Future Fuels From Forests Teacher Institute—Teaching Unit

Tim Barron   Gladstone High School

1. **Target:** Environmental Chemistry Class consisting of 11th and 12th Graders at GHS

2. **Unit Overview:** This unit will correlate close with an Alternative Energy unit that I currently do in my class. This unit has traditionally been an exploratory unit requiring students to basically learn about different forms of alternative energy that may be used to provide energy for a community. The Alternative Energy unit follows a general unit on Energy. The unit will use Problem-Based Learning to contrast different fuels that can be used for the automobiles of Delta County. Problem-based learning involves presenting students with a real-life problem that they as a group must come up with a solution to. It is a very open-ended type project and is a very active type of learning for students. This type of lesson fosters a lot of classroom discussion and students must really delve into the subject to create a suitable, finished project.

3. **Sources**


   Resource CD from Future Fuels Class at MTU, July 2009.

   Presentation Rubric courtesy of: [http://www.teach-nology.com/cgi-bin/presentation.cgi](http://www.teach-nology.com/cgi-bin/presentation.cgi)

4. **Learning Objectives for the Unit**
   By the completion of this unit, students will be able to:
   1. Differentiate between different fuel sources that can be used in vehicles.
   2. Discuss the advantages and disadvantages of the following fuel sources as they pertain to personal motor vehicles:
      - cellulosic ethanol
- corn ethanol
- fossil fuels
- biodiesel
- hydrogen
- fuel cells

3. Formulate a plan to do things better in regards to personal transportation.

4. Define carbon footprint.

5. Define carbon neutral.

6. Discuss life cycles of the various fuels.

7. Explain the importance of conservation in any energy plan.

8. Consider the economic, social, political, and environmental impacts of each energy source.

5. State Content Expectations Met
C1.1A Generate new questions that can be investigated in the laboratory or field.
C1.1E Describe a reason for a given conclusion using evidence from an investigation.
C1.1g Based on empirical evidence, explain and critique the reasoning used to draw a scientific conclusion or explanation.
C1.1i Distinguish between scientific explanations that are regarded as current scientific consensus and the emerging questions that active researchers investigate.
C1.2B Identify and critique arguments about personal or societal issues based on scientific evidence.

C1.2C Develop an understanding of a scientific concept by accessing information from multiple sources. Evaluate the scientific accuracy and significance of the information.
C1.2D Evaluate scientific explanations in a peer review process or discussion format.

C1.2E Evaluate the future career and occupational prospects of science fields.
C1.2f Critique solutions to problems, given criteria and scientific constraints.

C1.2g Identify scientific tradeoffs in design decisions and choose among alternative solutions
C1.2j Apply science principles or scientific data to anticipate effects of technological design decisions.
C1.2k Analyze how science and society interact from a historical, political, economic, or social perspective.
P3.p2A Trace (or diagram) energy transfers involving various types of energy including nuclear, chemical, electrical, sound, and light.

6. Future Fuels From Forests Teacher Institute—Teaching Unit Day by Day Plan

Day 1- Presentation of Problem- Students will get the letter located below:

To: ThinkTank, Inc.

From: State of Michigan Fuel Use Conservatory

The State of Michigan, in the midst of some of the worst economic times in recent memory, is attempting to be a leader in creating a car fleet that is the most efficient in the nation. Michigan is already pursuing many alternative energy technologies that create electricity for the consumers of Michigan. It is a logical step due to the presence of the auto industry in Michigan, that Michigan has the most efficient fleet of vehicles in the nation.

Michigan prides itself in its informed decision making, and continuing that trend is the reason we have chosen to contract with your company. The State needs a study done on the types of fuel that are possible for vehicles to check the feasibility of each type of fuel. The study needs to include the following type of fuels: cellulosic ethanol, corn ethanol, fossil fuels, hydrogen, fuel cell technologies, and biodiesel.

Each fuel type should be studied in depth and the advantages and disadvantages of each should be prepared in some type of presentation that will be presented to State officials about two weeks from today. The group from your company that presents the most convincing argument will receive a bonus from the State as a reward.

To reiterate, your goal is to explore one of the energy sources and explain the reasons why the State should or should not use the energy source your group has chosen to explore. Good luck and we look forward to hearing from you soon.
- Make Groups
- Assign a group foreman
- Describe nature of project
- Make Team Folders
  - Group Name should be on cover
  - Cut out pieces of construction paper (20 per person)
- Receive a 10 point grade for following directions

Note: The team folders consist of five pieces (11 x 14) of construction paper stapled together with a pocket in the back of it to store extra papers. The folder is written on by students but for the most part student input is on small pieces of construction paper that are coded by the shape and color that the students choose for themselves. This coding is essential to be able to assign individual grades to students for their efforts. This folder is graded as the students work and a bigger grade is assigned at the end of the project. The folder tasks that students are assigned can be fixed by the students if their submissions are not up to par. In this lesson plan, these tasks that each student must do will be in italics. For each task students must write their answers or ideas on their own pieces of construction paper and glue them in the team folders.

Day 2- Brainstorming session

- Step 1- Problem Sheet
  - Tasks your group has to accomplish
  - What your group needs to do

- Step 2- What we know sheet
  - Starting point
  - Prior knowledge
  - Knowledge to build on
Day 3- Brainstorming session (continued)

- Step 3- Question Sheet
  o Things that make you go Hmmmmmm
  o Ideas that might need to be explored
  o Ideas for further research

- Step 4- Plan of Action
  o Assign tasks for each person
  o Too much for only one person to do
- Discuss a life cycle analysis of a product

Day 4 Library Day

- Print off materials
  o Put name on what you produce
  o Keep track of the website
- Put all materials in group folder

Day 5 Discussion Day in Classroom

- In class, discuss where we are so far
- Make a plan for who is going to do what in the library
- Finish up/fix any tasks not done so far
- Discuss what is meant by a carbon footprint and define carbon neutral

Day 6&7 Library Day

- All students on a separate computer researching their particular area of study relating to the fuel problem
- All students must write a paragraph describing their take on the fuel problem so far

Day 8 Debriefing

- Set up room like a Senate style hearing
- Each student reads the paragraph they created
- The “Senate” and the facilitator(teacher) grill the groups about holes in their research
- Each group on the hot seat for 10-15 minutes

Day 9 Finish Debriefing/ In-Class Work Day
- the aftermath of the grilling session of the day before
- Make a plan for where to go from here
- Work on folders, maps, or diagrams
- Turn in folders for a check of progress

Day 10 and 11 Library Days
- work on power points if that is the preferred method of sharing information
- continue data acquisition

Day 12 In class work day
- In front of the class again for a quick Q & A
- Brief lecture- Review reactions in an internal combustion engine, air pollution
- Pass out study guide for the upcoming test and to act as a guide for their presentation format
- Fix any problems with folders for a re-grade later on

Day 13 & 14 Library/Computer Lab Days
- finish work on projects and power points

Day 15 &16 Presentations and Review
- fill in study guides based on information presented by other groups

Day 17 Go Through and Discuss Powerpoint Presentation:
Overview of Energy and Future Fuels:
*Assessing Social, Economic, and Environmental Considerations of Energy*

**David R. Shonnard**

*Department of Chemical Engineering*

*Deputy Director: Sustainable Futures Institute*

*Director: Biochemical Engineering Laboratory*

### 7. Assessment

Grading of this project will be done of the folders periodically during the course of the project. The booklet will be graded for completion at the end of the project as well. The power points will be graded as well for accuracy and completeness. In the future, a test may be created to check student’s knowledge of all the fuel sources.

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**Gladstone High School**

*Fuel Source Presentation*

Name: ______________________

Teacher: Mr. Barron

Date of Presentation: __________

Title of Work: ___________________
<table>
<thead>
<tr>
<th>Criteria</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organization</strong></td>
<td>Audience cannot understand presentation because there is no sequence of information.</td>
<td>Audience has difficulty following presentation because student jumps around.</td>
<td>Student presents information in logical sequence which audience can follow.</td>
<td>Student presents information in logical, interesting sequence which audience can follow.</td>
</tr>
<tr>
<td><strong>Content Knowledge</strong></td>
<td>Student does not have grasp of information; student cannot answer questions about subject.</td>
<td>Student is uncomfortable with information and is able to answer only rudimentary questions.</td>
<td>Student is at ease with content, but fails to elaborate.</td>
<td>Student demonstrates full knowledge (more than required) with explanations and elaboration.</td>
</tr>
<tr>
<td><strong>Visuals</strong></td>
<td>Student used no visuals.</td>
<td>Student occasionally used visuals that rarely support text and presentation.</td>
<td>Visuals related to text and presentation.</td>
<td>Student used visuals to reinforce screen text and presentation.</td>
</tr>
<tr>
<td><strong>Mechanics</strong></td>
<td>Student's presentation had four or more spelling errors and/or grammatical errors.</td>
<td>Presentation had three misspellings and/or grammatical errors.</td>
<td>Presentation has no more than two misspellings and/or grammatical errors.</td>
<td>Presentation has no misspellings or grammatical errors.</td>
</tr>
<tr>
<td><strong>Delivery</strong></td>
<td>Student mumbles, incorrectly pronounces terms, and speaks too quietly for students in the back of class to hear.</td>
<td>Student incorrectly pronounces terms. Audience members have difficulty hearing presentation.</td>
<td>Student's voice is clear. Student pronounces most words correctly.</td>
<td>Student used a clear voice and correct, precise pronunciation of terms.</td>
</tr>
</tbody>
</table>

**Teacher Comments:**

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