

PBL Unit Title: Energy Woes

Primary Subject Area: Earth/Environmental Science

Interdisciplinary Areas also Covered: ELPS, English

Grade/Age Level: High School 9th –12th Grade

Description of students' role and problem situation: Students are members of Save the Earth Foundation attending a public hearing about potential energy failures.

Educational Objectives: (Indicate if unit is interdisciplinary, but only list the objectives from primary subject area) Introduce students to alternative energy sources (disadvantages, advantages, feasibility, etc.)

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SAVE THE ENERGY FOUNDATION

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To: All Foundation Members

From: Windy Geothermally
Save the Energy Founder

Date: May 23, 2002

Re: This could be our big chance!

Hello Gang!

I was looking through my hometown newspaper and found this article. This may be just the opportunity that we were looking for in order to get the word out about the need for alternative energy sources. It sounds like this county is in a real mess and we do not want those stuffed-shirts from CP&L to have a chance to cloud the minds of these citizens with environmentally harmful means of solving their energy dilemma.

Here's the plan. If we could get at least one member from the following programs to attend this public hearing, we could make a difference in the outcome of that meeting: NO MORE NUKES!, ANTICOAL COALITION, WINDS OF CHANGE, THE SUNSHINE GROUP, HYDROPOWER UNLIMITED AND GO GEOTHERMAL. Of course, any and all other program members are equally welcome as well.

Please provide me with your plan of action that should include such topics as advantages and disadvantages in regards to other energy sources, economic and ecological feasibility, etc. by June 3.

Thanks for all your help,

Windy Geothermally

Meet the Problem Article

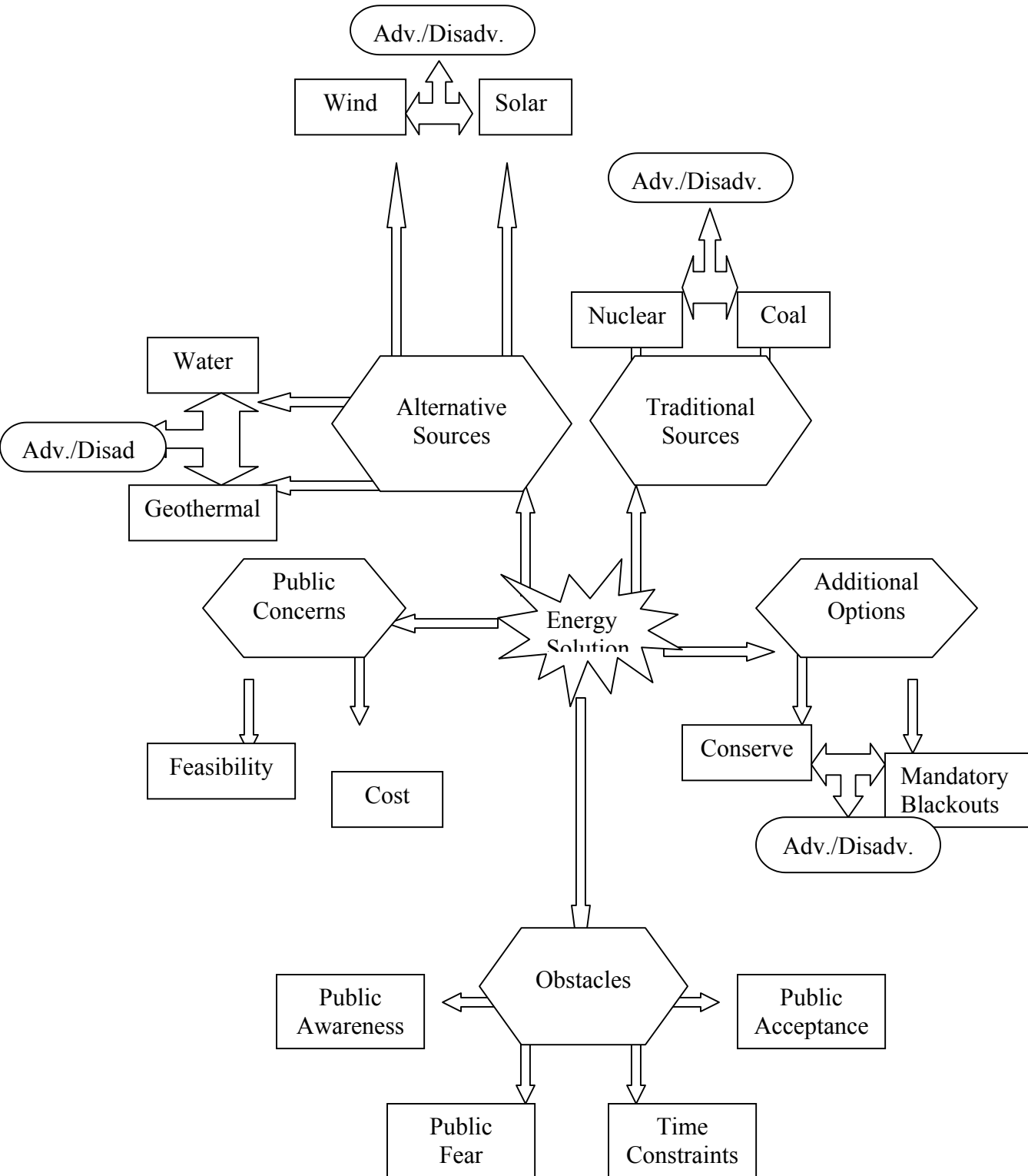
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Public Notice

Fearing potential power shortages and outages due to the increased population growth of this area, the Johnston County Planning Board along with representatives from Carolina Power and Light Company will hold a public hearing to discuss possible solutions on Friday, June 7 at 10:00 a.m. in the Johnston County Courtroom located in Smithfield, NC.

5-22-2t

Problem Map



Know/Need to Know Board

Know

Power problems are feared.

Power problems may arise as a result of recent population growth.

Possible solutions will be discussed in a public hearing on Friday, June 7 at 10:00 a. m.

The public hearing will take place at Smithfield, NC.

The Johnston County Planning Board and representatives from CP&L will be there.

The article was published in the newspaper The News and Review on May 22, 2002.

Geothermally is the Save the Energy Foundation Founder.

The Save the Energy Foundation wants to get at least one member from specific groups to attend the meeting.

Any/all members of the Save the Energy Foundation may attend.

Participants are to let Windy Geothermally if they plan to attend.

Need to Know _____

Have there been power problems already?

How much growth has occurred?

Why has there been recent growth?

Who will pay for the solutions to ease the potential energy problem?

Have any possible solutions already been investigated?

How serious is the threat of power problems?

Why is CP&L going to be Windy at the meeting?

How long will the meeting last?

Who else/what other groups or organizations will be at the meeting?

Exactly what are the Save the Energy members going to do at the meeting by June 3?

How many people will the court house hold for the meeting?

What are the pros and cons of alternative energy?

Curriculum Alignment Assignment

Part 1

The following objectives will be covered from the Earth/Environmental Science curriculum:

Competency Goal 1- The learner will build an understanding of lithospheric materials, processes, changes, and uses with concerns for good stewardship.

Objective 1.03 Assess the importance of economic development of earth's finite rock, mineral, fossil fuel and other natural resources to society and our daily lives:

availability
geographic distribution
wise use
conservation
recycling

Competency Goal 7- The learner will build an understanding of alternative choices facing human societies in their stewardship of the earth

Objective 7.01 Analyze the relationships between the potential of technology to improve the quality of life and the possible causes of stress on the environment.

Objective 7.02 Analyze the interdependence of Earth's natural resources and systems, including land, air, and water, with the need to support human activity and reduce environmental impacts.

Objective 7.03 Assess how society weighs the choices of economic progress, population growth and environmental stewardship and selects a balanced, responsible course of action.

Part 2

The following objectives will be covered from various interdisciplinary areas:

ELPS

Competency Goal 1- Recurring Issues and Problems

The learner will investigate issues and problems confronting the American economic, legal and political systems.

Objective 1.1 Describe the examples of recurring public problems and issues.

Objective 1.2 Analyze causes and consequences of recurring social economic problems and issues.

Competency Goal 3- Economic Choices

Objective 3.3 Explain why scarcity causes producers and consumers to make choices.

English Language Arts

Goal 3- The learner will demonstrate increasing sophistication in defining issues and using argument effectively.

Objective 3-1 Use language persuasively in addressing a particular issue by: finding and interpreting information effectively, recognizing propaganda as a purposeful teaching technique, establishing and defending a point of view, and responding respectfully to viewpoints and biases.

Technical Mathematics I

Goal 1- Number Sense, Numeration, and Numerical Operations

The learner will perform operations with real numbers to solve problems.

Part 3

The following student characteristics will be accommodated:

Materialist

Social learner

Out of touch with current events

Questions authority

Environmentally concerned

Enjoys debate

Problem Statement

How can we as members of various Save the Energy Foundation groups (No More Nukes!, Anticoal Coalition, Winds of Change, The Sunshine Group, Hydropower Unlimited, Go Geothermal, etc.) present information at the public hearing on June 7, 2002 at 10:00 a.m. in favor of alternative energy sources in a way that:

- 1.) is understandable.
- 2.) offers more than one viable option.
- 3.) focuses on and explains the importance of environmental safety.
- 4.) presents energy sources/solutions that are ecologically feasible for that area.
- 5.) presents energy sources/solutions that are economically feasible for that area.
- 6.) is respectful and non-threatening.

Resource List

Books:

Berinstein, Paula. (2001). Alternative energy: facts, statistics, and issues. Westport, CT: Oryx Press.

Blackburn, John O. (1987). The renewable energy alternative: How the United States and the world can prosper without nuclear or coal. Durham, NC: Duke University Press.

Cassedy, Edward S. (2000). Prospects for sustainable energy: A critical assessment. Cambridge, NY: Cambridge University Press.

Journals:

Connors, Stephen R., & McGowan, Jon G. (2000). Windpower: A turn of the century review. Annual Review of Energy and the Environment, 25, 147-197.

Smil, Vaclav. (2000). Energy in the Twentieth century: Resources, conversions, costs, uses, and consequences. Annual Review of Energy and the Environment, 25, 21-51.

Newspapers:

Coal-fired plants keep polluting. (1999, May 25). News and Observer, p. D1.

State basks in solar ranking tax credits may be encouraging more people to rely on the sun to heat their homes. (2001, August 15). Greensboro News Record, p. A1.

Websites:

U.S. Environmental Protection Agency
<http://www.epa.gov/>

CP&L: A Progress Energy Company
<http://www.cpl.com>

Capstone Performance

Representing Save the Energy Foundation members at a public hearing, students will show mastery of the attached curriculum objectives through participation in oral presentations. Presentations should show incorporation of both prior research and computer skills. Each presenter will show evidence of thorough research and preparation by means of group lead discussions, on hand exhibits in the form of posters, handouts or transparencies of charts, tables, graphs, etc. showing detailed knowledge of various traditional and alternative energy sources. Students will be assessed based upon both peer and teacher evaluations. The presentations will be performed in front of adult volunteers representing the Johnston County Planning Board and Carolina Power and Light Company along with their teacher and classmates.

Assessment Instrument

| Criteria | Quality (30pts.) | Mediocre (20pts.) |
|----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Length of Presentation | 10-15 mins. | 7-9 mins. or 16-20 mins. |
| Visual Aids (posters, handouts, transparencies, etc.) | 4-5 samples typed, easily readable | 2-3 samples typed, easily readable |
| Information Presented | correct and thorough (advantages, economic & ecological feasibility, history) | mostly correct with one category missing |
| Sources Listed | minimum of 5 sources from at least two different types of sources | maximum of 3 sources from at least two different types of sources |
| Communication Skills | spoken clearly, few grammar errors, flows smoothly with little or no extended pauses or interruptions | most words spoken clearly, 4+ grammar errors, flows somewhat smoothly but with 2-3 extended pauses or in- terruptions |

Coaching Questions

Question #1=Cognition Question#2=Metacognition Question#3=Epistemic Cognition

Meeting the Problem:

1. Are there any unfamiliar terms in either the newspaper article or the memo?
2. Will the problem of how to prevent energy failures be easy or hard to solve?
3. Do you think the problem of energy shortages is a realistic/real world issue?

Know/Need to Know Board:

1. Do you have enough facts to suggest that power failure has already occurred?
2. Why is it important to know that representatives from CP&L will be at the meeting?
3. How do you know in the big picture of things that alternative energy is better than traditional sources?

Writing Problem Statements:

1. What is your role at the public hearing?
2. Why do you think that protecting the environment is the central issue?
3. What factors do you need to consider in order to reach a solution that will be accepted by all parties involved?

Information Gathering and Sharing:

1. What does geothermal energy mean?
2. How can you verify that wind energy is feasible in this area?
3. Why is it important to research both advantages and disadvantages for each energy source?

Generating Possible Solutions:

1. What have you learned about energy?
2. How did the group arrive at the need to consider conservation as a solution?
3. If you decide to ask people to conserve energy and they refuse, then what? How are you going to monitor who conserves and who doesn't?

Alternative Solutions

Solution #1: Conservation

Pros

1. Requires little/no money to implement.
1. People would save money on energy bills.
3. Will not harm the environment.
4. Familiar method.

Cons

1. Everyone might not do it.
2. Impossible to monitor.
3. Hard to determine the extent of this method needed.
4. May not be sufficient enough to solve problem.

Consequences of choosing conservation:

1. The energy problem could be solved quickly and cheaply.
2. People involved would have to make a conscious and concerted effort to conserve.

Solution #2: Wind power

Pros

1. Nonpolluting
2. Could produce enough additional energy to solve problem.
3. Proven effective in some areas.
4. Wind is a limitless resource.

Cons

1. Wind is not constant.
2. Wind farms are dangerous to some birds.
3. Large, treeless area needed for construction of wind farm.
4. Wind farms may be considered aesthetically unpleasing.

Consequences of choosing wind power:

1. Money would be needed to purchase land for the wind farm and for construction of the aerogenerators.
2. New jobs would be created as workers would be needed on the wind farm.

Even though the population of the area is growing, if everyone involved would voluntarily conserve energy, this would be the better solution to prevent possible power failures. Compared to wind power, conservation would be the quicker, easier, less costly, more environmentally sound method. Once the public is made aware of the energy dilemma and presented with a choice like wind power that may be funded by raising their taxes and may ultimately lower their property value, they may be eager to choose the less invasive choice of conservation.

Debriefing Session

Review of Student-Generated Solutions:

Representing members of various Save the Energy groups (Anti-coal Coalition, Go Geothermal, etc.), students will make oral presentations for the entire class. All students will have the opportunity to hear and ask questions about each group's solution.

Rating of Solution:

Once every solution is presented, students will be allowed to revisit and collectively discuss all of the groups' solutions. Students will then compile and post a list of advantages and disadvantages of each solution presented.

One Best Solution:

Once all advantages and disadvantages are posted and discussed as well as any new concerns are addressed, each student will anonymously vote on the best solution. After all votes are tabulated, the class solution will be announced.

Coaching by Teacher:

If important concepts are not addressed, students may be given additional created memos, news articles, e-mails, faxes, phone messages, etc. addressing these issues in a way consistent with the authenticity of the problem. For example, if students fail to mention the idea of hydroelectricity, I may give the class an "e-mail" or "fax" that I received from another environmental group wishing to be part of the public hearing.