Name: Date: Class:

Alternative fuel: Biodiesel

Instructions: Read this webpage (https://afdc.energy.gov/fuels/biodiesel_benefits.html) and then answer the questions below.

1. **Biodiesel Benefits and Considerations:**
   What is biodiesel?

2. **Energy Security and Balance:**
   Where is biodiesel produced?

3. **Air Quality:**
   Why does using biodiesel reduce the amount of carbon dioxide in the atmosphere?

4. **Safety:**
   Summarize the information that is provided about the safety of biodiesel.

5. Use the GREET excel database to complete the chart below:
   a. Open this link: https://greet.es.anl.gov/greet_1_series
   b. Click the link underneath “GREET 1 Series (Fuel-Cycle Model) or open this link: https://greet.es.anl.gov/files/greet-2020rev1
   c. Open the GREET folder
   d. Select “GREET1-2020”
   e. To use the GREET database, you have to click on the tab at the bottom of the screen. Biodiesel is called “BioOil”, so click the “BioOil” tab. The red arrow above is pointing to it.

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f. There is a lot of information on this database. Scroll all the way down to #4 Summary of Energy Consumption, Water Consumption, and Emissions.
g. Because we are interested in reducing carbon emissions and climate change, you will be looking at the values for methane (CH_4), carbon dioxide (CO_2), and nitrous oxide (N_2O). There are other variables in this chart, but we will focus just on these three. There is a red box around them in the table below.
h. There are many different oils that are used to make biodiesel. Look through the data table and find the type of oil that you think is best in regard to the amount of CO_2, N_2O, and CH_4 in the emissions. To move through the data table, use the arrow that has the red circle around it. Record the data in the table below. This is what you will share when the group comes back together. (Note: there are extra lines in the data table, you can use them if it is helpful to record information while trying to determine which version of oil you want to use – after make sure you circle the one that you will share) Also keep in mind: what are the units? Each gallon of ethanol? (it says Btu or Grams per mmBtu of fuel)

Gas emission	**Type of Oil-based Biodiesel (Fuel)**					
CH_4						
N_2O						
CO_2						

The abbreviations in GREET are defined below:

VOC = volatile organic compounds
CO = carbon monoxide
NO_X = nitric oxide
PM10 = particulate matter with a diameter of 10 micrometers or less
PM2.5 = particulate matter with a diameter of 2.3 micrometers or less
SO_X = sulfur oxides
BC = black carbon (particulate matter/ soot & contributes to climate change)
OC = organic carbon (respiratory effects)
CH_4 = methane
N_2O = nitrous oxide
CO_2 = carbon dioxide

9. Fill in the row below in the table for biodiesel.

10. When everyone is finished learning about the energy sources, share what you have learned with the group. Each individual should summarize the questions they answered and share the GREET emissions that were calculated. Notes should be taken in the table below so that the information can be shared with your poster group.

Energy Source	Information about energy source	GREET values
Ethanol		
Electric		
Biodiesel		
Natural Gas		
Propane		
Hydrogen		

11. Circle the energy source you will use to heat your building (remember that we are assuming that the technology for this will be in place) and complete the information below the table.

12. What type of fuel will you recommend for use in heating your building structure?

13. What is the evidence and reasoning for your recommendation?

14. Return to the “Energy Source” document and continue to step 2.