Curriculum Units by Fellows of the Yale-New Haven Teachers Institute
1980 Volume V: Man and the Environment

The Energy Crisis

Curriculum Unit 80.05.05
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This unit can be used from grades 5-10. It is an interdisciplinary approach to a current problem facing our society. It is a topic that has been in the mainstream of our news for the past ten years and with each succeeding year the intensity of the energy dilemma heightens.

There are many experts who consider the energy crisis as the main

problem of the Western world. In the coming years our way of life will be seriously affected and our standard of living has already been altered. Certainly a main concern of everyone in the energy field is the public acceptance that there is a severe problem. There is no better place to begin the education of all our consumers than in the schools. This is the purpose of my preparing a curriculum unit about energy. The scope of the dilemma cuts across all boundaries; young and old, rich and poor, black and white. As an educator, I hope to reach some future citizens and enlist their help in tackling this serious problem.

At the earliest stage of human history, man was using energy. As time passed, our energy consumption has continually increased. Initially, man burned wood and that continued for hundreds of years. About 200 years ago, we began using coal. Then 100 years later oil and soon after, natural gas. In the past few decades, nuclear energy appeared. What will the future bring? That is one question that I will try to answer. These are some of the other ones.

I. What is the energy crisis?
II. What are fossil fuels and what is the availability in the future?
III. What is nuclear power and what are the problems caused by its use?
IV. What is a national energy policy and why does the United States need an effective one?
V. Is the energy crisis affecting other parts of the world?
VI. What is OPEC and what is their position in international politics?
VII. What are the alternate sources of energy and what is their availability?
VIII. What are some suggested solutions, short and long term, to our energy crisis?

To begin the unit, there are several suggestions. It is not a topic that has one textbook which adequately covers the subject. Everyday there are new suggestions and plans proposed by individuals and various interest groups. The topic constantly bantered around by every mass media publication. Thus it is highly effective to use some of these publications as your source. During the year that I plan on teaching the unit, I keep a folder and when an article appears, I clip it out and date it. Another important source is television. Periodically there are special programs dealing with the energy plight. If you are fortunate enough to have video tape equipment at your school, you can tape the program for later use. Also the utility companies of New Haven are very helpful. They offer a number of publications and film lists which are available. On a national level the oil companies send free films to schools or groups. I think it is such a current field, changing daily, that you can make the educational process more vivid by involving the students in bringing in articles and other naturales.

I. WHAT IS THE ENERGY CRISIS?

Webster defines crisis as a “decisive moment”or “turning point”. We are now at an extremely critical stage of using energy beyond a practical limit. We have increased our usage enormously, especially oil, in the past decade. The consequence is we are quickly exhausting our finite supplies of oil and natural gas. As a result, we are becoming more dependent on foreign sources of oil to keep our country functioning. In 1977 the United States with only 6 percent of the world’s population consumed approximately 30 percent of the energy produced in the world. These statistics are startling reminders of our insatiable energy appetite. Some people may ask “do we have an energy crisis”. The answer is a definite yes. Our next step is to realize we are at a crucial time if we are to reverse our terrible trip towards energy starvation. We will have to recognize our mounting trouble and act decisively to stem the tide.

II. WHAT ARE FOSSIL FUELS AND WHAT IS THE AVAILABILITY IN THE FUTURE?

The crux of our problem is the rising use of fossil fuels. These nonrenewable sources of energy include petroleum, natural gas and coal. In the past decade and one-half the United States populace has become a gluttonous user of unimaginable amount of oil and its by-products. Within the last ten years, we have widened the gap between our production and our use. We are using more and more and producing less and less. We have an abundant supply of coal, however, our factories, transportation system and power plants do not run on coal in most instances. Professor D. Allan Bromley of Yale University estimated that at our 1977 usage rate we have in the United States 1500 years supply of coal, 24 years of oil and 48 years of natural gas.

These sources of energy are called fossil fuels because they developed millions of years ago from animal and vegetable matter buried deep under the earth’s surface. They are considered non-renewable sources due to the finite quantities available.

Also, a word can be said about the enormous use of oil. In this country our different modes of transportation, much of our heating supplies and many of our industrial complexes are almost exclusively dependent on oil or its by-product, gasoline. Within the students’ scope, this can be listed in any number of ways. Immediately they will think of cars, trucks, buses, airplanes and the thousands of houses, factories, school buildings and apartment houses that either run on gasoline or are heated by oil.

III. WHAT IS NUCLEAR POWER AND WHAT ARE THE PROBLEMS CAUSED BY ITS USE?

Nuclear power seems to be the answer to our problems. A pound of uranium could provide as much energy as over 1000 tons of coal and more than 30,000 gallons of oil. Basically the fission process releases tremendous amounts of energy when atoms of uranium are split. This is done inside a nuclear power plant where the controversy begins. Connecticut is the most nuclear dependent state in the country with more than 50 percent of the state's electricity being produced by the atom. There are three plants in operation; Connecticut Yankee in Haddem, and Millstone I and II in Waterford. Also there is a third plant in Waterford under construction.

The controversy revolves around several public fears. One is a possible catastrophic explosion. Another is radiation release into the environment and the other is waste disposal. The opponents of nuclear power say these dangers are so real that construction of new plants should be stopped and operating plants should be shut down. The reality of a possible melt down of a nuclear reactor or another nuclear accident was vividly portrayed by the recent human failures at Three Mile Island in Pennsylvania. However, after reading numerous accounts of the happening, it seems as though the mass media created a sensational media event. It demonstrated human failures, but it was in no way close to an explosion or any other nuclear catastrophe.

The harmful effects of radiation exposure include the dreaded disease, cancer and the birth of deformed babies. The nuclear waste disposed creates another potential hazard if it is hijacked by some terrorist or criminal group. What havoc will these unscrupulous people raise?

IV. WHAT IS A NATIONAL ENERGY POLICY AND WHY DOES THE UNITED STATES NEED AN EFFECTIVE ONE?

A national energy policy is a program to harness all of our resources to improve our rapidly deteriorating energy future. There are no simple answers and any progress will take concerted action for a number of years. The leaders in this country have been negligent for not responding to this imposing dilemma. The handwriting has been on the wall for more than 40 years. Time is running out as well as our finite energy supply. Recently President Carter signed a bill into law to begin a national program to develop a large synthetic fuel industry. This is only one step. The congressional leaders and the President have to push aside their selfish political interests and hammer out a sensible program that will pave the way for a secure energy future.

V. IS THE ENERGY CRISIS AFFECTING OTHER PARTS OF THE WORLD?

The energy crisis is seriously affecting most of our allies. Our allies include France, West Germany, Japan, Italy, Israel, Portugal and Spain. All of these countries depend on foreign sources for most of their energy, more specifically oil. Japan is a highly industrialized country on an island with limited space and no energy resources to speak of. The Western European nations; France, West Germany, Italy, Portugal, Spain and their neighbor England do not have any appreciable amount of fuel resources. Israel is surrounded by hostile neighbors who have the fuel resources, but certainly will not share with her Canada, our northern neighbor, is well supplied for her own needs, but it is not in a position to contribute to our shortages. Russia, one of our

adversaries, is supposedly well supplied although her exact situation is not known. Our southern neighbor, Mexico, is currently reluctantly dickering with us about making an arrangement for buying her natural gas. The many underdeveloped nations of the world in South America, Africa and Asia are caught by the rising prices for fuel as they try to attack their problems of development.

VI. WHAT IS OPEC AND WHAT IS ITS POSITION IN INTERNATIONAL POLITICS?

The Organization of Petroleum Exporting Countries was organized in 1960 to enable its member nations to formulate a common policy, to set certain trade rules, and to establish prices for their tremendous fuel supplies. Its members produce more than half the world's oil and supply about 80 percent of the oil imported by non-member nations. OPEC has become one of the most influential groups in world politics because of its great supply of oil. Its member nations are Algeria, Ecuador, Gabon, Indonesia, Iran, Iraq, Saudi Arabia, United Arab Emirates and Venezuela. More than half of its members are Middle Eastern countries. The largest oil reserves are in Saudi Arabia, which is our largest supplier and closest friend within the group. Previously, we had close ties with Iran. In the Iranian crisis, our closest allies West Germany, Japan, Britain and France did not wholeheartedly support us because of their dependence on Iranian oil.

VII. WHAT ARE THE ALTERNATIVE SOURCES OF ENERGY AND WHAT IS THEIR AVAILABILITY?

The alternative sources of energy are the ones we hope to develop the future. The energy substitutes are necessary as the price of fossil fuels increases and supplies are depleted. I will discuss each source and its availability.

SOLAR:

This is the energy from the sun. There is an inexhaustible supply. However, the problems are numerous. First let me enumerate some of the solar methods that are being used. In Connecticut a number of people have made solar water heaters. The state has even given out 900 federal grants for experimentation. The solar voltaic cell is another source. With this method, sunshine is turned into electricity. The Southern New England Telephone Company is experimenting with this on a building in North Branford. Many builders and new home owners are experimenting with passive solar design. This means using more windows where their homes are facing the sun and using less windows and more insulation where their homes receive less sunlight and tend to lose heat. Finally, the most advanced technology is space satellites that would receive more sunlight and transmit it back to earth continually. The stations would be put in orbits so they would receive a maximum amount of solar energy.

The problem begins with storing solar energy so we would have it at night or on sunless days. Also, presently the cost of solar technology is high. Hopefully in the near future there will be some breakthrough.

GEOTHERMAL:

This alternative is using the earth's heat. There are several sites in the western part of the United States using it, but it does not seem that the high cost and the problems involved would be worth involvement.

TIDAL ENERGY:.

This source would harness the ocean's tides, but except in isolated instances it would not appreciably affect our energy future.

WIND:

For years and years windmills have been a source of power. However, for the massive amounts of energy we consume it would be no alternative.

SYNTHETIC FUELS:

During the summer of 1980, President Carter signed into law the synthetic fuels bill. Synthetic fuels are artificial fuels produced from oil shale (rock) tar sands or made of liquefying or gasifying coal. We have abundant amounts of coal and this will be the primary source. It will certainly not supplant our use of oil, but if we can produce two million barrels a day by the 1990's it will be a big plus. The positive aspects would be two-fold; it would reduce our dependence on OPEC and produce many new jobs. Also, it will involve a tremendous cooperation between private corporations and the government.

WOOD:

This is only an energy source for a limited amount of households. If wood was used by any of the large industrial consumers, our forests would be quickly dissipated. In Connecticut and other northern parts of this country, many people are using wood burning stoves and other similar equipment; however, this is not a visible alternative for the future.

VIII. WHAT ARE SOME SUGGESTED SOLUTIONS, SHORT AND LONG TERM TO OUR ENERGY CRISIS?

These suggestions could be condensed into a three fold plan. Conservation, nuclear power and coal are the choices.

Conservation is not the total Answer, but it would certainly improve our situation. This would have to be a conservation program that would encompass all of our consumers. The initial step would be less driving and more use of mass transportation system. In some parts of the country it would mean adding more buses and trains, in other parts, it would be modernizing the existing systems. Also it would include an educational program for the energy consumers to make them aware of how they can save energy daily. This has already begun and hopefully it will continue.

In addition, the new car manufacturers will have to increase the fuel efficiency of all cars. Another solution will concern the industrial sector of our economy, to continue their cutbacks and their fuel efficiency programs without seriously affecting their production. What will be necessary in an across the board conservation program which will touch every part of our populace?

Nuclear power is an important part of the fusion of uranium atoms. There are a number of nuclear energy plants operating in 1980 and their safety record is the best compared to oil refineries and coal mining. We

should continue to develop more nuclear sources with proper regulatory procedures and not bow to any pressure groups unless their objections are completely valid.

The other short term solution is to take more advantage of our abundant coal supply. One step is the recent synthetic fuel development act signed by President Carter. Another would be more transitions by electrical energy plants to coal as a source instead of using oil or natural gas. At the same time, we must be very careful with the safety hazards to the environment that coal creates.

Besides the previously mentioned short term solutions; each regime, state and country must be cognizant of their particular energy problems and be open to innovative or unorthodox solutions. For example, Maine possibly could supplement their energy supplies with modern windmill devices because of their location in the North Atlantic. California has already been successful using geothermal as an energy source. Most likely in the near future there will not be any easy answers. However, if each area could blend a combination of alternatives to satisfy their needs, then all of our difficulties through this transitional period could be lessened.

LONG TERM:

After the next several decades, we must continue to use the previous solutions wherever feasible. In addition, we must go full speed with research and development of new techniques of energy production. The most logical today are atomic power by fusion, solar power, reusing waste, and further development of synthetic fuels.

The atomic fusion power would be a great source if we were able to use hydrogen from the oceans as its source. There are numerous dangers that would have to be ironed out. And last, possibly the same Yankee ingenuity that has made this country flourish could take another step for mankind and came up with some entirely new and effective source of energy.

PRE-TEST

PART I Circle the right letter

1. What is our country’s most abundant energy resource?
    A. Coal
    B. Electricity
    C. Natural gas
    D. Oil
2. What percentage of the oil Americans use is imported from other countries?
    A. 10%
    B. 20%
    C. over 50%
    D. 90%
3. Electricity is generated using:
    A. Coal
    B. Natural gas

C. Uranium
D. Oil
E. All of these

4. The United States uses more energy than:
   A. Japan
   B. Great Britain
   C. West Germany
   D. Russia
   E. All of the above combined
5. From an environmental standpoint, what is the cleanest energy? A. Oil
   B. Coal
   C. Natural gas
   D. Electricity
6. In the foreseeable future, what kind of energy system is our country likely to have?
   A. All-electric
   B. All-solar
   C. All-gas
   D. All-nuclear
   E. None of the above
7. What's the first thing you should do to save energy in your home?
   A. Turn down the thermostat
   B. Install storm doors and windows
   C. Insulate
   D. Caulk the windows and the doors
8. In 1976, United States energy consumption
   A. Went down nearly 5%
   B. Went down nearly 2%
   C. Stayed the same
   D. Went up nearly 5%
9. Most homes are heated by:
   A. Coal
   B. Electricity
   C. Oil
   D. Natural gas
10. What energy provides the largest amount of fuel for America's transportation system?
    A. Natural gas
    B. Coal
    C. Electricity
    D. None of the above

PART II Briefly answer the question

11. What is the energy crisis?
12. What is a fossil fuel?
13. What is OPEC?
14. What is nuclear energy, and why do they have demonstrations against nuclear power?
15. How can we solve the energy crisis?

LESSON PLAN I

This activity will demonstrate to the student how we are totally dependent on energy. Our way of living is completely connected to energy consumption.

Instructions:.

Each student when he leaves class should make a list of everything he does for the rest of the day and tomorrow. He should put four headings for each activity. For example:

Activity Machine Type of Energy Source
1. Going home Bus Gasoline Oil

2.

3.

4.

5.

6.

7.

8.

LESSON PLAN II

The students should have a working knowledge of the following words and terms used in this unit. Since no textbook will be used, an introductory lesson is necessary to give the students notes and explain the vocabulary. The vocabulary list will expand as the section is taught, but this is a good starting point. It will probably take two days.

1. crisis

2. energy

3. environment

4. fossil fuels

5. non-renewable

6. consumption

7. abundant

8. natural resource

9. pollution

10. finite

11. nuclear energy

12. import

13. export

14. conservation

15. supply and demand

16. efficiency

17. alternative energy sources

18. solar energy

19. self-sufficient

20. dependent

The teacher should research the topic from the mentioned sources and have a set of notes on the vocabulary.

LESSON PLAN III

After we have discussed the world energy situation, including OPEC and the strategic importance of energy supplies, this is a concluding lesson on the various countries frequently mentioned in the news. Although this strays from the strict science discipline it is a good example of science and political science undeniably interwoven. As a related topic, there could be a class discussion of the IrAnian hostages' and what part oil played in the whole scenario.

Instructions:
For each country listed describe their energy resources with one of the following words or phrases; dependent, self-sufficient, member of OPEC

Country
Soviet Union

Japan

Great Britain

Iran

France

United States

Venezuela

China

Saudi Arabia

Israel

Mexico

Canada

Iraq

West Germany

TEACHERS BIBLIOGRAPHY

Bromley, D. Allan, Energies of the Future. This well-done pamphlet is based on talks delivered to a number of industrial groups in Southern Connecticut during the spring of 1979. Copies can be obtained from the United Illuminating Company in New Haven.

Cohen, Bernard L., Nuclear Science and Society, Anchor Books. This is a general review of nuclear energy, and I recommend it.

Energy Sources, The Promises and Problems. (Center for Industrial and Institutional Development, University of New Hampshire, Durham, New Hampshire 03842). This is a group of ten reports by experts in the field on different energy sources. The full version and the students can use the summAries.

Miller, Janes Nathan, “The Energy Crisis” There Is an Easy Answer.” (The Reader’s Digest, Pleasantville, New York 10570). An interesting solution is proposed by the author, however, it seems a bit simplistic.

Stobaugh, Roger and Yergin, Daniel, Energy Future, Report of the Energy Project at Harvard Business School (Random House, New York). This is an expert analysis of the problem and other possibilities.

Also, there are numerous other newspaper and magazine articles which constantly appear daily. The best suggestion is to keep your eyes open and a scissors handy. Furthermore, there are often TV specials which are usually well-done.

STUDENTS BIBLIOGRAPHY AND CLASSROOM MATERIALS

Branley, Franklin M., Energy for the 21st Century, New York: Thomas Y. Crowell Company, 1975. Illustrated by Henry Roth. An optimistic energy forecast for the future is included with the problems and cogent illustrations.

Energy Sources, the Promises and Problems, (Center for Industrial and Institutional Development, University of New Hampshire, Durham, New Hampshire 03842). This pamphlet summarizes ten reports by experts in the field on different energy sources and does an excellent job. Copies can be obtained by writing to the address above and will only cost the printing and postage.

Newsweek, “The Energy Crisis” pp. 19-33, 16 July 1979. A good discussion of the possible solutions with pertinent diagrams.

Szulc, Tad, The Energy Crisis 2nd Ed., New York: Franklin Watts Company, 1978. A clear analysis of the crisis is combined with a thorough explanation of the political and economic realities.

Write or call the following places for resources available:

American Gas Association

Dept. 1114-4 N.W.

1515 Wilson Boulevard

Arlington, Virginia 22209

Energy and Education

c/o Mary McQuire

National Science Teachers Association

1742 Connecticut Avenue, N.W.

Washington, D.C. 20009

New Haven Register

Jackson Publishing Company

ask for: A Special Register Report

“Energy: Which Way Are We Heading?”

Sunday, April 20, 1980

United Illuminating Company

William S. Murphy

Educational Services Administrator

80 Temple Street

New Haven, Connecticut 06506

Telephone Number 787-7240

Free Films:

U.S. Atomic Energy Commission Division of Technical Information Washington, D.C. 20545 or

U.S. Department of Energy Technical Information Post Office Box 62

Oak Ridge, Tennessee 37831