sun's energy the plant stored as it grew. Your body uses



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**MOVING WATER PRODUCES POWER** Water flowing through a dam runs through a turbine to generate electricity. Tall dams produce more power than short dams since the water falls farther.

the vegetables' biomass to give you energy to work and play.

Today, biomass energy in corn is used to produce cleaner-burning fuels, such as ethanol.

At urban landfills, where typically about three-fourths of municipal solid waste is biomass, methane gas is naturally produced. The gas can be used to generate electricity.

## **HYDROELECTRIC ENERGY**

Water is the foundation of life and falls as rain because of the sun's radiant energy on the earth. This process provides a continual supply of water to the earth's surface. The power of falling water is energy that can be harnessed

to produce electricity. In fact, the largest power plants in the world are hydroelectric.

Water can be dammed in a reservoir and released through turbines that directly produce electricity. The amount of power that can be taken from falling or flowing water is dependent upon the amount of water available and how far it falls. In simple terms, one gallon of water falling one foot per second can light up a 10 Watt light bulb.

## **SUNLIGHT AND THERMAL ENERGY**

Sunlight can be used to make electricity through thermal processes (heat). Solar energy can be focused by mirrors to heat water to produce steam that drives large turbine generators.

A solar pond at the University of Texas at El Paso generates electricity and usable heat. The pond, half a football field in size, produces electricity and delivers heat to a nearby food cannery.

## **SUNLIGHT AND PHOTOVOLTAICS**

Electricity can also be produced from sunlight through a process called photovoltaics. "Photo" refers to light and "voltaic" to voltage. Sunlight strikes a photovoltaic cell and is turned into an electrical current. Solar-powered cars and calculators are two examples of the use of photovoltaics.

*The future is bright for using renewable resources around the world. Using renewable resources can fill significant needs by supplying electricity, creating local jobs and promoting economic development, while avoiding the environmental costs associated with the use of fossil fuels and nuclear power.*

*Governments, electric companies, and people like you who choose to pursue a renewable/sustainable energy future now will be the ones who can offer experience, know-how, and leadership in the next century.*

## Resources

### TEXAS RENEWABLE ENERGY EDUCATION CAMPAIGN

Texas is in the midst of a major campaign to develop thought-provoking educational materials on renewable energy. The campaign includes: (1) the first-class video, "The Infinite Power of Texas." (2) 20 fact sheets for students and adults, and (3) a powerful World Wide Web site on the Internet. Begin your search for Texas-specific information on renewable energy at: <http://www.InfinitePower.com>

#### ON THE INTERNET:

<http://www.InfinitePower.com/factsheets/fs6.html>

<http://www.crest.org>

## Helpful Organizations

*Comprehensive educational source for renewables:*

### CREST CENTER FOR RENEWABLE ENERGY AND SUSTAINABLE TECHNOLOGY

777 North Capitol Street, N.E. #805

Washington, D.C. 20002

(202) 289-5370

email: [info@crest.org](mailto:info@crest.org)

<http://solstice.crest.org/>

*Summaries of renewable energy projects around the world:*

### CADDET CENTER FOR RENEWABLE ENERGY

1617 Cole Blvd

Golden, CO 80401-3393

(303) 275-4373

<http://www.caddet.co.uk/>

*Great source for wind energy information:*

### AMERICAN WIND ENERGY ASSOCIATION

122 C Street, N.W.

Washington, D.C. 20001

(202) 383-2505

<http://www.econet.org/awea>

*Trade association for U.S. solar companies:*

### SOLAR ENERGY INDUSTRIES ASSOCIATION

122 C Street, N.W., 4th floor

Washington, D.C. 20001-2109

(202) 383-2600

e-mail: [info@seia.org](mailto:info@seia.org)

<http://www.seia.org>



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