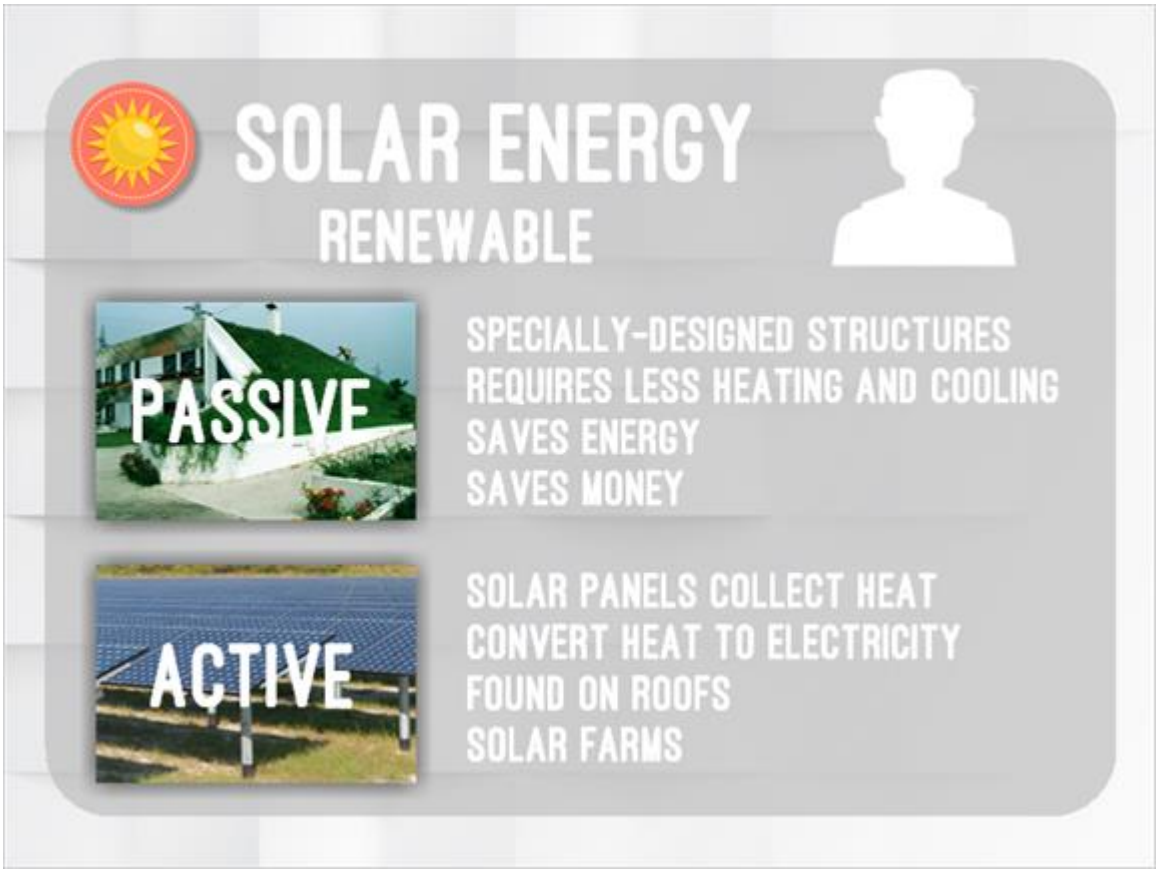
Module 10: Earth Resources and Virginia Geology
Topic 3 Content: Alternative Energy Resources Notes

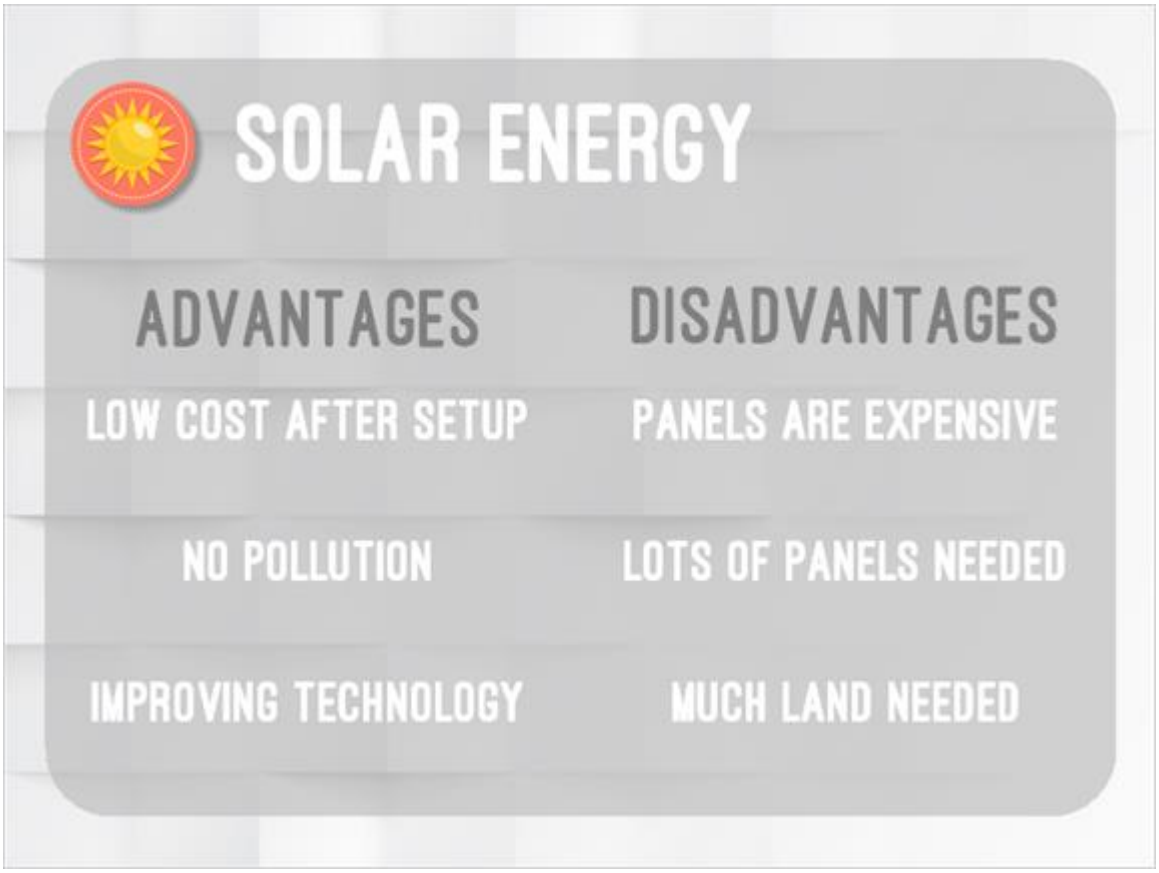
Since burning fossils fuels has negative environmental consequences, alternative energy resources have been researched, developed, and used. In this interactivity, visit all of the resources by clicking the appropriate icons. Make sure to visit each one of the alternative energy resources.



Solar energy is a renewable resource because light from the Sun is inexhaustible. The Sun produces enough energy in just one hour to supply the world's energy needs for an entire year, but the problem scientists and engineers face is how to collect and store that energy since it is spread out over the entire Earth.

There are two types of solar energy currently in use. The first is called passive solar energy. Some homes and buildings are specially designed to let in a lot of natural sunlight in the winter months for natural heat and reflect light during the summer to keep them cool. These buildings require much less heating and cooling from other sources, saving energy and money. Active solar power is when a technology called a solar panel collects heat from sunlight and turns it into electricity. A solar panel is made up of photovoltaic cells that convert sunlight directly into electricity. Solar panels can be found on the rooftops of homes to create electricity or heat hot water tanks. There are also solar farms that include a large area covered in solar panels that create energy for power companies to distribute to customers.

Click next to learn about the advantages and disadvantages of solar energy.



There are many positive aspects of solar energy. Sunlight is plentiful, and once a system of collection is functioning, it requires very little maintenance, leading to a low energy cost in the long-term. Other than manufacturing the solar panels, solar energy does not cause any pollution as it generates energy. Solar technology is continually improving to create more efficient solar panels and better batteries for energy storage.

Solar panels are still very expensive to manufacture, which is one of the biggest drawbacks for solar energy. Prices continue to drop as the technology improves, but for now, solar panels are still too expensive to appeal to homeowners and energy companies. Another issue with solar energy is that a wide area of solar panels is needed to produce a significant amount of energy, so large areas of land need to be dedicated to solar farms in order to meet energy demands.

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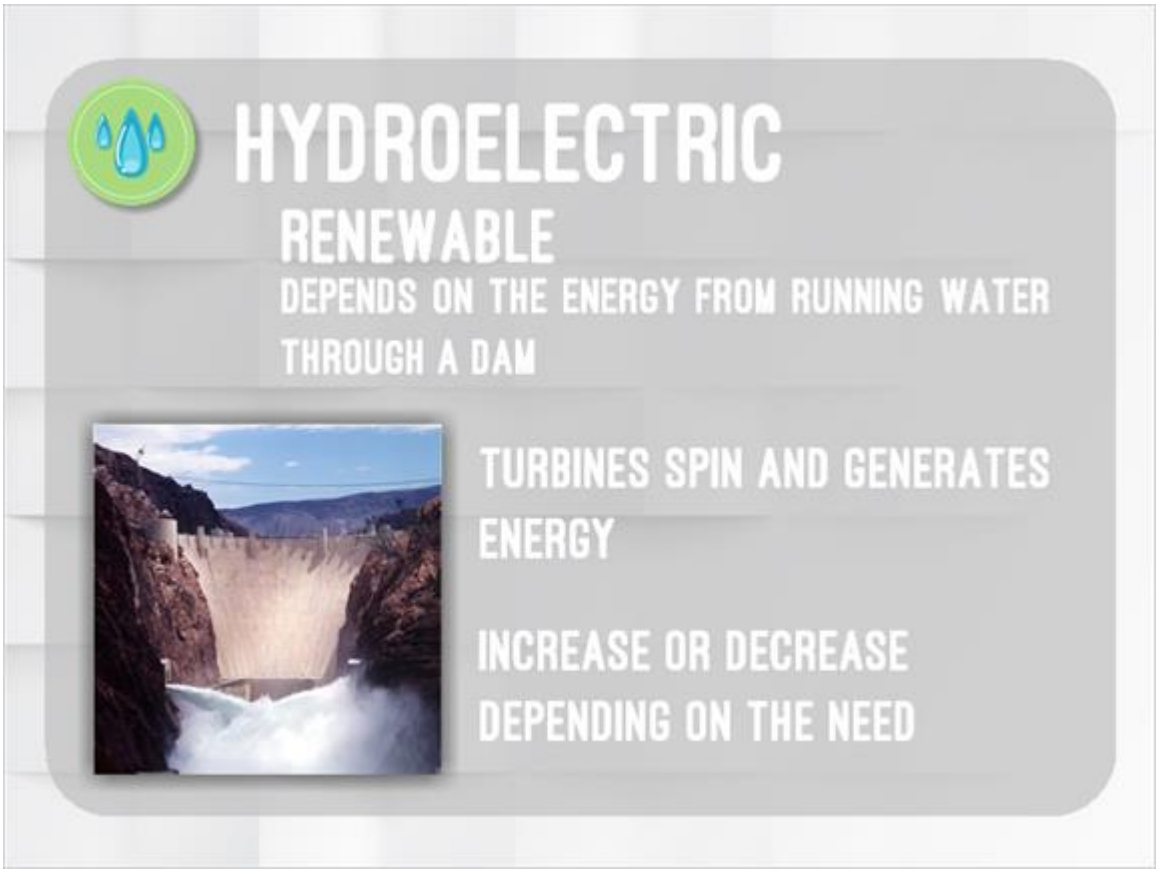
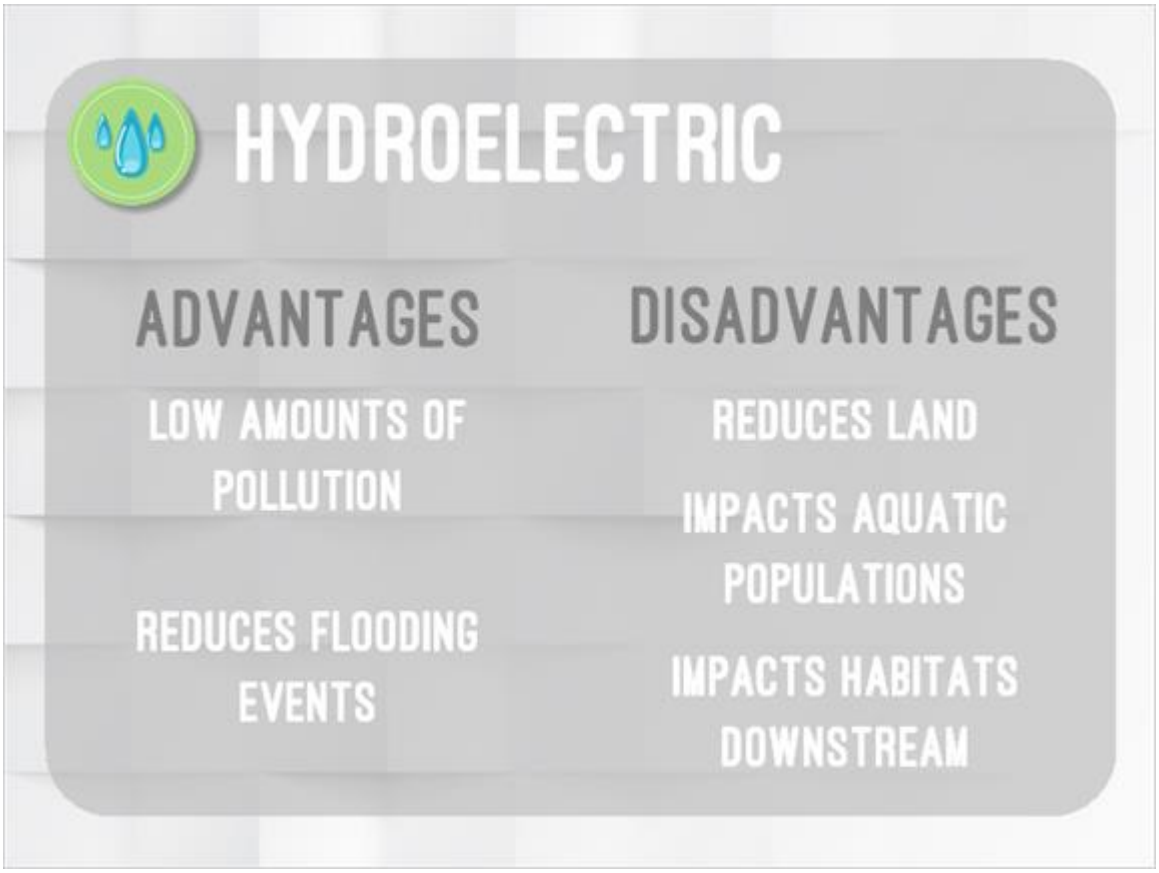


Hydroelectric power is a renewable resource, because it depends on using the energy from running water through a dam to create electricity. The running water causes turbines to spin, and the energy generated by the turbines is collected, stored, and used for electricity. Since dams are designed to control the flow of water through them, they can increase the flow of water if more energy is needed and decrease it as demand falls.

Click next to learn about the advantages and disadvantages of hydroelectric energy.



Hydroelectric power is a renewable resource that emits very low levels of pollution compared to fossil fuels. Once they are built and operational, dams require very little maintenance. Controlling the flow of water through a dam can also reduce flood levels in nearby communities when storm events occur.

When a dam is first built on a river, a large area is flooded to create a reservoir. Sometimes valuable agricultural land or habitat is lost, and sometimes entire communities of people must be relocated before a dam is built. A dam keeps fish, such as salmon, from swimming upstream to spawn and can negatively affect their population, although sometimes technology such as salmon ladders can help fix the problem. A dam can also reduce the flow and output of a river into the ocean. This creates a drought downstream, which can affect water use and habitats.

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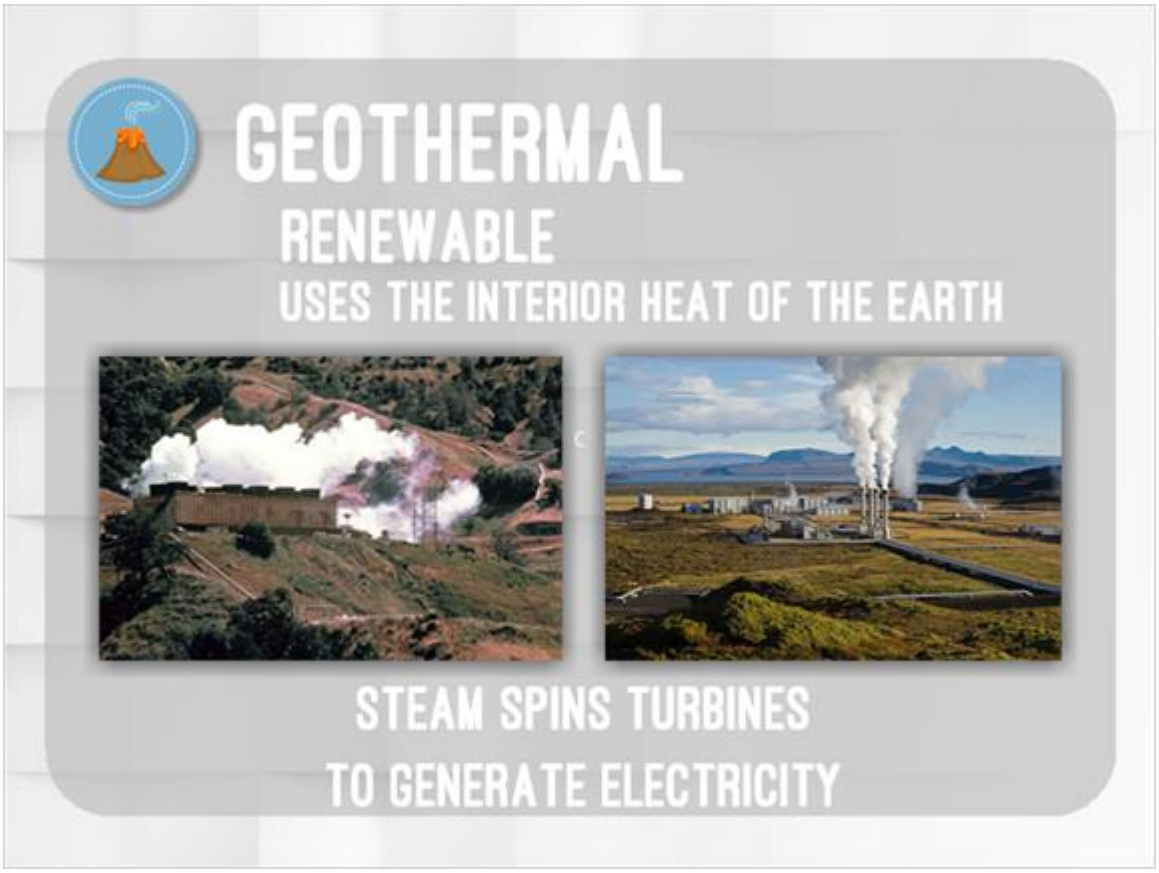

Geothermal power is a renewable energy source because it generates electricity by using the interior heat of the Earth, which will not run out. Geothermal energy takes advantage of natural geologically active places where water seeps into the Earth's crust and is heated until it rises as steam. This steam is used to spin turbines and generate electricity. Another way to use geothermal energy is to pipe a liquid with a low boiling point into an active geothermal site. As the liquid heats up, it vaporizes into steam, turns a turbine to generate electricity, and then is cooled until it condenses into liquid and can be piped down into the site again.

Click next to learn about the advantages and disadvantages of geothermal energy.

Geothermal energy is a non-polluting renewable source of energy. It is also very reliable. Low level geothermal heat is located in almost every location worldwide.

Geothermal heat occurs everywhere under the Earth's crust, but large areas of trapped heat are not always close enough to the surface to access. This limits the areas where large-scale geothermal energy production can occur. Currently, geothermal energy is more expensive than fossil fuels because of the initial cost for exploring sites and building the systems, but it continues to become less expensive as technology improves.

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Nuclear power is a nonrenewable energy source because it depends on the metal uranium to produce energy. Nuclear reactors produce energy from uranium through a process called nuclear fission. Fission takes place when radioactive uranium atoms are split and the energy of the nuclear process is harnessed. The fission process can take place in large power plants. This process is also harnessed to supply energy to the United States Navy's ships and submarines.

Click next to learn about the advantages and disadvantages of nuclear energy.

When a nuclear power plant is running properly, it does not emit any greenhouse gases. A small amount of uranium can be used to produce a large amount of nuclear energy. Statistically, dangerous accidents at nuclear power plants are very rare.

There have been three major incidents at nuclear power plants at Three Mile Island, Chernobyl, and Fukushima that have caused major concerns about the safety of nuclear power. Radiation poisoning can cause immediate illness and death to everyone and everything in its range. It also causes cancer that develops slowly. High levels of radiation contaminate soil, water, and all food grown or harvested in the affected area. The mining of uranium for nuclear power is also expensive and causes pollution and land degradation. Finally, used nuclear fuel rods are radioactive and dangerous for 10,000 years or longer. Transporting and storing these radioactive fuel rods safely for that long is also a major issue.

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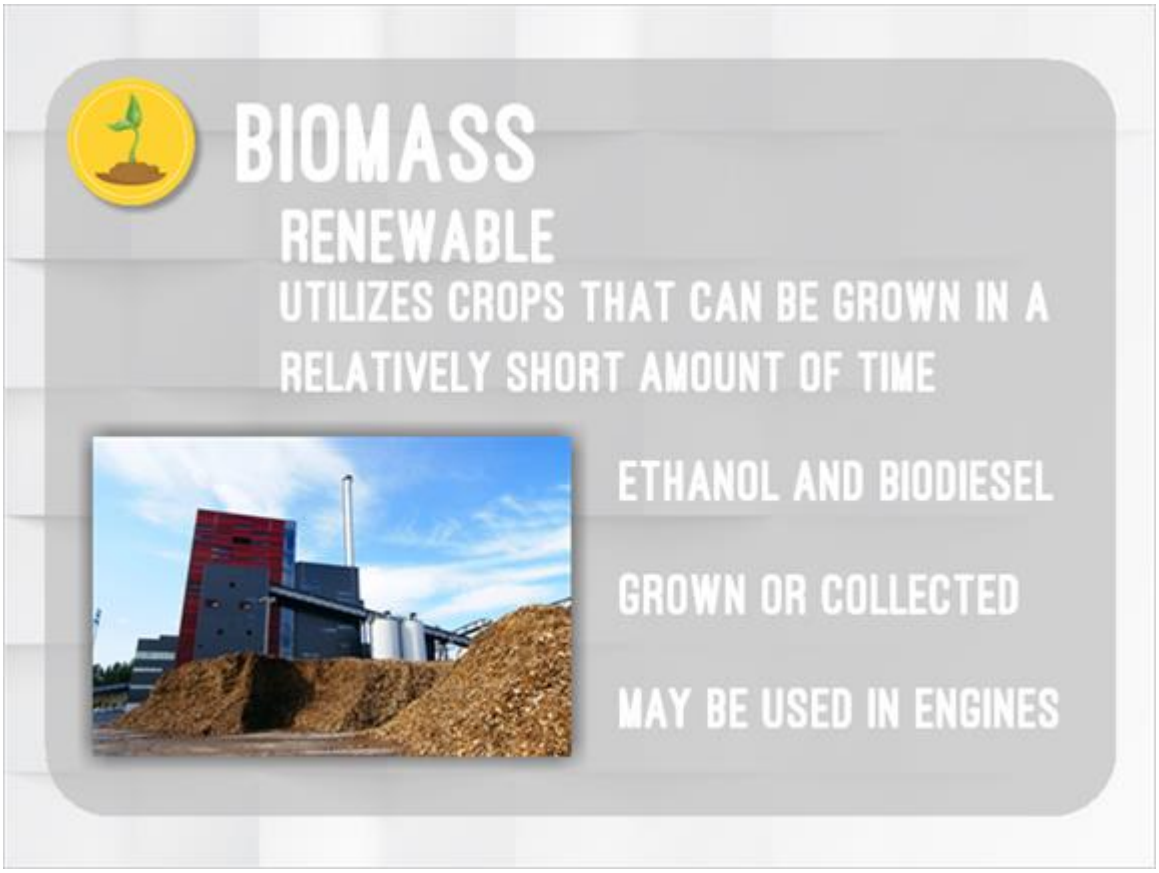
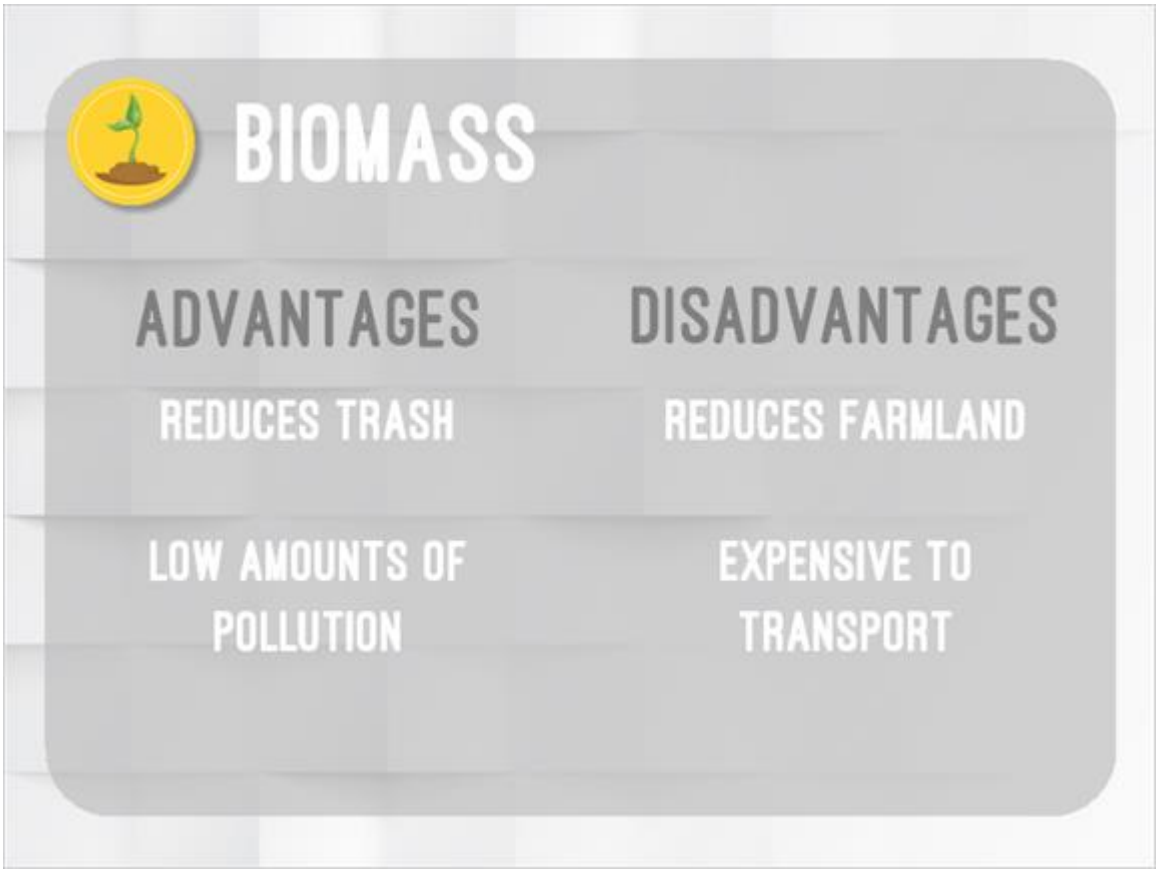


Biomass is a renewable energy source because it utilizes crops that can be grown in a relatively short amount of time. Biomass can also use human and animal waste as a source of energy, which is renewable and helps reduce the amount of material going into landfills.

Organic material such as plants, human and animal wastes, and biodegradable garbage are used to produce fuel. The most common fuels made from these materials are ethanol and biodiesel. Biomass is grown on farmland or collected before it is thrown away and then converted into a solid, liquid, or gaseous fuel. The fuel is then burned to produce steam to run a turbine and generate electricity. Some of these fuels are used directly in certain gasoline engines to run cars and trucks instead of petroleum-based fuel.

Click next to learn about the advantages and disadvantages of biomass energy.



Biomass created from waste and biodegradable trash reduces the amount of matter sent to landfills and dumped into oceans. Biomass also emits far fewer greenhouse gases than burning fossil fuels because the emissions are balanced by the amount of carbon dioxide the plants absorbed as they were growing.

Growing biomass takes up a lot of farmland that could otherwise be used to grow crops and animals for food. Some predict that an increase in biofuels would cause food prices to increase due to competition for farmland use. If the biomass material is grown or collected far away from where it is used, the cost of transportation may make the electricity too expensive for consumers.

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Wind energy is a renewable resource that uses the power of the wind to generate electricity. As the wind blows, windmills collect the energy and spin. This turns the turbine, which then generates electricity. Individuals and businesses can supply their own energy needs with wind turbines, or energy companies can build wind farms with a large area of turbines that generate electricity to sell to their customers. Power companies are currently researching the advantages of offshore wind farms.

Click next to learn about the advantages and disadvantages of wind energy.

Wind power is a renewable source of energy that is non-polluting. It is also one of the lowest-cost renewable energy sources today, and the price continues to decrease.

The initial cost of building and installing wind turbines is currently more expensive than a fossil fuel powered plant. Wind energy can also be unreliable. If the wind is not blowing, it is not producing energy. There are also some negative environmental effects that are still being assessed such as issues with noise, bird migration, and the visual appeal of the turbines.

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