Physical Science Applications in Agriculture. Alternative Energy Sources from Agriculture.

As our world population increases, we need new sources of energy. Non-renewable energy sources are those which, when used, cannot be replenished. Examples include coal, oil, and other fossil fuels. Non-renewable sources of energy are becoming increasingly expensive *and* scarce. Humans have developed alternative energy sources through innovative technology. These help meet the energy demands for transportation, electricity, and food production.

Many kinds of alternative energy sources exist and are available for use by humans. Many people think that these are having no impact on the environment. However, even alternative energies frequently use some energy sources that are not non-renewable in their production. The two main goals of developing new alternative energy sources are that they are renewable and that they are sustainable. Four technologies that are being developed today as alternatives to non-renewable fossil fuels are biofuels, wind energy, solar energy, and geothermal energy.

Biofuels are mostly liquids that are produced from plants that are harvested in ways similar to how they would be harvested if they were meant for human or animal consumption. There are two main ways to convert plants into energy for human use. The first involves growing crops that are high in sugars or starches, such as corn and sugar cane. Processers then use yeast to ferment the harvested crops and produce ethanol, a form of fuel, as the end product. The second way that plants can be used to produce energy is to grow crops that are high in oils, like algae and canola, which can be processed into fuels called biodiesels.

A major controversial issue of biofuels is using crops for fuel. Instead of raising crops for food, farmers sell crops to make fuel. This may cause an increase in food costs for many people. This practice may also decrease the amount of food that can be exported for humanitarian purposes to other parts of the globe. Some people contend that the process of making ethanol is inefficient, meaning that the production of ethanol consumes nearly as much non-renewable fuel as is produced.

Wind energy technology is another alternative to non-renewable fuels. The idea of using windmills for generating energy is not new. They have been used for many centuries to mill grains into

flour and pump water from farmland. Current issues with wind technology include the variability and unpredictability of wind. It is difficult to predict when wind speeds would be adequate for energy generation. While the windmills do not produce carbon dioxide and use small amounts of lubricating fuels when they operate, the manufacturing process is energy-intensive.

Solar energy is produced using heat and light from the sun. The idea of using the sun to produce energy to meet the needs of humans is not new, either. Many cultures warm homes by building them oriented toward the sun. Today, using solar energy to produce electricity is most commonly accomplished with photovoltaics, or solar panels. While solar energy is increasing in popularity, the cost of installation and materials is initially high. Further, producing solar panels requires much energy.

Geothermal energy is produced when energy that is generated by heat stored in the Earth's core is collected and used for human purposes. It is more reliable than solar and wind energy because the heat energy produced by the Earth's core is constant, Geothermal energy is not affected by atmospheric weather conditions. The main issue with geothermal power plants is that they can have detrimental effects on land stability near geothermal production facilities. Some production practices require the injection of water into dry bedrock. Also, some production facilities emit greenhouse gases that were trapped below the earth's surface.

Today, energy is commonly stored using batteries which contain chemicals that react in a closed system. With alternative energy sources, scientists are also trying to find better ways to store the energy that is produced. One main way that is currently being developed is the fuel cell. Fuel cells are different from batteries because they exhaust the chemical reactants used to produce the electricity. These reactants must then be replenished in order for the fuel cell to be used again. Scientists are currently working to see if hydrogen, chlorine, oxygen, and other alcohols can be used in fuel cell technology. This technology is not used widely because the cost is high and the efficiency is low.

Write the letter of the answer choice on your answer sheet.
We will input them into Google Classroom when we return to school.

1. The passage gives examples of non-renewable fossil fuels. They are
- **a.** biofuels, wind energy, solar energy, and geothermal energy.
- **b.** light energy and kinetic energy.
- **c.** electrical energy, chemical energy and heat energy.
- **d.** coal and oil.

2. Why is the production of crops for biofuels a controversial topic?
- **a.** Farmers produce biofuels instead of food.
- **b.** It raises the prices of crops.
- **c.** Producing biofuels decreases the amount of crops to be exported.
- **d.** All of the above.

3. Which of the renewable energy sources is the most reliable?
- **a.** Solar energy.
- **b.** Geothermal energy.
- **c.** Wind energy.
- **d.** They are equally reliable.

4. Fuel cells differ from batteries because
- **a.** They exhaust the geothermal reactants used to produce the electricity.
- **b.** They exhaust the electrical reactants used to produce the electricity.
- **c.** They exhaust the chemical reactants used to produce the electricity.
- **d.** They do not differ.

5. When producing ethanol, processors will use crops which are high in
- **a.** vitamins and minerals.
- **b.** sugar and starches.
- **c.** oil and water.
- **d.** salt.

6. Using solar energy in private homes is increasing in popularity. There is one major drawback, what is it?
- **a.** Energy is wasted because the sun is so hot.
- **b.** The materials are initially quite expensive.
- **c.** Government holds many restrictions on building solar panels.
- **d.** Very few workers can install solar panels.

7. Why should we study or continue to embark on producing new sustainable energy resources?
- **a.** Sources of energy are decreasing, and the population is increasing.
- **b.** Crops such as corn and soybeans are in abundance for human consumption, so we need to find other uses.
- **c.** Non-renewable energy is becoming expensive.
- **d.** A and C.

8. Which of the following are possible solutions to the contention that food grown for fuel allows hunger to persist?
- I. Scientists can identify plants that yield higher quantities of biofuels.
- II. Scientists can identify plants that grow in areas not currently used for food crops.
- III. Scientists can identify plants that have properties useful for biofuels and food.
- **a.** I only
- **b.** II and III
- **c.** All of the above
- **d.** None of the above

9. The author of this passage would likely agree with which of the following statements?

- **a.** Biofuels offer a rich opportunity to address our global energy needs.
- **b.** Alternative energy sources may eventually be limited in volume.
- **c.** Non-renewable energy sources are not in limited supply.
- **d.** Use of solar energy is in jeopardy because of the greenhouse effect.

10. Even if scientists found new crops to use for biofuels, why might some people continue to argue that biofuels are not a viable option for energy?

- **a.** New crops used to produce biofuels still require productive farmland, which means food crops cannot be produced and hunger persists.
- **b.** Biofuels, because they are food crops, can also be used for food.
- **c.** Because new crops might be the product of science, they might harm the environment.
- **d.** Biofuels likely contribute to global warming because production of these crops involves greenhouse gases.

Borrowed From:
Travis Park
Assistant Professor
Agricultural Science Education
Cornell University

Name _____ Date _____Class Period_____

AMI Day 3 Answer Sheet

Directions: After reading the short article, answer the multiple choice questions. Select the best answer from the choices provided and write the letter on this sheet.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____