

BIOMASS: Valuable Trash

Energy: Non-renewable and Renewable

Most of the energy we use today comes from fossil fuels. Fossil fuels include coal, oil, and natural gas. **Decaying** plants and animals that have been buried between layers of earth and rock form fossil fuels. This process takes millions of years! We are consuming fossil fuels faster than they are created. We could run out of fossil fuels some day, and for this reason, they are considered **nonrenewable**.

Scientists are working very hard to find alternative forms of energy that are renewable. Natural processes form **renewable energy**. Four energy alternatives that are being seriously studied are solar, wind, geothermal, and **biomass**. Renewable energy has been used since prehistoric times, but now there is an urgency to develop it further for two reasons:

- (1) Fossil fuels will run out some day, and
- (2) People are increasingly concerned about how fossil fuels affect global warming and air quality. Among other things many scientists suggest global warming is causing havoc with our weather systems.

Biomass Power

The term **biomass** is an abbreviation for biological mass, meaning the amount of **vegetation** found in a given area. Biomass contains stored **solar energy**. This solar energy can be **converted** to electricity or fuel when burned.

Types of Biomass

Wood is the largest source of biomass used throughout the world as an energy source. Some other types of biomass that are used to produce energy include sawdust, corn, switchgrass, paper wastes, alfalfa, rice husks, and sugarcane.

Concerns and Benefits with the Use of Biomass

Biomass is not a perfect source of energy, but many people are positive about its growing popularity in the energy market. Even though in some areas the use of biomass is causing problems of **deforestation** where trees are cut faster than they can re-grow, some believe biomass will cut **emissions** of harmful greenhouse gases. The amount of carbon dioxide released by biomass when burned is equal to the amount it absorbed when living – thus creating a closed carbon cycle. The key to the use of commercially grown biomass is to grow as much as we consume.

Some people have concerns about growing biomass commercially. They are afraid that growing biomass will continue to eat up our natural forests and **wetlands**. Yet many farmers say they have lots of land where they could grow biomass, and they are excited with the prospect of increasing their incomes. They can also make money from their agriculture wastes, such as cornhusks. Their trash is now valuable!

Another benefit of biomass is that landfill use would **decrease**. Instead of throwing by-products away, such as yard clippings and sawdust, they can now be burned in biomass plants.

If biomass becomes a major energy source in the United States, they would spend less money buying oil abroad. It is estimated that the United States spends \$25 billion a year for oil. This would also happen in other countries that have to buy their oil from outside their country.

Increased use of biomass would create a new global **industry**. Many jobs would be created for production, harvesting, and use. More jobs would also be created in the biomass power plants.

The following story features a company that demonstrates biomass power can lead to cleaner air and financial benefits for those involved.

Poultry Litter Power

Poultry litter? What in the world is that? Poultry litter comes from chicken cages, which are kept dry with wood chips or straw. The chickens poop on this material, which makes clean up easier. Farmers used to throw away this poultry litter, but now they can sell it to **generate** electricity!

The Fibrowatt Group

Poultry farmers sell their litter to a company in the United Kingdom (UK), Fibrowatt Group. Fibrowatt operates three power plants, all which use poultry litter to generate electricity. So far these are the only power stations in the world using this biomass fuel! The company does have plans to expand worldwide. They are now working on projects in Belgium, the Netherlands, France, Ireland, Germany, Spain, Japan, and the United States.

How it Works: Poultry Litter to Electricity

1. Poultry litter is collected from poultry farmers. The UK poultry farming industry produces 1.5 million tons per year. It is driven to the plant in covered trucks.
2. Here the fuel is stored at negative pressure in order to prevent the escape of odors.
3. The poultry litter is burned in a furnace at 850 degrees C or 1,500 degrees F and heats up water.
4. Steam is produced at 450 degrees C.
5. The steam drives a turbine, which generates electricity. The power plant in Thetford, Norfolk, UK produces enough energy to supply 70,000 homes.

Benefits

1. Poultry litter in the past would either end up in a landfill or be used as very stinky manure.
2. As stored poultry litter begins to **decompose** it can give off a dangerous gas called methane. Methane is a greenhouse gas. Using the litter to produce electricity avoids additional global warming.
3. No waste products are produced except for a nitrogen-free ash that is sold as a fertilizer.
4. Recycling carbon rather than producing new CO₂ reduces CO₂ emissions. This helps to reduce the greenhouse effect.
5. In comparison to coal-fired power stations, only a fraction of carbon dioxide and nitrogen oxides are emitted.
6. Dry litter is worth more than wet litter so farmers are motivated to improve the conditions under which they care for their birds. Conditions that usually improve are: ventilation, drink equipment, and feed quality. In addition, fewer birds are usually put in one cage.
7. The power plants provide work for many. During construction 200-400 people are hired and 20-40 people are hired as permanent employees.

Celebration

Certainly using biomass in an environmentally responsible way has clear advantages over using fossil fuels. It is renewable, clean, and environmental friendly. The local economy also benefits. The Fibrowatt Group has been recognized for their wonderful work. They have won several environmental awards.

Chickens Aren't the Only Ones

There are other animals whose caretakers are contributing to the quest to find alternative energy sources. Believe it or not, people are using animal manure to create energy. Maybe your mom and dad use manure to fertilize the garden. Another word for manure is dung. Some grazing animals eat biomass, which isn't always completely digested and it shows up in animals' excrement. It's good for the soil, which is why your parents use it in the garden.

Using Animal Dung in India

In India, villagers living in areas where firewood is scarce usually burn "dung cakes" to be used as fuel. Sometimes these dung cakes are mixed with straw to add bulk and make the dung burn longer. The dung cakes are burned in traditional fireplaces and fill the home with smoke and ash. The dung cakes are usually stored in the home.

Biogas

As animal dung begins to rot it gives off **biogas**. Biogas is a mixture of methane and carbon dioxide. It is clear, and believe it or not, odorless when it burns. Nor does it produce any smoke. The methane from the biogas is considered an alternative energy source.

Biogas Plants

Many homes in India now have their very own biogas plant. Each year 200,000 families replace their traditional fireplace with a biogas plant to provide energy for cooking and heat. More than 2 million biogas plants are in use now. A biogas plant has two parts: a digester and a gas holder. The digester is a waterproof container that holds the animal dung and sometimes human wastes are also added. The gas holder fits directly into the digester and floats like a ball on the animal dung. It keeps oxygen from entering and collects the biogas as it forms. A pipe

extends from the gas holder, which channels the gas to where it will be consumed. Once the gas is totally extracted from the dung, “**sludge**” remains. Another pipe also extends from the gas holder to drain the sludge. The sludge makes an excellent fertilizer.

Benefits of Biogas Plants

Biogas plants have many benefits and address many problems. Throughout India there are areas where firewood is scarce. Some forests have already been picked clean to meet the needs of the growing population. To gather wood, women can spend up to 2-4 hours searching. Biogas means the quality of women’s and children’s lives are improving. They now have more time for education and interesting activities outside the home.

Biogas plants also improve health conditions in the homes. Since biogas burns clean, homes do not fill with smoke and ash. Women and children experience less bronchial problems and can expect to live longer. Homes are also more hygienic. Dung cakes are no longer stored in the homes.

Biogas plants also offer environmental benefits. With the use of biogas plants, fuelwood is not necessary. They reduce any further damage to the local forests. Farmers also benefit. The remaining sludge is used to fertilize the soil.

Biogas plants have also created almost 200,000 permanent jobs for the male working force.

The use of biogas is an alternative energy source that is proving to be successful in rural areas in many countries. Biogas plants are also being used in China. They may not be feasible for use in the United States but are proving their worth to solve serious energy and ecological problems in other parts of the world.

You're an Expert

1. Think about how nonrenewable and renewable energy are alike and different. Draw a "Venn Diagram" to record your ideas. A Venn Diagram is two circles drawn so that they intersect in the middle. Label one circle with nonrenewable energy and the other circle with renewable energy. If you think they have something in common, write your ideas in the space where the two circles overlap. You may want to do this with a partner and then share your work with your other classmates.
2. Fold a piece of drawing paper in half. On one half illustrate and label a closed carbon cycle. On the other half illustrate and label an occurrence that is not a closed carbon cycle.
3. Draw a sequence story of how animal dung becomes an alternative energy source. This might make you laugh because you have to start with animal poop. It will be interesting to compare your drawing of a biogas plant with your classmates.
4. Children love to read the back of cereal boxes. Think about something important you learned from this article. Create a picture with words that can be pasted on the back of a cereal box to teach a young child. Your cereal boxes would make a great bulletin board.

Take Action

1. Throughout the world farmers are growing biomass specifically for energy purposes. Some people call farms that grow biomass "energy plantations." Investigate to find out if your state is involved in biomass farming. Find out what is grown, how it is harvested, and who buys it. Share your findings with your classmates. It may be fun to draw the different kinds of biomass on large pieces of paper and write your findings on your work. You may want to

expand your investigation and find out about energy plantations throughout the United States or the world. Use a map to indicate where farming is occurring.

2. Investigate how China is relying on alternative energy sources such as biogas to meet their energy needs.
3. Find out if there are any poultry farms in your state or a neighboring state. Find out how much poultry litter is produced weekly and what happens to it. Educate the farmers about Fibrowatt Group.
4. Contact Fibrowatt Group to request information about their other projects throughout the world. Report your findings. Use a world map.
5. The article mentions that biogas plants may not be able to be put to use in the United States. Think of some reasons why you might support this statement and some reasons why you might not support this statement. Use the provided discussion web to record your thinking. Then use it to debate this issue with your classmates.