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Renewable Energy

Renewable Energy

Renewable energy comes from sources that will not be used up in our lifetimes, such as the sun and wind.

Grades

2 - 12

Subjects

Earth Science, Experiential Learning, Engineering, Geology

Image

Wind Turbines in a Sheep Pasture

Wind turbines use the power of wind to generate energy. This is just one source of renewable energy.

Photograph by Jesus Keller/ Shutterstock





Selected text level

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ArticleVocabulary

The wind, the sun, and Earth are sources of renewable energy. These energy sources naturally renew, or replenish themselves.

Wind, sunlight, and the planet have energy that transforms in ways we can see and feel. We can see and feel evidence of the transfer of energy from the sun to Earth in the sunlight shining on the ground and the warmth we feel when sunlight shines on our skin. We can see and feel evidence of the transfer of energy in wind’s ability to pull kites higher into the sky and shake the leaves on trees. We can see and feel evidence of the transfer of energy in the geothermal energy of steam vents and geysers.

People have created different ways to capture the energy from these renewable sources.

Solar Energy

Solar energy can be captured actively or passively.

Active solar energy uses special technology to capture the sun’s rays. The two main types of equipment are photovoltaic cells (also called PV cells or solar cells) and mirrors that focus sunlight in a specific spot. These active solar technologies use sunlight to generate electricity, which we use to power lights, heating systems, computers, and televisions.

Passive solar energy does not use any equipment. Instead, it gets energy from the way sunlight naturally changes throughout the day. For example, people can build houses so their windows face the path of the sun. This means the house will get more heat from the sun. It will take less energy from other sources to heat the house.

Other examples of passive solar technology are green roofs, cool roofs, and radiant barriers. Green roofs are completely covered with plants. Plants can get rid of pollutants in rainwater and air. They help make the local environment cleaner.

Cool roofs are painted white to better reflect sunlight. Radiant barriers are made of a reflective covering, such as aluminum. They both reflect the sun’s heat instead of absorbing it. All these types of roofs help lower the amount of energy needed to cool the building.

Advantages and Disadvantages

There are many advantages to using solar energy. PV cells last for a long time, about 20 years.

However, there are reasons why solar power cannot be used as the only power source in a community. It can be expensive to install PV cells or build a building using passive solar technology.

Sunshine can also be hard to predict. It can be blocked by clouds, and the sun doesn’t shine at night. Different parts of Earth receive different amounts of sunlight based on location, the time of year, and the time of day.

Wind Energy

People have been harnessing the wind’s energy for a long, long time. Five-thousand years ago, ancient Egyptians made boats powered by the wind. In 200 B.C.E., people used windmills to grind grain in the Middle East and pump water in China.

Today, we capture the wind’s energy with wind turbines. A turbine is similar to a windmill; it has a very tall tower with two or three propeller-like blades at the top. These blades are turned by the wind. The blades turn a generator (located inside the tower), which creates electricity.

Groups of wind turbines are known as wind farms. Wind farms can be found near farmland, in narrow mountain passes, and even in the ocean, where there are steadier and stronger winds. Wind turbines anchored in the ocean are called offshore wind farms.

Wind farms create electricity for nearby homes, schools, and other buildings.

Advantages and Disadvantages

Wind energy can be very efficient. In places like the Midwest in the United States and along coasts, steady winds can provide cheap, reliable electricity.

Another great advantage of wind power is that it is a clean form of energy. Wind turbines do not burn fuel or emit any pollutants into the air.

Wind is not always a steady source of energy, however. Wind speed changes constantly, depending on the time of day, weather, and geographic location. Currently, it cannot be used to provide electricity for all our power needs.

Wind turbines can also be dangerous for bats and birds. These animals cannot always judge how fast the blades are moving and crash into them.

Geothermal Energy

Deep beneath the surface is Earth's core. The center of Earth is extremely hot—thought to be over 6,000 °C (about 10,800 °F). The heat is constantly moving toward the surface.

We can see some of Earth's heat when it bubbles to the surface. Geothermal energy can melt underground rocks into magma and cause the magma to bubble to the surface as lava. Geothermal energy can also heat underground sources of water and force it to spew out from the surface. This stream of water is called a geyser.

However, most of Earth's heat stays underground and makes its way out very, very slowly.

We can access underground geothermal heat in different ways. One way of using geothermal energy is with geothermal heat pumps. A pipe of water loops between a building and holes dug deep underground. The water is warmed by the geothermal energy underground and brings the warmth aboveground to the building. Geothermal heat pumps can be used to heat houses, sidewalks, and even parking lots.

Another way to use geothermal energy is with steam. In some areas of the world, there is underground steam that naturally rises to the surface. The steam can be piped straight to a power plant. However, in other parts of the world, the ground is dry. Water must be injected underground to create steam. When the steam comes to the surface, it is used to turn a generator and create electricity.

In Iceland, there are large reservoirs of underground water. Almost 90 percent of people in Iceland use geothermal as an energy source to heat their homes and businesses.

Advantages and Disadvantages

An advantage of geothermal energy is that it is clean. It does not require any fuel or emit any harmful pollutants into the air.

Geothermal energy is only available in certain parts of the world. Another disadvantage of using geothermal energy is that in areas of the world where there is only dry heat underground, large quantities of freshwater are used to make steam. There may not be a lot of freshwater. People need water for drinking, cooking, and bathing.

Biomass Energy

Biomass is any material that comes from plants or microorganisms that were recently living. Plants create energy from the sun through photosynthesis. This energy is stored in the plants even after they die.

Trees, branches, scraps of bark, and recycled paper are common sources of biomass energy. Manure, garbage, and crops, such as corn, soy, and sugar cane, can also be used as biomass feedstocks.

We get energy from biomass by burning it. Wood chips, manure, and garbage are dried out and compressed into squares called briquettes. These briquettes are so dry that they do not absorb water. They can be stored and burned to create heat or generate electricity.

Biomass can also be converted into biofuel. Biofuels are mixed with regular gasoline and can be used to power cars and trucks. Biofuels release less harmful pollutants than pure gasoline.

Advantages and Disadvantages

A major advantage of biomass is that it can be stored and then used when it is needed.

Growing crops for biofuels, however, requires large amounts of land and pesticides. Land could be used for food instead of biofuels. Some pesticides could pollute the air and water.

Biomass energy can also be a nonrenewable energy source. Biomass energy relies on biomass feedstocks—plants that are processed and burned to create electricity. Biomass feedstocks can include crops, such as corn or soy, as well as wood. If people do not replant biomass feedstocks as fast as they use them, biomass energy becomes a non-renewable energy source.

Hydroelectric Energy

Hydroelectric energy is made by flowing water. Most hydroelectric power plants are located on large dams, which control the flow of a river.

Dams block the river and create an artificial lake, or reservoir. A controlled amount of water is forced through tunnels in the dam. As water flows through the tunnels, it turns huge turbines and generates electricity.

Advantages and Disadvantages

Hydroelectric energy is fairly inexpensive to harness. Dams do not need to be complex, and the resources to build them are not difficult to obtain. Rivers flow all over the world, so the energy source is available to millions of people.

Hydroelectric energy is also fairly reliable. Engineers control the flow of water through the dam, so the flow does not depend on the weather (the way solar and wind energies do).

However, hydroelectric power plants are damaging to the environment. When a river is dammed, it creates a large lake behind the dam. This lake (sometimes called a reservoir) drowns the original river habitat deep underwater. Sometimes, people build dams that can drown entire towns underwater. The people who live in the town or village must move to a new area.

Hydroelectric power plants don't work for a very long time: Some can only supply power for 20 or 30 years. Silt, or dirt from a riverbed, builds up behind the dam and slows the flow of water.

Other Renewable Energy Sources

Scientists and engineers are constantly working to harness other renewable energy sources. Three of the most promising are tidal energy, wave energy, and algal (or algae) fuel.

Tidal energy harnesses the power of ocean tides to generate electricity. Some tidal energy projects use the moving tides to turn the blades of a turbine. Other projects use small dams to continually fill reservoirs at high tide and slowly release the water (and turn turbines) at low tide.

Wave energy harnesses waves from the ocean, lakes, or rivers. Some wave energy projects use the same equipment that tidal energy projects do—dams and standing turbines. Other wave energy projects float directly on waves. The water’s constant movement over and through these floating pieces of equipment turns turbines and creates electricity.

Algal fuel is a type of biomass energy that uses the unique chemicals in seaweed to create a clean and renewable biofuel. Algal fuel does not need the acres of cropland that other biofuel feedstocks do.

Fast Fact

Renewable Nations

These nations (or groups of nations) produce the most energy using renewable resources. Many of them are also the leading producers of nonrenewable energy: China, European Union, United States, Brazil, and Canada

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