

# Biology

## SMUD doesn't Waste our Waste

Subject Area: Ecology Grade Levels: 9-12

Date: Fall 2012

### Lesson Overview

#### Materials Included in this Lesson

- Journal prompts
- Vocabulary development worksheet
- Research scaffolding worksheet
- DVD movie of renewable sites used by SMUD

#### Other Materials for this Lesson

- Lab: Fish in a bottle (ecosystem)
- Fieldtrips
  1. Cosumnes River Reserve
  2. Walnut biodigester
  3. Dairy Farm Biodigester

#### Skills the Student will Learn

- 6 renewable/environmentally friendly energy types (Natural gas, Solar PV/Solar Thermal, Geothermal, Hydro, Biomass, wind)
- water cycle, nitrogen cycle, carbon cycle
- food pyramids
- biotic and abiotic factors

#### Student Deliverables

- 2 minute-ignite talk about renewable energy program at SMUD
- ignite talk will turn into a public awareness video with the intent to educate SMUD users about where SMUD is headed. It's a feel good PSA
- concept map using C-MAP tools of the concepts and vocabulary learned
- lab/fieldtrip write-ups

Length of Lesson: 10 Days

#### Activity Day One

Problem Presented:

SMUD's Board Policy is to reduce greenhouse gas emissions from generation of electricity to 10% of its 1990 carbon dioxide emission levels by 2050 while assuring reliability of system; minimizing environmental impacts on land, habitat, water quality, and air quality; and Maintaining a competitive position relative to other California electricity providers.

4 minutes: what questions would you need to know the answer to in order to solve the problem

above

10 minutes: With your partner, choose two questions that you want to answer first.

20 minutes: Take one question each, and attempt to answer it. Go forth and explore.

Closing Journal:

- How do these questions help me solve the big problem
- Do I have all the information I need to answer the big question?

Vocabulary Exploration:

Step 1: Post a word/word phrase that you learned with your name on it on the discussion board.

Tell why you think the word is important.

Step 2: Decide on two words from the group that you will go learn about.

Step 3: you will go around the room and talk to that person about what that word means and take notes in your iBook(interactive notebook, which is just a bound notebook).

Facilitator Prepared Workshop Sign-Up offered over the next 8 days:

- Habitats and species
- Pyramids: Food chains, energy, biomass
- Human impact, succession, speciation
- Cycles:
  - Water cycle
  - Nitrogen cycle
  - Carbon cycle
- Population fluctuation
- 6 renewable energy types
- climate change/greenhouse gas emissions
- water quality
- air quality
- ignite talk protocol

Student need Workshop Sign-up:

Weekly HW:

1. study guide questions
2. book assignments
3. vocabulary
4. c-maps

## Activity Day Two

Research:

Workshops:

Vocabulary exploration:

## Activity Day Three

Cosumnes River Reserve Field Trip: Observe Habitat

## Activity Day Four

Find a native species and predict how it could be affected by renewable energy (2 slides)

Workshops:

Vocabulary exploration:

c-map development(iBook)

## Activity Day Five

DUE:

- Digital continued c-map of what you've learned (weeks 5-8)
- iBook
  - vocabulary
  - fieldtrip notes
  - PrBL notes
  - C-map rough draft
  - Book questions
- Formal Lab/Fieldtrip Report
- 30 second presentations of species affected
- exit quiz (based on study guide and to prepare them for test)

## Activity Day Six

Fieldtrips: during the week, I'd like students to go to either a dairy farm biodigester and solar panel farm OR walnut farm biodigester OR American River Packaging (CleanWorld Partners)

Research:

Workshops:

Vocabulary exploration:

Ignite presentation preparation:

Weekly HW:

1. study guide questions
2. book assignments
3. vocabulary
4. c-maps

## Activity Day Seven

Research:

Workshops:

Vocabulary exploration:

Ignite presentation preparation:

## Activity Day Eight

Research:

Workshops:

Vocabulary exploration:

Ignite presentation preparation:

## Activity Day Nine

Ignite presentation preparation:

c-map development (iBook)

## Activity Day Ten

DUE:

- Ignite Presentations
- Digital Continued c-map of what you learned
- iBook
  - vocabulary
  - fieldtrip notes
  - PrBL notes
  - C-map rough draft
  - Book questions
- Formal Lab/Fieldtrip Report

## Foundation Academic Standards

### *1.2 Science*

Specific applications of Physics standards (grades nine through twelve):

(3.a) Students know heat flow and work are two forms of energy transfer between systems.

(3.g) Students know how to solve problems involving heat flow, work, and efficiency in a heat engine and know that all real engines lose some heat to their surroundings.

## CTE Pathway Standards

### **ENERGY AND UTILITIES INDUSTRY SECTOR**

- Foundation Standards
  - Technology
  - Problem Solving and Critical Thinking
  - Technical Knowledge and Skills
- Pathway
  - B. Energy and Environmental Technology Pathway

- C. Public Utilities Pathway

## **MANUFACTURING AND PRODUCT DEVELOPMENT INDUSTRY SECTOR**

- Foundation Standards
  - Technology
  - Problem Solving and Critical Thinking
  - Technical Knowledge and Skills
- Pathway
  - Graphic Arts Technology Pathway

### CA Content Standards Addressed

#### Ecology

6. Stability in an ecosystem is a balance between competing effects. As a basis for understanding this concept:
  - a. *Students know* biodiversity is the sum total of different kinds of organisms and is affected by alterations of habitats.
  - b. *Students know* how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.
  - c. *Students know* how fluctuations in population size in an ecosystem are determined by the relative rates of birth, immigration, emigration, and death.
  - d. *Students know* how water, carbon, and nitrogen cycle between abiotic resources and organic matter in the ecosystem and how oxygen cycles through photosynthesis and respiration.
  - e. *Students know* a vital part of an ecosystem is the stability of its producers and decomposers.
  - f. *Students know* at each link in a food web some energy is stored in newly made structures but much energy is dissipated into the environment as heat. This dissipation may be represented in an energy pyramid.

### Lesson Plan Relevance To Externship

In my externship at SMUD, I had the opportunity to work with Valentino Tiangco, Ph.D. in the ER&D department. I learned about the 6 forms of renewal energy that SMUD uses to generate electricity. For my biology class I want them to explore the expectation that SMUD has set for 2050 to reduce greenhouse gas emission by 90% from its 1990 emissions. With learning about renewable energy, my students will learn about ecology and human impact.

Sacramento New Technology High School  
 New Tech Network  
 PrBL (Problem Based Learning) Rubric #5  
 Environmental Impact of Renewable Energy

Evaluated:  
 Evaluators:

Problem is stated	What are the renewable energy sources that SMUD uses to provide electricity to the Sacramento citizens? What effect does renewable energy sources have on the environment?
Product Description(if needed):	2 minute ignite talk using PowerPoint and voice over function with QuickTime
Presentation Description:	Watch videos with class

Content Literacy	Unsatisfactory	Proficient	Advanced
Descriptors	<ul style="list-style-type: none"> <li>Don't explain content.</li> <li>Explain content, but out of context.</li> <li>Explain content, but incorrectly.</li> <li>Explain content, but in an oversimplified way.</li> <li>Describe with no analysis or creativity.</li> <li>Explain, but only in a limited, scripted way.</li> </ul>	<ul style="list-style-type: none"> <li>Explain content <i>in the context of</i> the product/ presentation.</li> <li>Explain content in depth and in detail.</li> <li>Explain content clearly.</li> <li>Explain in a creative, analytical way.</li> <li>Support your explanation with reason and evidence.</li> <li>Answer questions in a way that shows confident knowledge of the content.</li> </ul>	<p>In addition to "proficient" descriptors,</p> <ul style="list-style-type: none"> <li>Explain content thoroughly.</li> <li>Fully support and justify your explanation.</li> <li>Explain in a way that adds to the audience's understanding and appreciation of the topic or subject content.</li> <li>Answer questions in a way that shows flexibility with new contexts or applications of the content.</li> </ul>
Standards	<p>7. Evolution is the result of genetic changes that occur in constantly changing environments. As a basis for understanding this concept:</p> <p>a. Students know how natural selection determines the differential survival of groups of organisms.</p> <p>b. Students know a great diversity of species increases the chance that at least some organisms survive major changes in the environment.</p> <p>c. Students know the effects of genetic drift on the diversity of organisms in a population.</p>		

6. Stability in an ecosystem is a balance between competing effects. As a basis for understanding this concept:
- Students know* biodiversity is the sum total of different kinds of organisms and is affected by alterations of habitats.
  - Students know* how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.
  - Students know* how fluctuations in population size in an ecosystem are determined by the relative rates of birth, immigration, emigration, and death.
  - Students know* how water, carbon, and nitrogen cycle between abiotic resources and organic matter in the ecosystem and how oxygen cycles through photosynthesis and respiration.
  - Students know* a vital part of an ecosystem is the stability of its producers and decomposers.
  - Students know* at each link in a food web some energy is stored in newly made structures but much energy is dissipated into the environment as heat. This dissipation may be represented in an energy pyramid.

Point Scale	0.....69	70.....89	90.....100
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Critical Thinking	Unsatisfactory	Proficient	Advanced
	<ul style="list-style-type: none"> <li>• Don't address the driving questions.</li> <li>• Answer the driving questions directly.</li> <li>• Answer the driving questions, but in an oversimplified way.</li> <li>• Answer the driving questions, but not in context.</li> <li>• Only explain one point of view on the topic.</li> </ul>	<ul style="list-style-type: none"> <li>• Answer the problem, but not directly.</li> <li>• Address the problem with your whole presentation.</li> <li>• Address the problem in the context of your presentation.</li> <li>• Explain different points of view on the same topic.</li> <li>• Explain why you prefer one point of view.</li> </ul>	<ul style="list-style-type: none"> <li>• Answer the driving questions in a sophisticated way.</li> <li>• Explain the arguments for and against different points of view on the topic.</li> <li>• Make a strong, convincing argument for your preferred point of view.</li> </ul>
Driving Questions	What are the renewable energy sources that SMUD uses to provide electricity to the Sacramento citizens? What effect does renewable energy sources have on the environment?		
Point Scale	0.....69	70.....89	90.....100

Oral Proficiency	Unsatisfactory	Proficient	Advanced
Descriptors	<ul style="list-style-type: none"> <li>• Don't organize your ideas, or organize them poorly.</li> <li>• Use verbal fillers, awkward pauses, etc.</li> <li>• Use an inappropriate tone.</li> <li>• Don't use rhetorical strategies.</li> </ul>	<ul style="list-style-type: none"> <li>• Organize your ideas logically.</li> <li>• Deliver your presentation in a polished way.</li> <li>• Use a formal tone, or a tone appropriate for the setting and audience.</li> <li>• Use rhetorical strategies</li> </ul>	<ul style="list-style-type: none"> <li>• Organize your ideas so well that the structure of your presentation is invisible -- it just "flows."</li> <li>• Deliver your presentation in an elegant way.</li> <li>• Use rhetorical strategies in a remarkable, creative, or clever way.</li> </ul>
Rhetorical Strategies		Hook Repetition Preview and Summary Transition Ethos, Pathos, and Logos Tone, Gestures, and Call to Action	
Point Scale	0.....69	70.....89	90.....100