Biodiesel
What happens if we run out of oil?

Connections to the Next Generation Science Standards

**Practice Elements:**
Developing and using models
Evaluate a real world problem

**Crosscutting Concept Elements:**
Energy and Matter
Systems and System models

**Disciplinary Core Idea:**
Energy in chemical processes of everyday life

**Component Idea:**
PS1.B Chemical Reactions

Lesson Summary
- What are organic compounds?
- Where do they come from?
- Are there any “green” alternatives?

During this unit, students will learn about
- Structure of the atom
- Chemical bonding and the periodic table
- Electron dot formulas
- Ball and stick models to represent molecules
- Molecular formulas
- Energy conversions
- Combustion Reactions
- Types of hydrocarbons
- Functional group
- Making esters using condensation reactions
- AND focus on lab safety

In addition to making ball and stick models of a variety of organic chemicals, students will use the production of biodiesel as a model of how larger quantities of fuel can be produced from bio-renewable organic matter. Since it is the culminating project, the students must have a solid background in chemical bonding and energy calculation for the project to be successful.

Throughout the unit emphasis will be placed on bio-renewable alternatives to many petroleum based compounds as well as synthetic alternatives to expensive naturally occurring compounds.
Biodiesel: A Renewable Fuel

Have you ever wanted to be energy independent? YES! It’s a dream we all have. Let’s go to the lab and make some biodiesel!

Using ordinary cooking oil, or even USED cooking oil, students will make their own biodiesel. It will be tested to determine the amount of energy it produces (by heating water). The heat of combustion for their fuel will be compared to gasoline.

Students will then examine a few facts to decide if biodiesel can replace our current fuel consumption.

- 41 pounds of soybeans are required to make one gallon of biodiesel
- 1 bushel of soybeans weighs 60 pounds
- 45 bushels of soybeans, on average, are produced per acre
- U.S. agriculture uses nearly 990 million acres (47.3% for crops, 52.6% for livestock) and has 74 million surplus acres
- Biodiesel releases 123,540 kJ per gallon
- Gasoline releases 120,560 kJ per gallon
- The production of one gallon of biodiesel or gasoline requires about 24,900 kJ
- 1 acre of soybean land produces about 57 gallons of biodiesel

Other alternatives will be discussed including hydrogen fuel cells, hybrid cars, ethanol production and other methods of producing biodiesel.

Science Partners

Through Research Experience for Teachers at Iowa State University, I had the pleasure of working in the George Kraus laboratory group. I was able to synthesize a variety of organic compounds that do not occur in nature.

Learning how these compounds offer solutions to dependence on petroleum, I was inspired to take my unit on chemical bonds one step further and focus on “green” alternatives to organic chemicals normally produced from petroleum.

Additional Unit Plan Information:
http://bit.ly/2a4TeCF