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ABSTRACT

The causes of the energy crisis are many, and the solutions are complex. Since every person in the world is affected, every person should have an understanding of the energy shortage problem. This unit is designed around the following two ideas: (1) to develop an understanding of energy and the need for it, and (2) to understand some of the causes, effects, and solutions of the energy crisis. It attempts to present information regarding energy problems for level II and III educable mentally retarded students. Included are four topics: (1) What Is Energy, (2) Energy Fuels, (3) How We Use Energy, and (4) Conservation of Energy. For each topic there are behavioral objectives, student activities, and teacher suggestions. The numbers in parentheses by the activity number indicate the objectives the activity helps develop. The unit also includes goals and objectives, an objective summary sheet, a unit time line, a materials sheet, and 20 appendixes which contain various teaching aids related to the activities and which are also suitable for duplication. (TK)

ENVIRONMENTAL EDUCATION PROJECT
ESEA TITLE III, SECTION 306

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A unit developed by the Environmental Education Project Staff, January, 1974, for Level II and III Educable Mentally Retarded Special Education classes.

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ENERGY

AND

YOU

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Foreword

We have reached the point in time where our energy resources, which have been taken for granted, are becoming harder to obtain. The entire world is searching for new energy sources and trying to conserve what we already have. Conservation measures force most people to change their style of living, in some instances.

The causes of the "energy crisis" are many and the solutions are complex. Yet, since every person in the world is affected, every person should have an understanding of the energy shortage problems.

The amount of knowledge that can be absorbed and retained varies from person to person. This unit attempts to present information regarding energy problems for Level II and III educable mentally retarded students. There are four topics: 1) What is Energy; 2) Energy Fuels; 3) How We Use Energy; and 4) Conservation of Energy.

For each topic there are behavioral objectives, student activities, and teacher suggestions. The numbers in parentheses by the activity number indicate the objectives the activity helps develop. Teaching aids are located in the appendix. They can be removed for duplication.

A variety of activities are given for each objective. It is not expected that every activity will need to be used to achieve a specific objective. A variety of activities are included so teachers may select the activities that are appropriate for their class or an individual student. Teachers should feel free to modify or substitute activities to accomplish the objectives. Some objectives are more difficult than others. If a teacher wishes, she may select those objectives from the unit that best fit her class. Pretesting and posttesting should be done only with those objectives that are to be taught.

Thad Whiteaker
Program Specialist - Special Education

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Special recognition is given to the Board of Education for the Topeka Public Schools, who approved and are supporting this creative, exemplary and innovative project.

My sincere gratitude is extended to the program specialists for their tireless efforts in developing this unit. Curriculum development and revision has extended the working days for these staff members. My personal thanks are given to Glenn Clarkson, Bob King, and Thad Whiteaker for an outstanding job.

The enclosed curriculum is the result of input from the project's paraprofessionals and volunteers, special education teachers, Community Council members, parents, students, and interested lay citizens.

With the deepest appreciation, I acknowledge the work of the secretarial team. The constant revisions, pressures, deadlines, and demands for quality work were handled in a most outstanding manner by Dorothy Booher, Rita Dreiling, Peggy Ketter and Candy Redmon. A special thank you for a job well done goes to T. W. Mack who designed and put on stencils the numerous illustrations.

Donald French
Project Coordinator

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Goals and Objectives

Goals: 1) To develop an understanding of energy and the need for it.

2) To understand some of the causes, effects, and solutions of the energy crisis.

Behavioral Objectives:

1) Given four phrases, the students will select "makes things move" as the one that best describes energy.

2) Given four phrases, the students will select "nothing moves" as the one that best describes a total lack of energy.

3) Given four choices, the students will select "fuel" as a common name for food, coal, oil, gasoline, wood, kerosene, and natural gas.

4) Given four choices, the students will select "fossil fuels" as the term that applies to oil, coal, and natural gas.

5) Given four choices, the students will indicate that fossil fuels come from "beneath the earth."

6) Given four choices, the students will select "crude oil" as the source of gasoline, kerosene, and diesel.

7) Given the names of four fuels, the students will select "wood" as the fuel not connected with making electricity.

8) Given four choices, the students will select "factories" as the greatest user of energy.

9) Given four choices, the students will select "coal" as the fuel now used the most in making electricity.

10) Given four choices, the students will select "heating" as the biggest use of energy in the home.

11) Given four choices, the students will select "burning" as the process that usually changes fuel into energy.

12) Given four choices, the students will select "food" as the source of energy for the body.

13) Given the statement "one reason there are not enough energy fuels in America is because Americans are using more energy," the students will indicate that this is true.

14) Given the statement "energy crisis means that we don't have enough fuels to do everything we want to do," the students will indicate that this is true.

15) Given four choices, the students will select "small cars" as one way to save on gasoline energy.

16) Given four choices, the students will select "energy fuels" as the thing we really save by cutting down on our use of electricity.

17) Given four choices, the students will select "ride city bus" as a means of conserving fuel.

18) Given four choices, the students will select "car pool" as the term that describes several people sharing a ride in a car to work or school.

19) Given four choices, the students will select "keep the refrigerator door closed" as the phrase that describes a good way to help save energy at home.

20) Given four choices, the students will select "nuclear (atomic) power" as the energy that will probably be used to produce electricity in the future.

Objective Summary Sheet

Objective Number	Concept Within the Objective	Test Question Number	Class Pretest Results	Class Posttest Results
1	Energy makes things move.	1	_____	_____
2	A lack of energy results in no movement.	2	_____	_____
3	Food, coal, oil, gasoline, wood, kerosene, and natural gas are called fuel.	3	_____	_____
4	Oil, coal, and natural gas are fossil fuels.	4	_____	_____
5	Fossil fuels are found underground.	5	_____	_____
6	Crude oil is the source of gasoline, kerosene,and diesel.	6	_____	_____
7	Wood is not used as a fuel for producing electricity.	7	_____	_____
8	Factories use the greatest amount of energy.	8	_____	_____
9	At the present time, coal is the fuel used most in making electricity.	9	_____	_____
10	Heating is the biggest user of energy in the home.	10	_____	_____
11	It is usually necessary to burn fuel to change it to energy.	11	_____	_____
12	Food is the source of energy for the body.	12	_____	_____
13	Americans greater use of energy is one reason for fuel shortages.	13	_____	_____

Objective Summary Sheet (Continued)

Objective Number	Concept Within the Objective	Test Question Number	Class Pretest Results	Class Posttest Results
14	A definition of the energy crisis.	14	_____	_____
15	One way to use less energy is to drive small cars.	15	_____	_____
16	By using less electricity, we save fuels.	16	_____	_____
17	Using city buses can be a means of conserving fuel.	17	_____	_____
18	A definition of a car pool.	18	_____	_____
19	Keeping refrigerator doors closed is a means of saving on energy at home.	19	_____	_____
20	Electricity may be produced mainly by nuclear power in the future.	20	_____	_____

Unit Time Line

DAY	
	Before the trip:
X	Administer the unit pretest.
	Schedule all films to be used in the unit.
	Schedule the cassette "Our Energy Supply" through the Environmental Education Office.
	Begin study of the unit.
	Determine a date for the field trip.
14	Submit field trip request to building principal. Check to see that all requirements for notification of parents have been fulfilled.
	Schedule Oil Wall Charts from the Environmental Education Office.
	Schedule samples of fuels through the Environmental Education Office.
	Contact program specialist to set up a date for crude oil refining demonstration.
	Begin activity 36 at this time if you plan to use it.
7	Meet with those helping with the trip to go over field trip details.
1	Contact program specialist to affirm readiness for trip on the following day. Give students the instructions they will need to be fully prepared for the trip.
0	Field Trip
	After the trip:
1	Begin study of Topic IV.
	Prepare questions for activity 38.
	Complete study of the unit.
	Administer unit posttest.
	Fill out Teacher's Unit Evaluation and submit to program specialist.

Materials Sheet

The materials that will be needed to effectively track the unit are listed below. The list includes names and/or description of the activity needing the material, number of the activity in the unit, page number of the activity, and a list of materials needed for the activity.

Activity	Unit Activity Number	Unit Page Number	Materials
Our Energy Supply	2	10	Cassette tape from Environmental Education Office.
Energy Collage	3	11	A large piece of posterboard.
Personal Energy	4	11	Duplicate of Appendix I.
Sentence Completions	5	12	Duplicate of Appendix II.
Hero's Engine	6	12	One Hero flask, water, one rubber stopper, hot plate or alcohol lamp, and one metal stand.
Fuel Discussion	7	14	A copy of Appendix III.
Oil Wall Chart	10	17	One copy of "Science In the Search for Oil."
How Oil Is Used	11	17	A copy of Appendix IV, a sample of crude oil.
Oil Use - Fill-ins	12	18	Duplicates of Appendix V.
Oil Uses - A Demonstration	13	19	Small samples of crude oil, motor oil, kerosene, diesel, and jet fuel.

Materials Sheet (Continued)

Activity	Unit Activity Number	Unit Page Number	Materials
Crude Oil Refining	14	20	One pint of crude oil, small amount of steel wool, heat source (hot plate), one pyrex flask, one one-hole stopper, one to two foot piece of plastic tubing, one beaker.
How Coal Is Used - Discussion	16	21	One chunk of coal, a small amount of finely crushed coal.
The Story: The Big Push For Energy	17	22	A copy of Appendix VII
Coal: A Map Activity	18	22	Duplicates of Appendix VIII
Fuel - Energy Use	19	23	Duplicates of Appendix IX
View film and discuss	20	24	Film: Energy Crisis
View film and discuss	21	25	Film: We Use Power
Collect Energy Stories	22	26	Copies of newspapers and magazines
Energy Demonstration #1	24	27	Small round sticks (pencil size), construction paper, straight pins, scissors.
Energy Demonstration #2	25	28	Pinwheels from Activity 24, one teakettle (or other container with a long narrow spout), water, a heat source, samples of coal, wood, oil, kerosene (See ACtivity 13).
Energy Use Graph-Complete	26	28	Duplicates of Appendix XI
Energy Use Graph-Incomplete	27	29	Duplicates of Appendix XII

Materials Sheet (Continued)

Activity	Unit Activity Number	Unit Page Number	Materials
Making Electricity - A Diagram	29	31	Duplicates of Appendix XIII
Electricity Used at Home	30	32	Duplicates of Appendix XIV
Energy Chains	31	33	Duplicates of Appendix XV
Energy Use Puzzle	32	33	Duplicates of Appendix XVI
Energy Use Mural	33	34	General art materials
Energy Field Walk	34	34	Duplicates of Appendix XVII
Art Activity	37	37	General Art Materials
The Question Box	38	37	Questions for the box-see Appendix XVIII.
Saving Energy - A Discussion	42	40	A copy of Appendix XIX
Energy Interviews	43	41	A tape recorder.

TOPIC I: What Is Energy?

Behavioral Objectives:

1. Given four phrases, the students will select "makes things move" as the one that best describes energy.
2. Given four phrases, the students will select "nothing moves" as the one that best describes a total lack of energy.

Student Activities	Teacher Suggestions
1. (Objectives 1 and 2) Energy Power - Discussion 1. Discuss meaning of energy and the need for energy.	1. (Objectives 1 and 2) Energy Discussion 1. Write the word ENERGY on the board in large letters. Use this word to key the discussion. 2. Ask the students to give their impression of what the term means to them. 3. After the students respond with their interpretation of ENERGY, focus the discussion on the body's use of energy; for example, Why is a person able to run, walk, and play? 4. After discussing the students personal need for energy, focus on other needs for energy. Energy is necessary to make cars, planes, trucks, ships, and trains run. Energy is necessary to make electricity. 5. Demonstrate a use of energy . Turn on a light and/or roll or bounce a ball to a student. 6. If possible, end the discussion with emphasis on the fact that without energy nothing, including people, can move and do work.

Student Activities

2. (Objectives 1 - 7)

Our Energy Supply - A Cassette Tape
Side #1

1. Listen to the cassette tape. Discuss the meaning of energy. Give examples of energy.

Teacher Suggestions

2. (Objectives 1 - 7)

Our Energy Supply - A Cassette Tape - Side #1

1. Local teachers may schedule this tape by contacting the Environmental Education Project Office.
2. Be sure to review your objectives carefully before using this tape. The tape will help to achieve many objectives.
3. Side #1 is divided into two 8-minute segments. The first segment deals mainly with 4 and 5 listed below. Listen to this segment with the class then stop the tape for discussion.
4. Increased population is emphasized as the greatest factor of our increased need for energy fuels.
5. The point is made that to get energy from fuels something must be done to it - in most cases it must be burned.
6. The second segment of side #1 deals with the following points: (1) it emphasizes the part that we get most of our energy from FOSSIL fuels; (2) fossils fuels are defined as those formed from animal and plant life thousands of years ago; and (3) wood is not a fossil fuel because it is with us and growing in our time.
7. Coal in particular is pointed out as producing a great amount of our energy. Oil is mentioned also as an important fossil fuel.
8. Natural gas is not mentioned in the tape as a fossil fuel. However, it should be pointed out in the discussion that natural gas is usually found along with oil.
9. Make the tape available for students to use on their own. They may use it individually or in small groups.

Student Activities

3. (Objectives 1 - 20)

   Energy Collage

   1. Collect pictures from magazines and newspapers to help make an energy collage.

4. (Objectives 1 and 2)

   Personal Energy - Power Activity

   1. Match energy phrases with descriptive sentences.

Teacher Suggestions

3. (Objectives 1 - 20)

   Energy Collage

   1. Survey the class to determine the availability of picture sources at home. It may be that you will need to have your fellow teachers in your building bring magazines to school for you to use.
   2. This activity can probably be carried on for about one week. It can run in conjunction with discussion activities relating to energy.
   3. Obtain a rather large piece of poster board on which to make the collage.
   4. Instruct the students to bring a picture that shows something related to energy. They should bring one per day for one week.
   5. Set aside a block of time for collage work each day. Have each student explain how their picture relates to energy. Discuss the picture, then paste it onto the collage.
   6. If it seems that five days of pictures is going to be too much, use Monday, Wednesday, and Friday as energy collage days instead.
   7. Give the students examples of pictures to look for. Trains, boats, planes, cars, people, or animals eating are but a few.

4. (Objectives 1 and 2)

   Personal Energy Activity

   1. Appendix I contains ten sentences describing feelings and movement - plus two description terms relating to energy. A set of instructions is written in this Appendix too.
   2. This activity is designed to familiarize the students with the meaning and importance of energy.

Student Activities

5. (Objectives 1 - 7)

Language Activity

1. Complete the sentences contained in Appendix II by placing one of the two extra words in the blank space.

6. (Objectives 1 - 7)

Hero's Engine

1. Observe a demonstration showing the power of steams.

Teacher Suggestions

5. (Objectives 1 - 7)

Language Activity - Sentence Completions

1. Appendix II contains eleven sentences related to the energy crisis.
2. Each sentence ends in a blank space. Two words are listed at the end of each sentence.
3. The students can complete the sentence by selecting the correct word and writing it in the blank space.
4. If it takes two words to complete the sentence, there will be two blank spaces.
5. This Appendix can be duplicated so that each student may have a copy.

6. (Objectives 1 - 7)

Hero's Engine

1. This activity will visibly demonstrate the ability of steam to do work. You will also demonstrate the conversion of a fuel into heat energy.
2. Materials required for this demonstration are: (1) a Hero flask; (2) water; (3) a rubber stopper; (4) a heat source such as a hot plate or alcohol lamp; and (5) a metal stand on which to hang the flask.
3. Materials will be furnished to local teachers by the Topeka Schools Environmental Education Project. Call the project office to schedule the equipment.
4. Fill the flask to about one-fourth capacity with water. Hang the flask on the metal stand by the chain. Place the heat under the flask to heat the water. When the water reaches the boiling point the steam will be forced out of the nozzles causing the flask to revolve rather rapidly.

Student Activities

Teacher Suggestions

5. Set the demonstration up completely. Before you actually ignite the fuel to heat the water. Ask the students to voice their impressions of the demonstration. What will happen when I light the burner? What kind of fuel are we using? Where did this fuel come from? What will happen to the water when it gets real hot? Observe the lack of movement!
6. After the demonstration ask the students to voice their thoughts. Could this be used to make electricity? What other fuels could we use to heat the water? Would you say that energy can make things move? Was there energy present before we lit the burner? If so, where was it and how did we get it to do work?

TOPIC II: Energy Fuels

Behavioral Objectives:

3. Given four choices, the students will select "fuel" as a common name for food, coal, oil, gasoline, wood, kerosene, and natural gas.

4. Given four choices, the students will select "fossil fuels" as the term that applies to oil, coal, and natural gas.

5. Given four choices, the students will indicate that fossil fuels come from "beneath the earth."

6. Given four choices, the students will select "crude oil" as the source of gasoline, kerosene, and diesel.

7. Given the names of four fuels, the students will select "wood" as the fuel not connected with making electricity.

Student Activities	Teacher Suggestions
7. (Objectives 3 - 12) Fuel Discussion 1. Discuss the variety of fuels that can be used to make energy power.	7. (Objectives 3 - 12) Fuel Discussion 1. See Appendix III for a diagram that will aid you in this activity. 2. Write the word FUEL on the board. It would be very motivational to make the letters from colorful construction paper. 3. Use the word as the focal point for the discussion. Ask the students to relate what the word means to them. 4. Under the word FUEL write the word FOOD. Discuss food as a fuel for people and animals. Emphasize that certain foods are better fuel for people than other foods.

Student Activities

8. (Objectives 3 - 7)

Energy Spelling List

1. Study and learn to spell words that relate to fuels that are in the news today.

Teacher Suggestions

5. In another column, write the word OIL. Discuss oil as a fuel. List the ways that people use oil.
6. In another column, write the word COAL. Use the same procedure for discussion.
7. In yet another column, write and discuss NATURAL GAS.
8. In another column, write the word NUCLEAR and discuss it. If the term nuclear is too unfamiliar try the words ATOM (ATOMIC) power. Point out that most nuclear power comes from uranium, a rock like substance.
9. In another column, write WOOD. Since wood is constantly forming and growing, it is not classified as a fossil fuel. Point out that wood was one of the main fuels many years ago. Trains used it to heat their boilers to produce steam and people used it to cook and heat. Many people are going back to the use of wood to heat their homes instead of natural gas, propane, or fuel oil.
10. Emphasize that oil, natural gas, and coal are FOSSIL fuels because they were formed many, many years ago. They are found beneath the earth. Mention the fact that fossil fuels are not renewable, once used - gone forever.

8. (Objectives 3 - 7)

Energy Spelling List

1. Prepare a spelling list of fuels and related words that are currently in the news because of the energy crisis.
2. You may wish to assign the more difficult words to a small group of students that will be most likely to accomplish the task of learning to spell them.

Student Activities

9. (Objectives 3 - 6)

Oil Discussion

1. Discuss how oil is formed, where it comes from, and how we get it.

Teacher Suggestions

3. Put the word list on the board and discuss the meaning of each one.
4. Listed below is a suggested word list. You may want to delete or add some words.

gasoline	kerosene	coal	oil
well	mine	fuel	diesel
nuclear	atomic	wood	petroleum
fossil	electricity		

9. (Objectives 3 - 6)

Oil Discussion

1. This discussion should be rather brief.
2. Emphasize that many, many years ago, most of the earth was covered with water. The water contained millions of tiny insects. Gradually the water went away and the little insects were trapped beneath the earth, where due to heat and pressure they turned into oil.
3. Emphasize that scientists have to find where oil or water is beneath the earth and drill a hole to pump it out.
4. Emphasize that once the oil is completely removed from the hole no new oil forms there.
5. Mention the fact that oil is a fossil fuel. Ask the students to explain why it is so classified.
6. Reference books may provide additional information.

Student Activities

10. (Objectives 3 - 6)

Oil Wall Chart

1. View and discuss a pictorial chart which shows how oil is formed and how scientists find it.

11. (Objectives 3 - 7)

How Oil Is Used: A Discussion

1. Discuss the various uses that people have for oil.

Teacher Suggestions

10. (Objectives 3 - 6)

Oil Wall Chart

1. Use the wall chart entitled "Science In The Search For Oil." Copies of the chart can be obtained by writing The American Petroleum Institute, 1271 Avenue of The Americas, New York, New York, 10020. The Topeka Environmental Education Project will supply copies to local teachers.
2. Do not be too concerned with all the eras and technical aspects of this wall chart.
3. There are three main points to emphasize with this chart: 1) the earth has been covered with water many times. Each time it has been covered with water it has deposited small forms of animal life and plants in the mud when the water disappeared; 2) heat and pressure caused these plants and animals to turn into oil which was trapped in pockets in the earth; and, 3) the only way to get this oil is to drill for it.
4. Point out that it is a very expensive process to drill for oil. A company may spend thousands of dollars to drill for oil and not find it.
5. Using the chart, briefly point out how the oil companies survey a place for oil deposits.

11. (Objectives 3 - 7)

How Oil Is Used: A Discussion

1. During the discussion talk only about uses of crude oil not its by-products.

Student Activities

Teacher Suggestions

2. If possible obtain a sample of crude oil. A small jar of crude will be sufficient. Check with local fuel dealers for information on how to obtain a sample. Point out that the correct name for crude oil is PETROLEUM. It comes from two Latin words: PETRA (rock), and OLEUM (oil).
3. Let the students smell the crude oil.
4. The first part of the discussion should be devoted to letting the students give their own versions on the uses of oil.
5. Emphasize that crude oil itself has very few uses. It must be changed before it can be used efficiently.
6. Read the story, The First Oil Well found in Appendix IV. This story will give insight on the various ways that people use oil. It will begin to develop the reasons why there is a shortage of oil products today.
7. After reading the story, discuss how people long ago used oil as compared to today.
8. Point out that in 1859, when the first oil well was drilled about the only use that people had for oil was for lights and some lubrication of machines.

12. (Objectives 3 - 6)

Oil Use Fill-In Activity

1. Fill in the blank space in Appendix V with the words that describe products that come from oil.

12. (Objectives 3 - 6)

Oil Use Fill-In Activity

1. Appendix V contains a sketch of an oil well with eight blank spaces beneath it.
2. You may duplicate this appendix for each student.
3. A wide variety of words are also listed in Appendix V. There will be eight words that name products that come from crude oil.
4. Have the students fill in the blank spaces with the products that come from crude oil.

Student Activities

13. (Objectives 3 - 6)

Oil Uses: A Demonstration

1. Observe and discuss samplings of fuels taken from crude oil.

Teacher Suggestions

5. You may wish to do this as a group activity by putting the activity on the board. Let the class help you come up with the product that you put in the spaces.
6. Discuss each one as you fill it in.
7. The products to be inserted into the spaces are: 1) butane; 2) gasoline; 3) kerosene; 4) asphalt; 5) propane; 6) diesel; 7) fuel oil; and, 8) motor oil.

13. (Objectives 3 - 6)

Oil Uses: A Demonstration

1. For this demonstration, you will need the sample of crude oil used in Activity #11.
2. Obtain a small sample of motor oil, kerosene, and gasoline or diesel fuel. Point out that all of these come from crude oil.
3. Have the students smell and feel each one. Point out the dangers involved in handling such fuels. No matches or any kinds of flame should be allowed around these samples. There is a danger in putting these fuels into the mouth too. Children have been known to drink kerosene thinking it was something else.
4. Discuss gasoline and/or diesel fuel. Point out that it comes from crude oil. It is made in a place called a refinery. A refinery is where they take the crude oil, heat it to a point where it is super hot and it makes gasoline. Emphasize the many types of vehicles and machines that use gasoline or diesel fuel.

Student Activities

14. (Objectives 3 - 6)

Crude Oil Refining Demonstration

1. Observe a demonstration on how to make kerosene out of crude oil.

Teacher Suggestions

5. Discuss kerosene. Point out that it is made from crude oil in much the same way as gasoline. Kerosene was used mainly for lamps, lanterns, and heating stoves several years ago. Today, some homes that are not "modern" still use kerosene in these ways. Jet planes use a fuel that is a high grade of kerosene.
6. Discuss motor oil. Motor oil is not used in the engine of a car like gasoline. Gasoline is burned in the engine to produce the energy needed to make the car go. Motor oil is used to make the moving parts of the engine slick so they won't wear out so quick. Without oil, the parts of an engine would become so hot from friction they would stick together.

14. (Objectives 3 - 6)

Crude Oil Refining Demonstration

1. Appendix VI contains a diagram of the refining of kerosene from crude oil. Local teachers should request that the Environmental Education Specialist do this demonstration for their class.
2. The materials needed for this demonstration are also listed in Appendix VI.
3. This demonstration will point out to the students that after oil is pumped from beneath the earth it has to go to a refinery plant to be changed into the kinds of fuels we can use in cars and many other things.
4. Kerosene is refracted (refined) at a much lower temperature than gasoline. This is why it can be demonstrated so simply.
5. Be sure to advise your principal and fellow teachers that you are doing this demonstration. It can create quite an odor.

Student Activities

15. (Objectives 3 - 7)

Coal Discussion

1. Discuss coal as a source of energy.

16. (Objectives 3 - 7)

How Coal Is Used: A Discussion

1. Discuss the various uses that people have for oil.

Teacher Suggestions

15. (Objectives 3 - 7)

Coal Discussion

1. Write the word COAL on the board.
2. Let the students express their ideas on coal: where it comes from, its uses, and its availability.
3. It should be emphasized that coal, like oil, comes from beneath the earth and that plants buried beneath the earth thousands (actually millions) of years ago turned into coal.
4. Point out that we have used up our supply of oil much faster than coal because we have discovered more ways to use oil.
5. Emphasize that the United States has enough coal left to last about 1000 years at our present rate of usage.

16. (Objectives 3 - 7)

How Coal Is Used: A Discussion

1. If possible obtain a sample of coal. A fairly large chunk of coal plus some finely crushed coal will make good samples. Make the statement that "coal is a fossil fuel" and ask the students to explain it.
2. Ask the students to help you develop a list of the ways that coal is used. As they give you their ideas, discuss them, list valid items.
3. Ask the students if coal has to be changed to another form to be used. Compare this to oil that must be changed before it can be used efficiently.

17. (Objectives 3 - 7)

The Story: The Big Push For Energy

1. Listen to the story and discuss it.

4. Emphasize that the main use of coal is for heating and for producing electricity. Years ago many people, especially in the cities, used coal to heat their homes. Not many homes use coal today because natural gas is much cleaner, burns well, and is easy to get.
5. Mention that one of the problems with using coal today is the air pollution it causes.

17. (Objectives 3 - 7)

The Story: The Big Push For Energy

1. See Appendix VII for a copy of the story.
2. Read the story to the class twice. The first time read it to the students for the pleasure of listening to a story.
3. After the first reading, ask the students to give their own thoughts on what the story was trying to tell them.
4. Before reading the story for the second time, instruct the students to listen for every point that tells something about coal.
5. Stop the story for discussions on points that relate directly to coal and its uses.

18. (Objectives 3 - 7)

Coal: A Map Activity

1. Use a map of the United States to discover where coal deposits are located

18. (Objectives 3 - 7)

Coal: A Map Activity

1. Appendix VIII may be duplicated so each student can have a copy of the map.
2. Use a copy of the map to locate the coal deposits remaining in the United States.
3. Be sure to locate Kansas to determine if coal deposits are located there.
4. Mention that coal used to be mined by digging deep into the earth. Some mines still operate this way; however, most coal mining today is strip mining. In

19. (Objectives 3 - 7)

Fuel - Energy Use: Word Matching

1. Match fuels with their particular energy use(s).

strip mining, a big mechanical shovel is used to dig away the top layers of earth to get to the coal just beneath. Discuss possible damage done to trees, grass, and wildlife by strip mining.

5. Check objectives that might be reinforced by this activity. Re-emphasize that coal is a FOSSIL fuel because it was formed long, long ago and that in most cases it must be burned to produce energy.

19. (Objective 3 - 7)

Fuel - Energy Use: Word Matching

1. Appendix IX contains FUELS (Column A) and ENERGY USE (Column B). This Appendix may be duplicated for individual use.
2. Match each fuel listed in Column A with word(s) in Column B that it would serve as an energy source. One fuel may be matched with several words in Column B in some cases. Match the words by drawing a line from the fuel in Column A to the word(s) it best relates to in Column B.
3. The list in Column B has been restricted to one-word usage in order to stimulate discussion. Example: COAL from Column A could be matched with HOMES and ELECTRICITY in column B. COAL is used in some cases to heat HOMES. COAL is also used a great deal to supply the energy needed to make ELECTRICITY at power plants.
5. You may wish to do this activity by: (1) giving each student a copy of the Appendix and doing the activity together; or, (2) put the words on the board and let the class work from the board copy with you drawing in the lines to match the words.
6. Whichever method you choose, match a word then discuss it before moving on to another.

20. (Objectives 1 - 20)

Film: Energy Crisis

1. View the film and discuss the causes and solutions to the energy crisis.

20. (Objectives 1 - 20)

Film: Energy Crisis

1. This film is in the Topeka Schools Film Library. Schedule it through your own school's media center.
2. Preview the film before showing it to the class. Determine the places to stop the film to emphasize certain points.
3. The following points can be emphasized with this film: (1) definition of energy, (2) early uses of energy, (3) uses of electricity, (4) fuels used to produce electricity, (5) our way of living is causing us to run out of energy fuels, and (6) our present and future supply of energy fuels.

Behavioral Objectives:

8. Given four choices, the students will select "factories" as the greatest user of energy.
9. Given four choices, the students will select "coal" as the fuel now used the most in making electricity.
10. Given four choices, the students will select "heating" as the biggest use of energy in the home.
11. Given four choices, the students will select "burning" as the process that usually changes fuel into energy.
12. Given four choices, the students will select "food" as the source of energy for the body.

Student Activities	Teacher Suggestions
21. (Objectives 1 - 20) Film: <u>We Use Power</u> 1. View the film and discuss examples of power - energy shown in the film.	21. (Objectives 1 - 20) Film: <u>We Use Power</u> 1. This film is in the Topeka Schools Film Library. Schedule it through your own school's media center. 2. Emphasize that power and energy is very much the same. 3. Preview the film before showing it. Determine points that will need to be reinforced by class discussion. Be prepared to stop the film at predetermined points for discussion. 4. This film deals with the following topics: (1) early forms of energy (power) such as muscle, animal, wind, and water; (2) how electricity is produced; (3) steam power is shown and explained; (4) energy from fire; (5) burning gasoline to power a vehicle; and (6) nuclear (atomic) energy.

Student Activities

22. (Objectives 8 - 12)

Collect Energy Stories

1. Look through the newspaper daily and cut out stories relating to energy.
2. Discuss the stories with the class.

23. (Objectives 8 - 12)

Classroom Energy List

1. Make a list of everything in the classroom that uses energy.

Teacher Suggestions

22. (Objectives 8 - 12)

Collect Energy Stories

1. Arrange to have several copies of the local newspaper in your classroom each day.
2. Fellow teachers would be a good source for newspapers. Ask them to bring you a copy of the daily paper after they are finished with it.
3. Encourage the students that have newspaper delivery at their home to use the paper there.
4. Have the students look through the newspaper each day for articles relating to energy or power. Cut out the story and bring to class.
5. Encourage the students to explain the articles to the class.
6. Have a place on the board set aside to post the articles for a few days. After reading and discussing the articles place them on the bulletin board for the class to read during free time.
7. It will be interesting to keep a record (visibly displayed) of the number of articles that come from one source during a week.
8. Do not overlook magazines and scholastic newspapers as a source of energy stories.

23. (Objectives 8 - 12)

Classroom Energy List

1. Have the students make up a list of things in the classroom that use energy.
2. The list could be made by small groups working together, individuals, or the whole classroom.
3. If the individual or group method is used, integrate their listings into one master list to be put on the board for all to see and discuss.

Student Activities

24. (Objectives 8 - 12)

Energy Demonstration #1

1. Take part in a demonstration to illustrate energy in people.

Teacher Suggestions

4. Discuss each item listed. Trace it back to its energy fuel, if possible. Example: heat; heat is energy; it came from burning natural gas; natural gas is a fossil fuel--fossil fuels come from the earth and were formed millions of years ago from small forms of animal life.
5. The students list might include heat radiators, lights, water faucet and people.

24. (Objectives 8 - 12)

Energy Demonstration #1

1. This demonstration is to be used to motivate the students' into tracing power (a breath of air) back to its original energy source (the sun).
2. Make several pinwheels to use in this demonstration and others to follow. A pinwheel can be made with a straight pin, a small stick, and construction paper.
3. You might want the students to make their own pinwheels. See Appendix X for instructions on the construction of pinwheels.
4. Instruct the students to blow on the pinwheels. Discuss the energy (power) that cuased the wheel to turn (air). Trace the energy that it took to blow air out of their lungs back to food which comes from plants and the plants back to air, water, and specifically the sun.
5. Be sure to emphasize that the fuel in this case was food that is traced back to plants and sunlight.

Student Activity

25. (Objectives 8 - 12)

Energy Demonstration #2

1. Take part in a demonstration that illustrates energy from our natural resources.

26. (Objectives 8 - 12)

Energy Use Graph - Complete

1. Study the graphs in Appendix XI. Discuss the uses of energy shown by the graphs.

Teacher Suggestions

25. (Objectives 3 - 12)

Energy Demonstration #2

1. This demonstration is to be used to motivate the students into tracing power (steam) back to the fuel used to generate the energy.
2. Use a pinwheel to show the power of the steam. See Appendix X for instructions on constructing pinwheels.
3. You will need a teakettle or some other narrow longnosed spouted container. Water and a heat source will also be needed.
4. Put water into the container and let it boil. After the water begins to boil, place the pinwheel at the top of the spout. The pinwheel should begin to turn because of the steam produced by the boiling water.
5. Energy caused the pinwheel to turn. Trace it back to water, to heat, to the fuel that had to be burned to produce the energy.
6. Be sure to discuss where the fuel you used came from.
7. Discuss other fuels that could have been used to heat the water to produce the steam.
8. It would be helpful to have samples of other fuels for the students to see. Coal, wood, oil, and kerosene could be shown.

26. (Objectives 3 - 12)

Energy Use Graph - Complete

1. Read this activity and activity #27 over carefully. Both activities seek to achieve the same objectives; however, activity #27 has a higher level of difficulty.

Student Activities

27. (Objectives 8 - 12)

Energy Use Graph - Incomplete

1. Complete the graphs shown in Appendix XII by filling in the percentages supplied at the bottom of the appendix.

Teacher Suggestions

You may wish to use this activity as a lead-up or proceed directly to activity #27 without doing this one.

2. Appendix XI contains graphs that give a breakdown of energy users in the United States. Duplicate the appendix for your students if you want each one to have a copy.
3. First, study and discuss graph #1. It shows the amount of energy used by homes, businesses, factories (industry), and transportation. You may not wish to discuss the usage in terms of percentages. If not, you might use the terms "most," "more," or "more than" when comparing one user against the others.
4. After study and discussion of graph #1, move on to the other graphs shown in Appendix XI. When discussing how energy is used as shown by each graph, use specific examples. For instance, one section of the graph for home energy use shows the amount of energy used for cooking. Discuss the various types of energy used for cooking foods. Some people use gas stoves; others use electric stoves, or possibly electric skillets. Trace these back to the fuel used to make the electricity.

27. (Objectives 8 - 12)

Energy Use Graph - Incomplete

1. Appendix XII contains graphs that will give a breakdown of energy users in the United States when completed by the students. Duplicate the appendix if necessary in order to furnish copies to your class.

Student Activity

28. (Objectives 3 - 12)

Electricity - A Discussion

1. Discuss electricity in terms of how important it is to everyone.

Teacher Suggestions

2. The information needed to complete the graphs is located to the right of each graph. Use the labels from graph #1 to fill in the name for each of the other graphs. Refer back to the completed graph, Appendix XI, if you have difficulties.
3. You may decide to use this activity with only a selected group of students.
4. Use the same method for discussion as that in Activity #26.

28. (Objectives 3 - 12)

Electricity - A Discussion

1. Prior to this discussion activity turn off all the lights in the room. If possible have the lights off for some time before the discussion. If some child complains that "the lights are off" then you have an excellent entry into the session.
2. The main objective of this activity is to make the students aware of just how much people depend upon electricity.
3. After having noticed that the lights are off, have someone turn them on. Call attention to the fact that all the student had to do was flip a switch.
4. From the flipping of the switch, trace the electricity back to where it came from. This might be called an ENERGY CHAIN.
5. The electricity needed to power the lights came from a power plant (electric plant) nearby; it came to you over a cable power line. The electricity was produced by burning a fuel to supply energy to turn a generator. The fuel was probably coal or natural gas.

Student Activities

29. (Objectives 8 - 12)

Making Electricity - A Diagram

1. Observe the sketch in Appendix XIII. Trace the production of electricity from the fuel needed to turn the turbine to the homes and factories that use it.

Teacher Suggestions

6. Discuss other fuels that are used to produce electricity. Oil and natural gas are (or were) used to make electricity. We are beginning to use more coal because we have a better supply. Nuclear (atomic) energy is used in some places to make electricity.
7. You might end the discussion by asking the students to help you list the ways that you use electricity in your classroom. List them on the board.

29. (Objectives 8 - 12)

Making Electricity - A Diagram

1. Appendix XIII contains a simplified sketch of how electricity is produced. Be sure to explain that a power plant has a much larger and different set-up than the one depicted in the sketch. However, the principle is the same.
2. Duplicate the appendix so that each student may have a copy. Go through the sketch from beginning to end discussing each step.
3. Step 1: mention coal, fuel oil, natural gas, and nuclear (atomic) are the main fuels. Emphasize that nuclear energy is thought to be one of the best ways to produce electricity in the future because we do have a good supply of uranium (the mineral that is necessary to make nuclear power).
4. Four blank spaces are provided at the bottom of the page to write in the fuels mentioned above.
5. Go on through to step 8. Don't worry about all the technicalities of how the electricity is made. We are more concerned with the fuels used and the uses of electricity.

Student Activities

30. (Objectives 8 - 12)

Electricity Used at Home

1. Label the electrical appliances contained in Appendix XIV. Discuss the importance of each item.

Teacher Suggestions

6. Step 8: This is a good time to make a list of the many uses for electricity. Blank spaces are provided at the botton of the page to write in uses for electricity. They are listed under the headings of 1) Home; 2) School; and 3) Factories. Be sure to make a very complete listing of home uses because this is where the student will identify the most.

30. (Objectives 8 - 12)

Electricity Used at Home

1. Appendix XIV contains sketches of a variety of items that use electricity in the home. Duplicate it to provide copies for your class.
2. Each item is numbered and a blank space is provided for the name to be entered.
3. Names and corresponding numbers of each item are listed at the bottom of Appendix XIV. Example: Look at the name of the item number 1. Find the sketch that is numbered 1 and write the name of the item in the blank space.
4. You may wish to have the students help make a list of additional items that are used in the home. Write these on the board.
5. Discuss each item as to its importance in the home--how it is used and how often. Could you live well without a particular item?
6. At some point during this activity, be sure to trace electricity back to its energy fuel--coal, oil, natural gas, and nuclear (atomic), in some cases.
7. Ask the students to make an "X" over the items that they could do without in the homes. Discuss their reasons for deleting an item.

Student Activities

31. (Objectives 8 - 12)

Energy Chains

1. Fill in blanks with fuels that relate to items illustrated by sketches in Appendix XV.

32. (Objectives 8 - 12)

Energy Use Puzzle

1. Complete the Energy Puzzle by finding and circling the names of energy users pictured around the puzzle.

Teacher Suggestions

31. (Objectives 8 - 12)

Energy Chains

1. Appendix XV contains sketches of a variety of energy users. Duplicate and provide copies of the appendix to each member of your class.
2. Blank spaces are drawn by each name. These spaces should be used to unite the fuel used by the item depicted by the sketch and to trace the energy fuel (or power) back to its source.
3. Words are provided at the bottom of the appendix that will go in the blank spaces.
4. Example: ELECTRIC (POWER) PLANT uses COAL
   NATURAL GAS
   OIL

   which comes from _____

   CRUDE OIL.

   Since coal comes directly from the earth do not fill in the second blank across from coal. Natural gas also comes directly out of the earth--do not fill in the blank across from it. The oil referred to is distilled from crude oil--write this across from oil to show where it comes from.

32. (Objectives 8 - 12)

Energy Use Puzzle

1. See Appendix XVI for a copy of the energy use puzzle. Duplicate it to obtain copies for the students.
2. The instructions for using the puzzle are included in the appendix.
3. Used as an individual activity each student will work on his own copy following the directions of the teacher.

Student Activities

33. (Objectives 3 - 12)

Energy Use Murals

1. Draw murals showing the transportation systems of our area.

34. (Objectives 8 - 12)

Energy Field Walk

1. Go on a "field walk" with the class around the school neighborhood. Observe things that are using energy. Check off energy users observed and the fuels, or energy, they use on a data sheet.

Teacher Suggestions

4. When used as a group activity, the class could be divided into small groups. Put a good reader and writer with each group. Provide each group with one copy of the puzzle. The group then works cooperatively on the puzzle with the one student acting as a leader and doing the writing.

33. (Objectives 3 - 12)

Energy Use Murals

1. Briefly discuss with the class the transportation systems used in our area. These could include: automobile, bus, plane, and train.
2. Divide the class into four groups. Each group should draw a mural depicting one transportation system mentioned above.
3. After completed, discuss the fuels required for each system of transportation.

34. (Objectives 8 - 12)

Energy Field Walk

1. Take your class on a trip around the area of your school to observe things that are using energy.
2. Appendix XVII is a data sheet of energy users and their energy source. As you tour the neighborhood make a check by each item you see that is using energy. Draw a line from the energy user to its energy source.
3. Write in things you observe that are not included on the sheet.
4. Clipboards will be needed for the sheets. If not available, consider using stiff cardboard.
5. Duplicate Appendix XVII to provide copies for the students.

Students Activities

35. (Objectives 1 - 20)

Field Trip - Kansas Historical Society Museum

1. Visit the museum. Observe and discuss various settings that illustrate energy usage.

Teacher Suggestions

35. (Objectives 1 - 20)

Field Trip - Kansas Historical Society Museum

1. This is the field trip for this unit. Its purpose is to reinforce most, if not all, objectives of this unit.
2. The trip can be taken either in the morning or afternoon.
3. The program specialist will be responsible for the trip. Transportation will be provided by the Environmental Education Project.
4. The following displays will be the key features of the visit to the Museum.
   1) Agricultural
   2) Transportation
   3) Homes
   4) Mining - coal and oil
5. Each exhibit will be related to energy in various ways. The past, present, and future use of various fuels will be discussed while viewing the displays.
6. Reasons for the energy crisis will be demonstrated by viewing and discussing various ways that energy was used in the past as compared to the present.
7. Fossil fuels will be discussed while looking at displays of coal and pictures of oil wells and coal mines.
8. By viewing and discussing the great number of examples of energy usage, the students should have a better understanding of energy - its meaning and its application.

TOPIC IV: Conservation of Energy

Behavioral Objectives:

13. Given the statement "One reason there are not enough energy fuels in America is because Americans are using more energy," the students will indicate that this is true.

14. Given the statement "Energy Crisis means that we do not have enough fuel to do everything we want to do," the students will indicate that this is true.

15. Given four choices, the students will select "small cars" as one way to save on gasoline energy.

16. Given four choices, the students will select "energy fuels" as the thing we really save by cutting down on our use of electricity.

17. Given four choices, the students will select "ride city bus" as a means of conserving fuel.

18. Given four choices, the students will select "car pool" as the term that describes several people sharing a ride in a car to work or school.

19. Given four choices, the students will select "keep the refrigerator door closed" as the phrase that describes a good way to help save energy at home.

20. Given four choices, the students will select "nuclear (atomic) power" as the energy that will probably be used to produce electricity in the future.

Student Activities	Teacher Suggestions
36. (Objectives 13 - 20) Language Activity - Letters 1. Compose letters to two major industries in Topeka for the purpose of finding out the kinds of fuels they used to get energy to make their product.	36. (Objectives 13 - 20) Language Activity - Letters 1. Help your class compose a letter to these two industries. Mr. R. A. Wingerson Manager Public Relations Topeka Goodyear Tire and Rubber Co. Topeka, Kansas 66613

Student Activities

37. (Objectives 1 - 20)

Art Activity

1. Draw pictures showing fuels, products, and how to conserve them.

38. (Objectives 13 - 20)

The Question Box

1. Answer questions on ways to save on energy.

Teacher Suggestions

Mr. Hal Hudson
Director of Publicity
Kansas Power and Light Co.
818 Kansas Ave.
Topeka, Kansas 66603

2. Ask them for the following information: (1) what fuels are used in manufacturing their products; (2) how the fuel is used; (3) are they having problems getting fuels; and (4) what they are doing to help during the energy crisis.
3. The class might decide on questions of their own to ask in the letter.

37. (Objectives 1 - 20)

Art Activity

1. This activity can reinforce all objectives.
2. Art activities might work best following a movie, demonstration, or discussion. Example: following a discussion on the gasoline shortage you might want the students to draw pictures on how to conserve gas, such as a public transportation bus or a small car.

38. (Objectives 13 - 20)

The Question Box

1. Prepare a number of questions relating to: (1) conserving fuels such as gasoline, coal, and natural gas; and (2) conserving electrical energy.
2. Write each question on a slip of paper and place them in a box.

Student Activities

39. (Objectives 13 - 20)

A List of Home Energy Uses

1. Make a list of items in the home that use energy. Rank them in their order of importance. Discuss the fuels they are related to.

Teacher Suggestions

3. You may choose to divide the class into groups and have a contest, or you may choose to simply let a student reach into the box and select a question for the whole class to answer. The questions should be selected randomly.
4. See Appendix XVIII for sample questions. You might want to duplicate this page and use the questions.

39. (Objectives 13 - 20)

A List of Home Energy Uses

1. Suggest that the class make a list of all items (appliances) in the home that use energy. Such things as the furnace, cook stove, refrigerator, toaster, television, iron, clothes washer and dryer, hot water heater, etc. should be listed.
2. As the students mention the items write them randomly on the board. As you list each item, briefly discuss the fuel it relates to. Also discuss the real need for the item in the home.
3. After listing the items randomly, revise them to read in their order of importance in the home. Example: a furnace would rate high on the list because it is needed to supply heat in the cold seasons. Television would probably rate high in the opinion of the students because they like to watch it; however, it is one item people could live well without.
4. Discuss the things the students would be willing to give up to conserve energy.

Student Activities

40. (Objectives 13 - 20)

A Three Hour Energy Use List

1. List the energy sources used from the time the students awakes in the morning until his classes begin.

Teacher Suggestions

40. (Objectives 13 - 20)

A Three Hour Energy Use List

1. Have the students help compile a list of the things they do from the time they awake in the morning until their class begins this energy use activity.
2. Since most students do basically the same things you may want to compile their activities into a common list and write them on the board.
3. Along with the activity listed - determine its energy source. Example: A student might say that the first thing that he does when he wakes is to climb out of bed. This takes energy which is supplied by food. If he then turns on the radio, or light, this requires electricity which can be traced to coal in all probability.
4. Use this technique in tracing their activities through breakfast and getting ready for school.
5. This method of transportation to school should be given special emphasis. Since several students probably ride together in one car, mention the fact that this constitutes a "car pool" and is really a good way to help conserve gasoline. Others may ride the bus which is also a method of fuel conservation as opposed to one person riding in a car.
6. End this activity with an investigation into the activities that might be omitted as a means of energy conservation.

Student Activities

41. (Objectives 13 - 20)

Fuel and Schools: A Discussion

1. Discuss the fuel used in heating schools. Discuss methods used by schools in conserving heating fuels. Relate this to home conservation of heating fuels.

42. (Objectives 13 - 20)

Saving Energy: A Discussion

1. Discuss ways to save energy.

Teacher Suggestions

41. (Objectives 13 - 20)

Fuel and Schools: A Discussion

1. Invite the principal and the custodian to help with this discussion.
2. Arrange for a tour of the boiler room to the furnace that heats the school.
3. Have the custodian explain the process involved in heating the school. Be sure to emphasize the fuel used. He should explain how the thermostat controls the amount of fuel that is burned to produce heat and how it saves on fuel to turn the thermostat down.
4. Explain that if only one person were to turn down their thermostat it would not help a great deal, but where millions of people do it, it saves a great deal of fuel.

42. (Objectives 13 - 20)

Saving Energy: A Discussion

1. Discuss ways of saving energy fuels in the home and in transportation.
2. See Appendix XIX for a list of conservation tips which you may use as discussion points.
3. Stimulate the discussion by posing the question "If you were going to buy a car would you buy a large or small car?" Use their answers to further question their knowledge of the energy (gasoline) use by different size cars. Also, bring in the amount of gasoline used by cars travelling at different speeds.
4. Use the same technique in discussing home conservation of energy.

Student Activities

43. (Objectives 1 - 20)

Energy Interviews

1. Use a tape recorder. Interview one adult in your school about the "energy crisis."

Teacher Suggestions

43. (Objectives 1 - 20)

Energy Interviews

1. This activity can be handled in two ways--with or without a tape recorder.
2. Divide your class into groups of three's.
3. Each group should interview one adult within your school on the energy crisis. Each group should interview a different person in order to get a variety of opinions. Be sure to discuss with the class the fact that people do not always agree on things. They will get different answers to their questions.
4. Make arrangements in advance for the interviews. For example: if a group is to interview the principal of your school, arrange a time to meet with him in his office.
5. You or your aide may wish to go with each group on their assignment to bolster their courage and provide assistance when needed.
6. If a tape recorder is to be used, arrange for one member of the group to be responsible for it during the interview. Explain to the person being interviewed that the tape is to be used only in your classroom.
7. The students should know the questions they are to ask. Each member of the group should have at least one question to ask and discuss.
8. After all groups have conducted their interviews, which may span several days, play the tapes in the classroom. They need not be played at one time. Space them out over a period of time. Discuss each persons answers to your questions.

Student Activities

Teacher Suggestions

9. You may wish to help the group make a list of questions to ask. Here are some possibilities.

    1) What does "energy crisis" mean to you?
    2) What do you think caused the energy crisis?
    3) What is our school doing to help save on energy?
    4) What fuels do you use in your home or school?
    5) Do you know what fuels are used to make electricity now?
    6) How will our electricity be made in the years ahead?
    7) Do you think more people should ride city buses in order to help save gasoline?
    8) Will car pools help save gasoline?
    9) How do you think young people like me can help save energy?

10. Local teachers may borrow a recorder and tape from the Environmental Education Project.

APPENDIX I

Energy Sayings

Part A has ten sentences. Each sentence describes some sort of movement (active or potential) and feelings. Part B contains two terms. Each term relates to an amount of energy. Read each sentence (either individually or as a group) and determine the term from part B that will fit the sentence. Example: term A would fit sentence one.

A: 1. That guy moves around all the time._____

2. I really don't feel like doing much today._____

3. Gee, what a fast car!_____

4. I'm really sleepy today!_____

5. Wow! Look at that sailboat go!_____

6. That boat isn't even moving._____

7. Hey! Did you see that guy pop a wheelie?_____

8. He really hustles when he plays ball._____

9. I'm too tired to walk anymore._____

10. That hot rod really has a big motor._____

B: A. Lots of energy

B. Not much energy

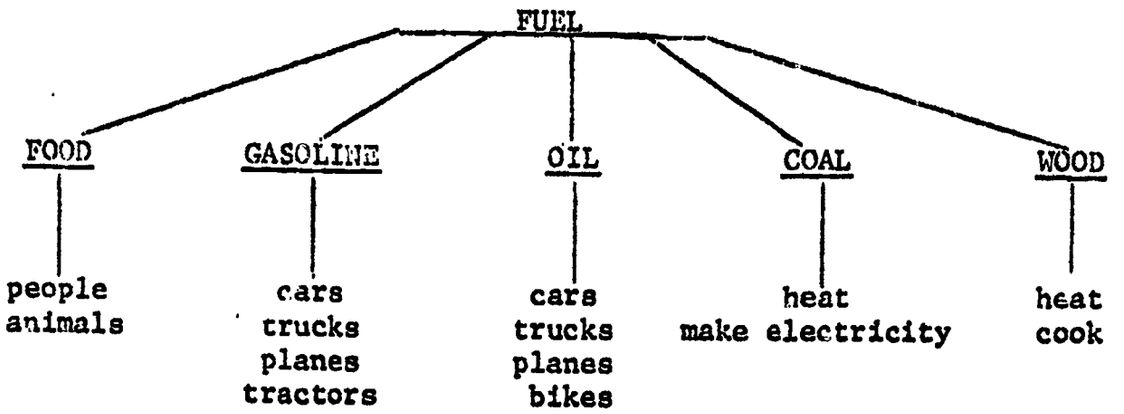
APPENDIX II

Sentence Completions

1. Most of the world today has an _____ _____. ENERGY CRISIS - ENERGY SURPLUS
2. Most cars and trucks use _____. GASOLINE - COAL
3. Gasoline is made from _____. NATURAL GAS - PETROLEUM
4. Petroleum is the same as _____ ____. HARD COAL - CRUDE OIL
5. Most homes in Topeka are heated by _____ ____. HEATING OIL - NATURAL GAS
6. When oil drillers find oil they usually find _____ ___. PROPANE GAS - NATURAL GAS
7. The United States has a good supply of ____. OIL - COAL
8. Most of our electricity is now made by burning ____. COAL - WOOD
9. Many people are saving on heating fuel by burning ___. COAL - W···
10. Much of our electricity in the future will probably be made from _____ energy. NUCLEAR - GASOLINE

APPENDIX III

Fuel Discussion Diagram



1. This diagram illustrates a way of setting up the chalk board for discussion. As an alternative to the key words you might use pictures.

APPENDIX IV

The First Oil Well

Scientists search for oil in many different ways. Using many different methods, teams of scientists get as much information as possible before they say that a certain place is likely to have oil. Millions of dollars may be spent before a single drop of oil is found, because "only the drill can find oil."

For thousands of years, men knew about oil (petroleum) because it seeped from the earth in small amounts in many different places. Oil exists as a liquid, in solid form, and as natural gas. Oil and natural gas are usually, but not always, found together.

The first well ever drilled to find oil was drilled in 1859 in Titusville, Pennsylvania. This well produced a great deal of oil. For a time, men found all the oil they needed by finding places where it seeped out of the ground. It was a simple job to locate oil deposits which lay close to the surface and to drill for it. During this time, people did not have electricity, cars, boats, machines, and most of the things we take for granted today. The main use for oil in those days was for lighting. Because there wasn't many uses for oil then, there was plenty of it.

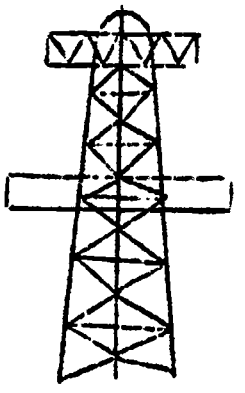
As we come to the time in which we live, there are many more uses made of oil than back in 1859 when the first oil well was drilled. Today, there are many cars, trucks, buses, factories, and trains that use gasoline and other fuels that come from oil. We have electricity that people didn't have back in the very old days. Much of our electricity is produced by using oil or natural gas to run the engines that make electricity.

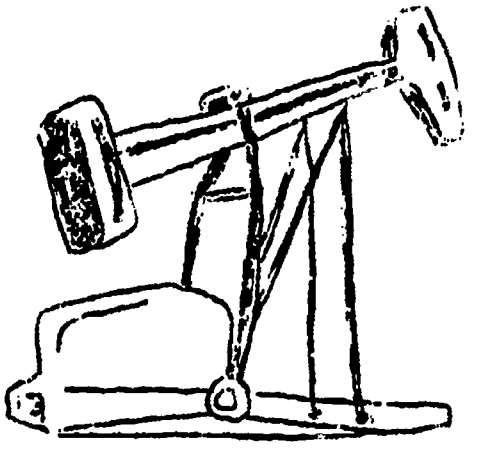
Since there are more people and a greater need for oil today, we are having an "energy crisis." This means that we are using up our supplies of oil and other fuels faster than we can produce them. We need to find new supplies of oil and other sources of energy. Since oil is becoming harder to find, scientists have to find new ways of locating new oil deposits and new and better ways of getting it out of the ground.

Since our country does not have all the oil we need, we buy some of our oil from other countries. However, they sometimes get mad at us and won't sell us oil. That is why we need to find oil supplies in our own country or find new ways of running cars and making electricity.

APPENDIX V

Oil Use: Fill In





1._____ 2._____ 3._____ 4._____

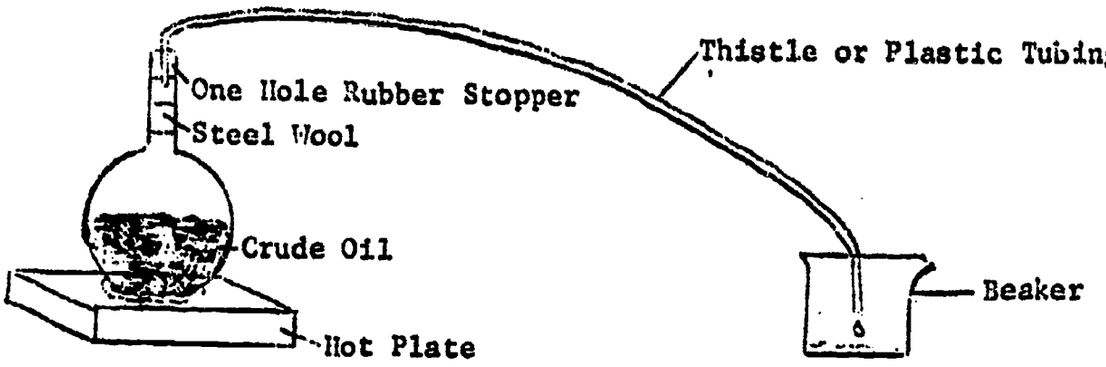
5._____ 6._____ 7._____ 8._____

radio	gasoline	kerosene	asphalt	toothpaste
diesel	cup	fuel oil	motor oil	chair
butane	propane	toothpaste	sleds	spoon

APPENDIX VI

Crude Oil Refining

Materials Needed: 1 quart of crude oil; 1 pyrex flask; 1 one-hole rubber stopper; small amount of steel wool; two feet of thistle or plastic tubing; heat source (HOT PLATE); and one pyrex beaker.



1. Pour the crude oil into the long-neck beaker: fill to about one-half capacity.

2. Put some steel wool into the neck of the beaker. The wool should not be packed in tight.

3. Insert one end of small diameter plastic tubing into the one hole stopper. If glass tubing is used, it will need to be bent into an arc by heating it.

4. Insert the stopper tightly into the neck of the beaker.

5. Set the beaker containing the oil over a heat source. A hot plate will probably do the job.

6. You will probably be able to use a camp stove if they are more easily obtained. The flame needs to be hot in order to bring the oil up to 180° rather quickly. Kerosene refracts somewhere between 180 and 300 degrees F.

7. After the crude oil reaches a temperature of 180° F. it should begin to vaporize. As the vapor travels through the tube it should condense and drip into the beaker at the open end of the tube. The condensation should be kerosene.

8. Be aware of the dangers of children around an open flame. Be aware of the the dangers of children's hands around hot glass.

APPENDIX VII

The Big Rush For Energy

By Ed Chaney

Just as the food which moves our muscles comes from the earth, so do the fuels which run the machines that do 99% of America's work. Coal, oil and natural gas are today's main sources of energy. One quarter of these energy sources is used to make electricity.

We use electricity to light our homes, streets, factories and classrooms. It provides heat in the winter and runs air conditioners in the summer. We use it to refrigerate and cook our food. Our television sets, radios, and record players use electricity. Some people even use electric toothbrushes. How many things in your home use electricity?

Electricity runs machines that make automobiles, glass and nearly all the other things we use. Businesses use it to run office equipment and to light bright, flashing signs. In fact, offices and factories use twice as much electricity as all the homes in the United States.

Electricity does not simply come from two little holes in the wall. Almost half of our electricity comes from power plants that burn coal. The burning coal heats water into steam. This steam turns the turbines. The spinning turbines create the electricity.

Just one of these power plants can burn two and a half million tons of coal every year! All together, they burned more than 300 million tons of coal last year. That much coal would fill a line of railroad cars stretching from New York to California and halfway back again.

Mining the coal that is burned in the power plants causes other kinds of serious trouble. Once almost all coal came from underground mines. But today this kind of mining is rapidly being replaced by what is called strip mining. Instead of tunneling into the mountainsides, mining companies use giant bulldozers to strip away the sides of mountains to uncover layers of coal. Then big power shovels scoop the coal into trucks to be hauled away.

On flatter land, huge earthmoving machines just rip up a whole hill to uncover the coal. One of these machines is as tall as a thirty-two-story building! It can pick up 325 tons of earth in a single gulp. That's as much as sixty-five school buses weigh!

About one and three-fourths million acres of the United States have been strip-mined for coal. That's larger than the state of Delaware! Parts of some states are so damaged they almost look like the bare surface of the moon.

Some of this land could be repaired by filling in the gullies and replanting trees and grass. This is called reclamation. But some coal companies have destroyed the land and left it for dead. Some of it can never be reclaimed.

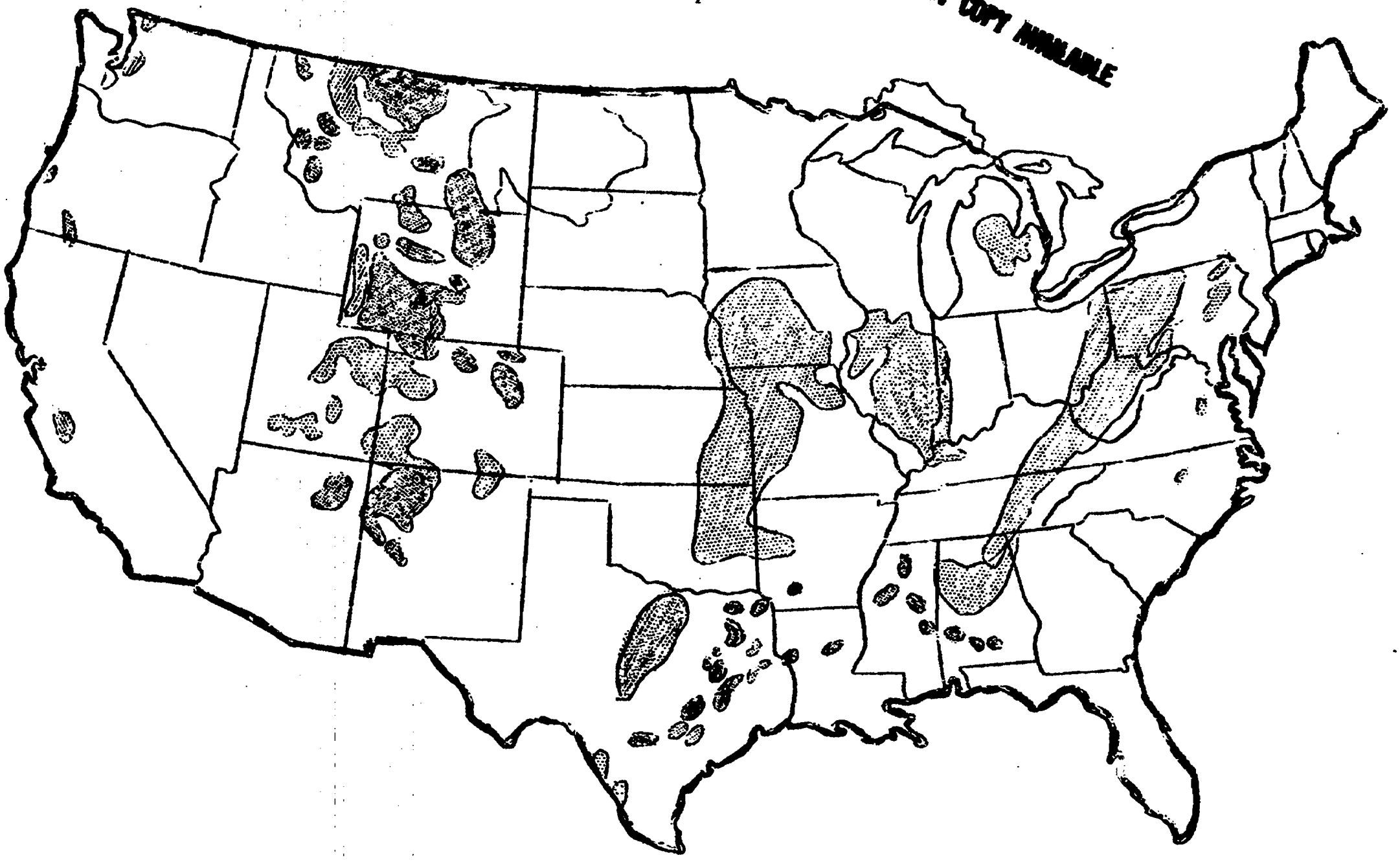
In the past, most coal strip mining was done in the region called Appalachia which was named after the Appalachian Mountains.

Soon the big machines will be moving into North Dakota, Montana, Wyoming and other Western states. In all, twenty-six states in every region of the United States have coal that can be strip-mined. Is your state included?

Quoted from Ranger Rick, January, 1973.

APPENDIX VIII

A Coal Map



This map shows the coal left in the United States that can be strip mined.

APPENDIX IX

Matching Energy Words

Draw a line from each type of fuel to its energy use.

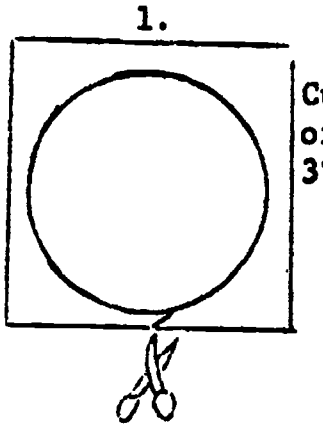
A Fuel	B Energy Use
Coal	Homes
Oil	Cars
Wood	Electricity
Natural Gas	Train
Food	Tractors
Gasoline	Planes
Kerosene	People
Diesel	Lamps
	Lanterns
	Trucks
	Bus

APPENDIX X

Pinwheel Construction

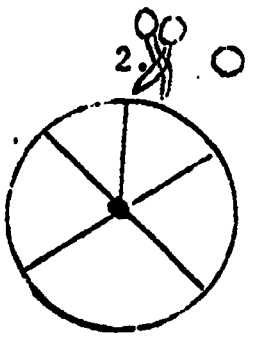
Materials: small round sticks (size of a pencil), construction paper, straight pins, and scissors.

1.



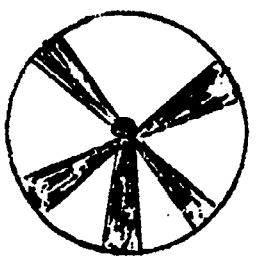
Cut out a round piece of construction paper 3" - 5" in diameter.

2.



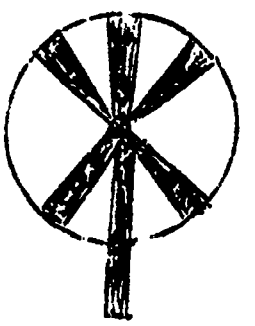
Cut the round piece into 5 separate pieces as shown. Leave the center intact.

3.



Fold back one edge of each section so that it will catch the wind and turn the wheel.

4.

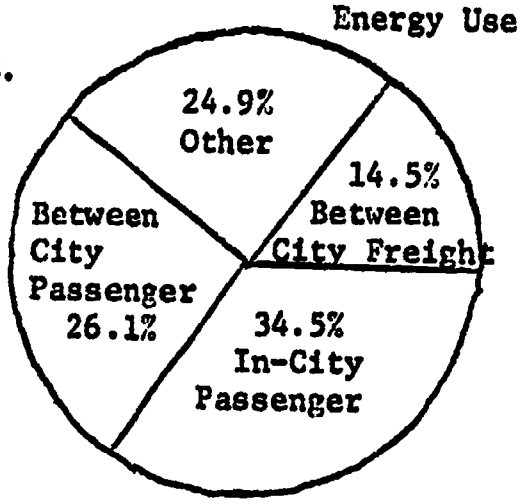


Stick a straight pin through the center of the wheel attaching it to the small stick.

There are various methods for constructing pinwheels. Many teachers use pencils by sticking the pin into the eraser. Others use drinking straws instead of a stick.

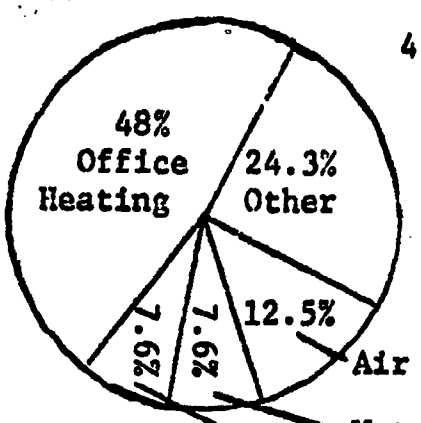
Energy Use Graph - Complete

3.



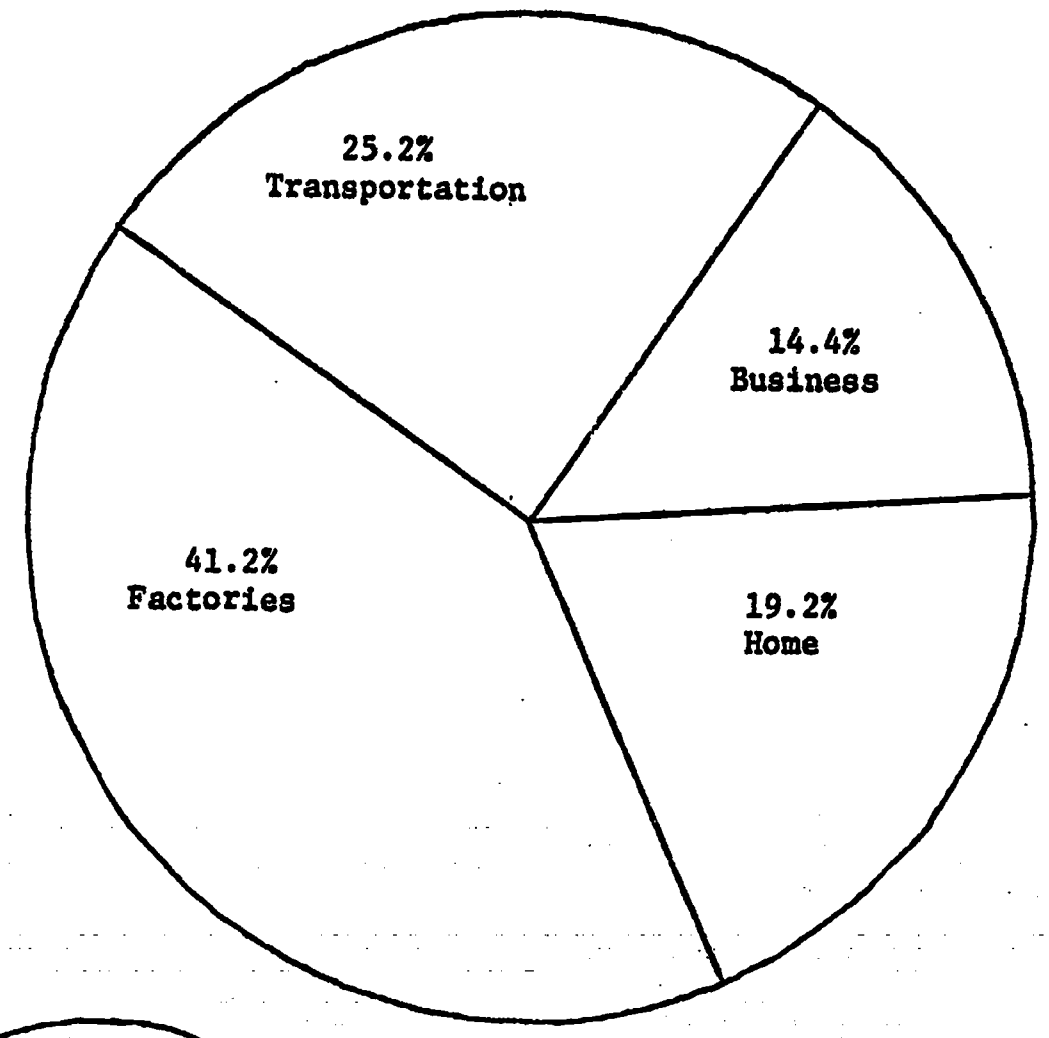
Transportation

4.



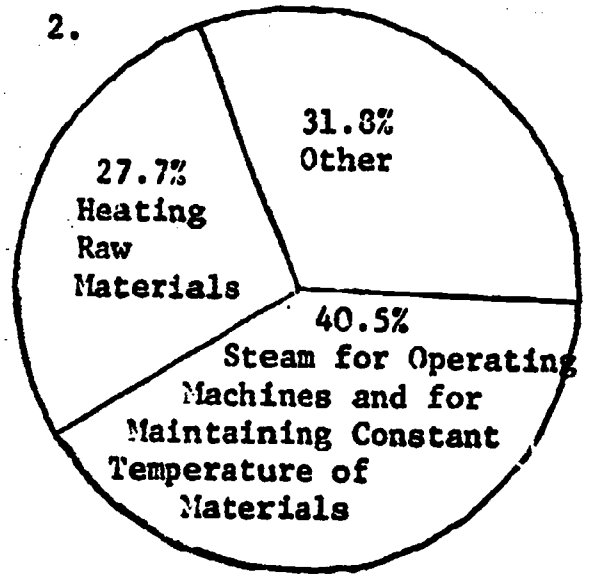
Business

1.



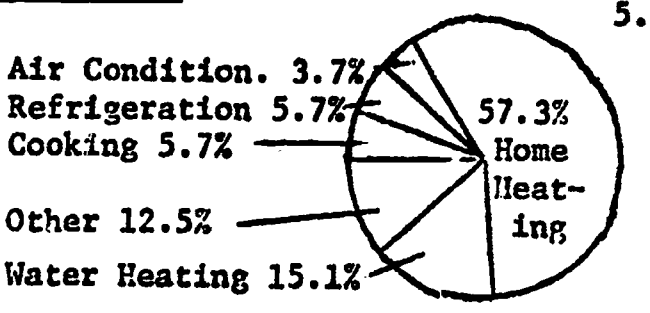
United States

2.



Factories

5.

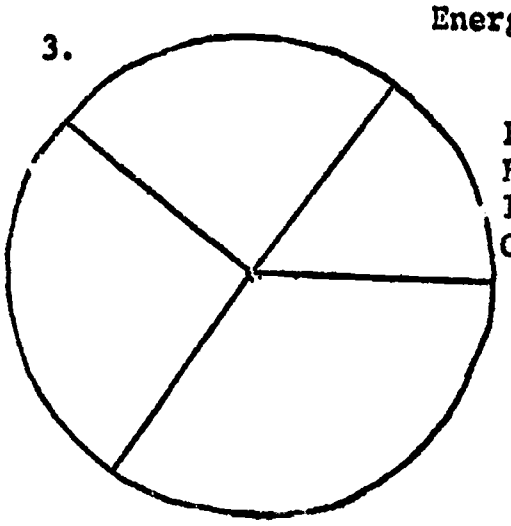


Home

APPENDIX XII

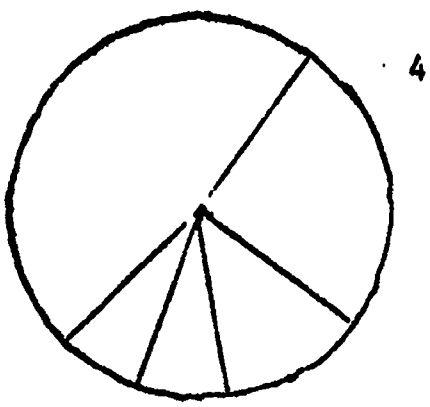
Energy Use Graph - Incomplete

3.



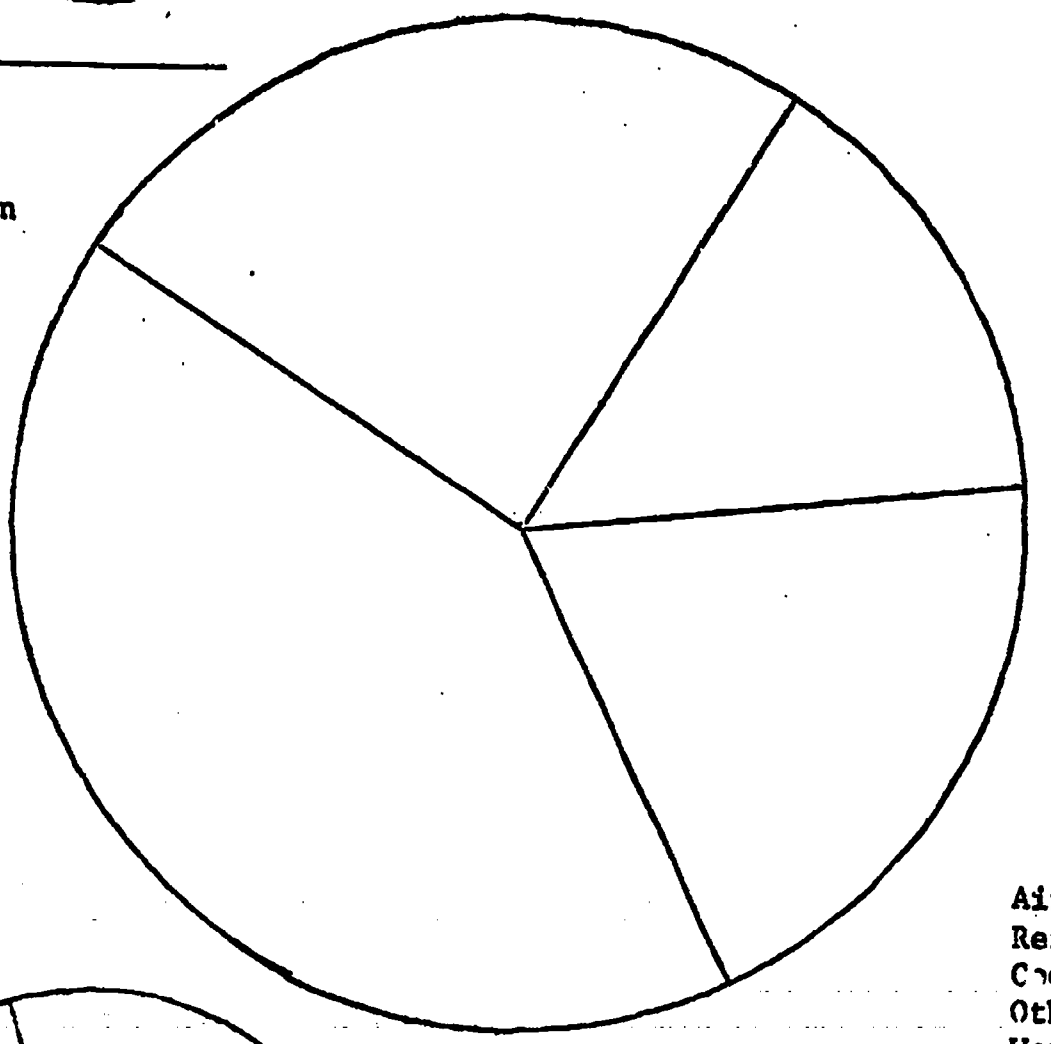
Between City Passenger
Between City Freight
In-City Passenger
Other

4.



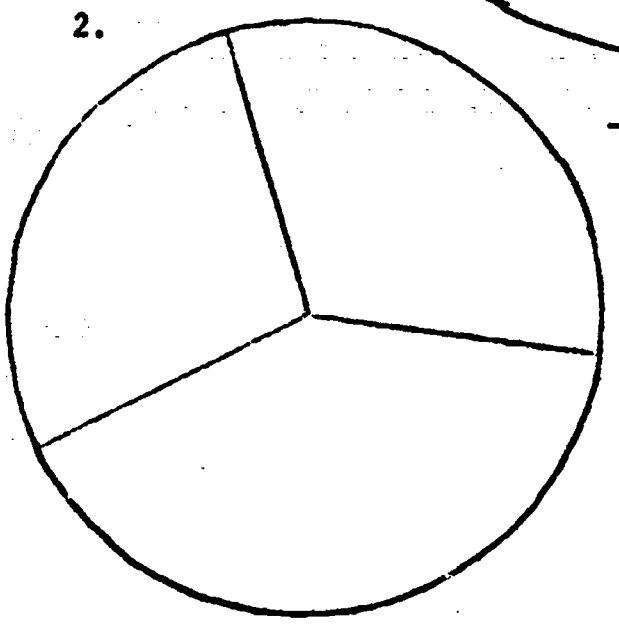
Refrigeration
Water Heating
Air Condition.
Office Heating
Other

1.



Transportation
Business
Factories
Home

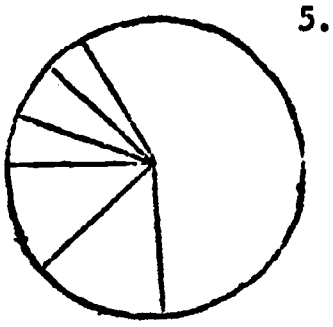
2.



Heating Materials
Steam for Machines
Other

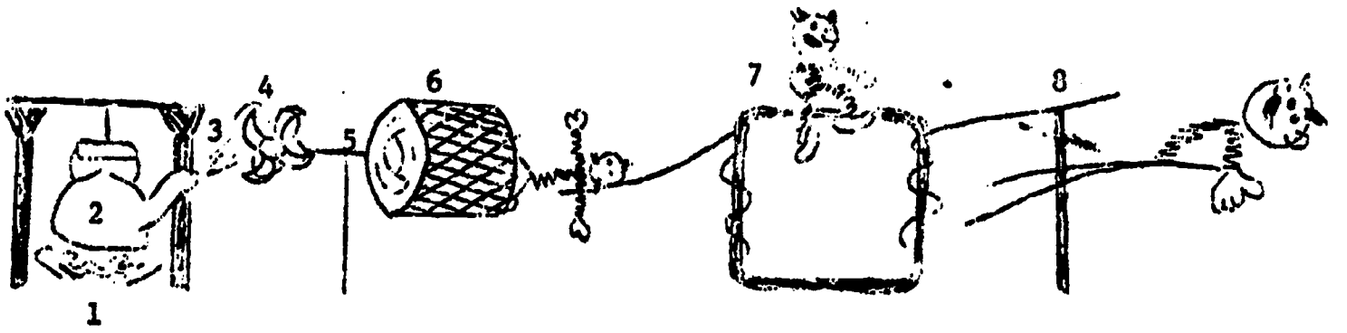
Air Condition.
Refrigeration
Cooking
Other
Water Heating
Home Heating

5.



APPENDIX XIII

Making Electricity



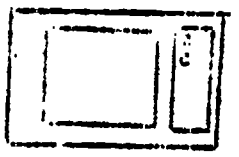
1. Fuel burns 2. changes water in boiler 3. into steam 4. which spins turbine 5. and turns shaft 6. on which is electric magnet that revolves (turns) inside a coil of heavy copper wire and makes electricity 7. which goes into a transformer to change the pressure (voltage) 8. and pushes it through wires to homes, businesses, and factories to be used.

Uses For Electricity

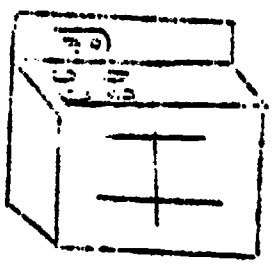
FUELS	Home	School	Factory
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____

APPENDIX XIV

Electricity Users At Home



1. _____

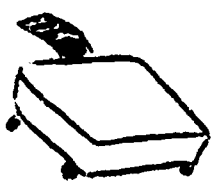


2. _____

3. _____

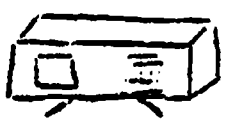
4. _____

5. _____



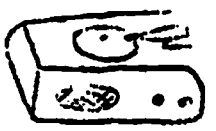
6. _____

7. _____

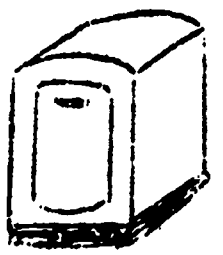


8. _____

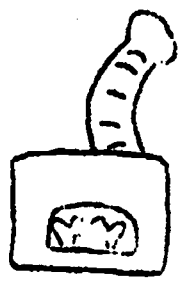
9. _____



10. _____



11. _____



12. _____

television	toaster	radio
range	vacuum cleaner	lamp
dishwasher	fryer	record player
water heater	clock	furnace

APPENDIX XV

Energy Chains

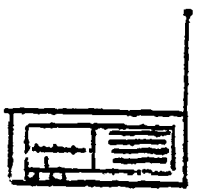
1. An airplane uses _____ which comes from _____.
2. A car uses _____ which comes from _____.
3. A house uses _____ which comes from _____.
   _____ _____.
   _____ _____.
4. A television uses _____ which comes from _____.
5. A person uses _____ which comes from _____.
6. A power plant uses _____ which comes from _____.
   _____ _____.
   _____ _____.
7. A cooking stove uses _____ which comes from _____.
   _____ _____.

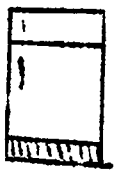
gasoline	kerosene	diesel	electricity	plants
crude oil	oil	natural gas	food	coal

APPENDIX XVI

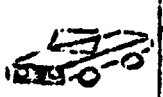
Energy Use Puzzle

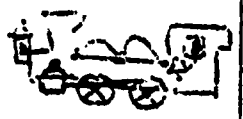
In this puzzle there are twelve items that use energy. Read down and across to find the names of these items. You will see the items pictured around the letters. Circle the letters that spell the name of each energy user shown. In the blank space by the picture of the energy user write the kind of fuel or energy it uses.

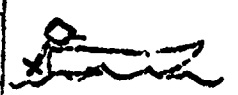




E	C	A	R	T	R	A	C	T	O	R	Q
Z	F	G	B	Q	R	S	T	S	A	B	G
P	O	B	O	A	T	W	X	C	D	B	T
L	S	U	L	X	Y	Z	S	E	F	U	E
A	T	N	B	A	B	C	T	I	J	L	L
N	E	L	S	T	U	O	O	L	P	B	E
E	P	E	O	P	L	E	V	H	I	J	V
T	R	A	I	N	D	K	E	P	R	T	I
C	A	N	I	M	A	L	B	D	P	K	S
R	E	F	R	I	G	E	R	A	T	O	R
K	L	M	N	O	P	Q	R	A	D	I	O
R	S	T	U	V	W	X	Y	Z	A	B	N







APPENDIX XVII

Energy Field Walk Sheet

Object Seen	Energy It Used
Automobile	Sun
Truck	Wood
Bus	Wind
Propeller Plane	Water
Jet Plane	Gasoline
People	Oil
Animals	Natural Gas
Trees	Coal
Grass	Kerosene
Paper	Food

APPENDIX XVIII

The Question Box

1. Can you give some reasons for the "energy crisis"?
2. What does "energy crisis" mean?
3. Can you explain why a small car uses less gasoline than a large car?
4. Which will use less gasoline - a small car or a large car?
5. What is meant by "car pool"?
6. How can "car pools" help save fuel?
7. How will "keeping the refrigerator door closed" help save electricity?
8. Would it help save gasoline if more people rode city buses to school and work?
9. Whan we save on electricity what fuels are we really saving?
10. What will probably be used to make electricity in the years to come in place of coal, natural gas, and oil?

APPENDIX XIX

Energy Conservation Tips

Transportation

1. Buy a car no larger or more powerful than you need. A car weighing 5,000 pounds uses over twice as much fuel as one weighing 2,000 pounds. Accessories such as air conditioning and automatic transmission contribute to fuel consumption.

2. Have your car engine tuned regularly.

3. Drive at a conservative speed. The average car driven at 75 to 80 mph will consume twice as much fuel as the same car driven at 50 mph.

4. Accelerate smoothly and ease into stops.

5. Do not race your engine.

6. Instead of idling the engine to warm it in cold weather, drive slowly for the first quarter mile.

7. Never leave your engine idling longer than 3 minutes while waiting.

8. Walk. If all trips of less than three miles were walked, gasoline consumption would be cut in half.

9. Use car pools. If several people ride in one car to work or school it will save gasoline.

10. Ride city buses instead of driving your own car.

Home Cooling

1. Open your windows.

2. Shade windows from direct sunlight with trees, window vines, awnings, shutters, or roof overhangs.

3. Close light-colored draperies to the sunlight.

4. Use less artificial illumination.

5. Avoid using air conditioning unless weather is intolerable.

Home Heating

1. Install storm windows and doors. Check for other air leakage especially in the attic.

2. Have furnace checked once a year and change filters often.

3. Lower thermostat to 60° for sleeping.

4. Lower thermostat daytime setting by 1° to decrease fuel requirements by 3% to 4%. By lowering it 5° you will use 15% to 20% less fuel.

5. Insulate your body with a sweater.

Home Appliances

1. Turn off water heater while away from home for more than 2 days.
2. Whenever possible run washing machine on cold water.
3. Do not wash dishes under hot running water.
4. Use a standard model refrigerator. The frost-free refrigerator requires 50% more energy than the standard model. The side-by-side refrigerator-freezer uses up to 45% more energy than the standard model.
5. Keep freezer full at all times.
6. Use only solid state television sets.
7. When not in use unplug television sets which supply the instant turn-on feature.
8. Install fluorescent lamps in place of incandescent ones wherever feasible. Fluorescent lamps are 4 times as efficient as incandescent lamps and last 7 to 10 times as long.
9. Use lights in specific work areas instead of lighting the whole room.
10. Turn off all lights when not in use.

General

1. Discourage over-heating of public buildings, particularly schools and libraries.
2. Encourage less nighttime illumination of public buildings.
3. Discourage open refrigerators in supermarkets.
4. Complain about over-cooling in public places such as theatres, restaurants, and supermarkets.

APPENDIX XX

Instructions for Administering Student Test

1. This test may be given individually or as a group.

2. The student's first and last name should be on the test paper.

3. Each question relates to a specific objective (question 1 relates to objective 1). If you do not teach a certain objective, skip that question.

4. The questions may be read to the students.

5. Feel free to lower the vocabulary of the questions. Be sure the students understand what the question is asking.

6. There is only one answer per question.

7. Students may circle the letter to indicate their choice, or they may underline their answer. As a teacher, you are free to change the method by which they indicate their answers to fit your own situation.

8. The correct answer for each question is listed below.

1.	(B)	6.	(D)	11.	(D)	16.	(D)
2.	(A)	7.	(B)	12.	(C)	17.	(C)
3.	(D)	8.	(C)	13.	(A)	18.	(A)
4.	(C)	9.	(A)	14.	(A)	19.	(C)
5.	(A)	10.	(A)	15.	(B)	20.	(C)

ENERGY AND YOU

Pre-test 092, Posttest 093

1. Which group of words describes energy?

   A. slows everything down
   B. everything moves
   C. pollutes everything
   D. does nothing

2. When there is no energy at all:

   A. nothing moves
   B. everything moves
   C. things move slowly
   D. things move fast

3. Food, coal, oil, gasoline, kerosene, and natural gas are all kinds of:

   A. electricity
   B. heat
   C. petroleum
   D. fuel

4. Oil, coal, and natural gas are:

   A. liquid fuels
   B. car fuels
   C. fossil fuels
   D. solid fuels

5. Fossil fuels come from:

   A. beneath the earth
   B. the water
   C. the top of the ground
   D. the air

6. Gasoline, kerosene, and diesel come from:

   A. motor oil
   B. castor oil
   C. heating oil
   D. crude oil

7. Which of these fuels is not used to make electricity?

   A. natural gas
   B. wood
   C. coal
   D. oil

8. Which of these use the most energy?

   A. business
   B. homes
   C. factories
   D. transportation

9. Which of these fuels is used the most to make electricity today?

   A. coal
   B. nuclear power
   C. natural gas
   D. oil

10. Which of these use the most energy in the home?

   A. heating
   B. television
   C. lights
   D. radio

Energy and You
Pre-test 092, Posttest 093

11. Which of these is usually necessary to change fuel into energy?

A. mining
B. cooling
C. polluting
D. burning

12. What gives your body energy?

A. exercise
B. water
C. food
D. clothing

13. There are not enough energy fuels in America because Americans are using more energy.

A. true
B. not true

14. "Energy crisis" means we do not have enough fuels to do everything we want to do.

A. true
B. not true

15. Choose the car that would help save gasoline.

A. large cars
B. small cars
C. fast cars
D. pretty cars

16. What do we really save when we use less electricity?

A. repair bills
B. electric toys
C. food fuels
D. energy fuels

17. Which of these is a way to save on fuel?

A. leave for work early
B. buy more cars
C. ride city bus
D. drill more oil

18. When several people share a car ride to work or school it is called a:

A. car pool
B. loaded car
C. several people
D. many people

19. Which of these tell of a way to save on energy at home?

A. use large light bulbs
B. leave lights on when they are not being used
C. open and close the refrigerator less
D. put hot food in the refrigerator

20. Which of these will probably be used the most to make electricity in the future?

A. natural gas
B. gasoline
C. nuclear (atomic)
D. wood