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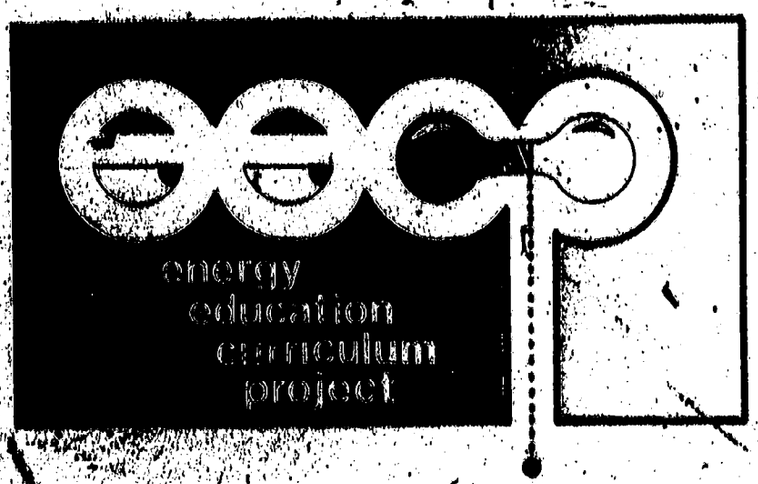
ABSTRACT

This guide is intended to integrate energy education into the curriculum of the middle school grades. It contains a rationale; a detailed introduction including a teacher's guide, glossary, and bibliography; a teacher's guide to a cartoon book; and separate teacher's entries and student entries for various eras of American history. The subjects discussed in the various sections include: (1) Energy and Colonial America; (2) Energy and Industrialism; and (3) Energy and the Post War Period. (RE)

An Energy Curriculum for the Middle Grades

Unit II: Energy and American History



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AN ENERGY CURRICULUM FOR THE MIDDLE GRADES

UNIT TWO: ENERGY AND AMERICAN HISTORY

with adaptations for

Science
Language Arts
Practical Arts

Indiana Energy Group
Indiana Department of Commerce
Lt. Governor Robert D. Orr, Director

Division of Curriculum
Indiana Department of Public Instruction
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These materials were created by the Development Team from the Program in Educational Policy and Change. This program is housed at the Workshop in Political Theory and Policy Analysis, Indiana University, Bloomington. Judith Gillespie directed the work of the team. Mary Soley developed the student cartoon book, Quantum Conserves, the teacher's guide to the cartoon book and the chapter, "Energy and Colonial America." MaryAnne Olsen developed the chapter, "Energy and Industrialism." Judith Gillespie developed the chapter, "Energy and the Post-War Period." Joel Pett developed all of the art work through the materials.

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Elaine Ervin, residential and education programs coordinator, Indiana Energy Group, also served on the Steering Committee and offered suggestions and comments which helped to improve these materials.

These materials have been substantially revised on the basis of comments from teachers throughout the state who pilot tested the materials. These teachers and their students have made valued contributions and their help has been appreciated.

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ENERGY AND EARLY ADOLESCENCE

Most early adolescents are undergoing significant changes. The change pattern is not linear; it is serendipitous, making this age group extremely heterogeneous physiologically, psychologically and socially.[1] Schools must deal either directly or indirectly with these changes. One way schools can help early adolescents is through the curriculum.

The Energy Education Curriculum Project will focus on increasing the potential of young adolescents. Here a plan for an energy curriculum for the middle grades will be outlined which recognizes the heterogeneous changes and developmental patterns of early adolescents, while trying to push them beyond current levels of intellectual and participatory achievement. The Project will focus on students' potential as effective energy actors,[2] as citizens who have the knowledge and skills to conserve scarce energy resources and products in significant ways and to influence others in wise energy use. In this way, the Project hopes to provide one curriculum solution to the twin concerns of adolescent development and energy education.

RATIONALE

In a recent Psychology Today article a noted authority on adolescence, Joseph Adelson, made the following statement, "Adolescents as a whole are not in turmoil, not deeply disturbed, not at the mercy of their impulses, not resistant to parental values, not politically active or rebellious." In the article called "Adolescents and the Generalization Gap," Adelson points out that most of our generalizations about adolescents are based on a "tyranny of the visible." People tend to remember some of the more shocking, more spontaneous, more idiosyncratic events which adolescents experience and to generalize based on this behavior. Adelson pleads for a more well-rounded look at adolescents as a group that can be significantly generalized across the whole spectrum of types of young adults.[3]

The general approach outlined here is based on a "positive" approach to adolescents and their potential. The focus will be on what adolescents can do, what their potential is, or how people can help move them to achieve their potential. In the following paragraphs one approach to adolescents as individuals, to middle/junior high schools, and to the place of curriculum change will be described.

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[1] For our purposes here, young or early adolescents will refer to 10 to 15 year olds and are distinguished from their 16 to 19 year old adolescent counterparts by the fact that significant physiological changes are initiated in the earlier age group.

[2] By effective energy actors, the Project means those who can translate knowledge and skills into action which promotes energy conservation.

[3] Joseph Adelson, "Adolescents and the Generalization Gap," Psychology Today, February, 1979, pages 33-38.

Approach to Adolescents. Our view of early adolescents is shaped by a single word: "potential." Early adolescents have potential for moving from the concrete to the abstract in cognitive thinking. They can move from a rule-bound value position to a more principled value position. They have the capacity to shed their "subject" role and become citizens by taking responsibility for their actions on energy problems. The approach is not insensitive to where adolescents are, what problems they are having, and what kinds of growth patterns exist. But the "potential" concept keeps it headed beyond where adolescents are to where they can be.

The approach to adolescents is action-oriented. Anyone who has taught in junior high or middle schools, or has raised early adolescents, knows that they are spontaneous in their activities. They think, feel, and do things spontaneously within almost every setting in which they operate. The action base for the curriculum will focus on the need for self-expression in order for potential to be increased. The approach will mobilize the natural need that adolescents have to think creatively, more actively, and express themselves in a variety of ways inside and outside of schools to promote student development and energy education.

Approach to Schools. Over the last decade, a distinction has been made between middle schools and junior high schools. Whatever the title, these schools generally include grades 6 through 9. Some have a four-year sequence, and most a three-year sequence that includes grades 6 through 8 or 7 through 9. When the middle grades are referred to here, both middle schools and junior highs are included.

As a recent report by the National Science Foundation indicates, there are relatively few differences between middle schools and junior high.[4] Presently, most schools in the middle grades prepare students for their high school years. They support a discipline-centered curriculum. Because of these school characteristics, the Project's approach to schools involves dealing realistically with the segmented structure of the school. Yet in order to serve adolescent development, everyday boundaries of schedule and structure need to be pushed beyond normal routines. Interdisciplinary cooperation will be emphasized in order to reinforce student experiences. Student activities will involve a variety of teachers and staff, transcending barriers of role and function. Therefore, the approach also supports the principle of dealing with the whole school and student participation in it.

Approach to the Curriculum. Every type of educational change needs a base. While the approach focuses on the whole school, it uses social studies as a base for curriculum development and change. Social studies is interdisciplinary by nature, and the focus of the social studies is on both knowledge and policy, or action. It seems a natural home for curriculum materials on energy education. Many materials have been developed in science; few in social studies. The scientific base is one important

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[4] National Science Foundation, Early Adolescence: Perspectives and Recommendations. Washington, D.C.: U.S. Government Printing Office, 1978.

part of the curriculum, but it is only one part of what is needed to promote effective energy actors. Therefore, the materials will find their home in social studies in order to implement the curriculum and effect educational change in the schools. The middle grades material will focus on social studies lessons adapted to World Cultures and American History courses.

OBJECTIVES

The general goal of the curriculum is to promote effective energy actors. An effective energy actor is a person who is aware of his/her environment and its uses. This person is knowledgeable about energy resources, transformation processes and outcomes of those processes. An effective energy actor has the intellectual skills to deal with energy problems and to think through these problems in important ways. Finally, an effective energy actor can use his or her awareness, knowledge, and skills in acting in participatory ways in individual and group settings which promote energy conservation. It is the conversion process between awareness, knowledge, skills and participation that seems crucial to the promotion of effective energy actors.

Knowledge Objectives. Knowledge is an important domain of objectives for the middle grades. However, the content and kind of knowledge is unique. The National Assessment of Education Progress study reflected that a good deal of common sense information is held by young adults about the energy problem.[5] They gain this knowledge through the media. However, knowledge was amazingly low concerning major concepts about energy problems, the processes of energy transformation and especially the policy processes through which people influence energy problems. For example, only 14% of the young adults knew that coal is the primary energy source used to produce the nation's electrical energy.

The assessment also showed that in the policy area, people doubted that they could influence government, manufacturers or oil companies with regard to energy problems. They also showed a lack of knowledge of alternatives in the policy process or alternative outcomes of their actions: they wanted to continue driving cars. Finally, they showed a lack of knowledge of the consequences of people's actions for the energy situation.

The knowledge objectives in the middle grades materials will focus on concepts which will allow students to abstract from their specific environment. The concepts will include concepts about energy, such as conservation or transformation, and concepts about human behavior, including effective energy habits. The knowledge objectives will also focus on policy processes, so that students can understand ways in which they can interact in decision-making. Finally, the objectives will stress the

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[5] National Assessment of Educational Progress, Energy Knowledge and Attitudes: A National Assessment of Energy Awareness Among Young Adults. Denver, Colorado: Education Commission of the States, December, 1978.

alternatives and consequences of actions so that students can see the trade-offs that they make in taking action on energy problems. (See chart on following page.)

Imagination Objectives. A new dimension becomes very important at the middle grades level. It can be labelled "imagination." Imagination is a motivational concept. It comes internally from the individual, not externally from the teacher or the school. It is necessary as a motivator to promote interest in a particular subject matter. It is through the vehicle of imagination that we will attempt to catch students' interest in energy and to motivate them to do something about it.

Basically, imagination includes four different steps. First, it involves motivation. A student is asked to imagine something. This "something" comes internally from the student. A student can think about a problem or an event which may or may not be related to the specific subject matter at hand. The second level involves description. A student describes the image that is in his or her mind. Students can share that concrete image with other students. Third, the student utilizes abstract concepts to describe the image, moving from the concrete to the abstract. Finally, a student will apply those concepts to specific real-world situations. In this way, imagination capitalizes on the potential of students to move from concrete to abstract situations and provides internal motivation and concern for energy problem-solving.[6]

It is important to state here that the imagination objectives are not mere instructional strategies for motivating students. The reader should not think in standard curriculum categories. Imagination is, in itself, an objective which can be promoted by a variety of strategies. It is an ability to think new thoughts, feel new feelings and share them with others. It is one key for opening important conceptual and valuing capabilities. It is a skill of a different genre than either inquiry or moral reasoning. It is a skill in expanding potential dimensions of thinking, feeling and acting. It is a key to the unique potentials of early adolescents.[7]

Participation Objectives. The participation domain will focus on developing skills in the decision-making process. Desicion-making refers to choices that people make and the consequences of those choices.

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[6]The idea of imagination is built from many sources. The chief source cited here is Robert Samples, The Metaphoric Mind. Menlo Park, California: Addison-Wesley, 1976; and The Whole School Book. Menlo Park, California: Addison-Wesley, 1977.

[7]See especially Jerome Bruner, On Knowing: Left Hand Learning. New York: Antheneum Press, 1962; and Abraham Maslow, The Farther Reaches of Human Nature. New York: Viking, 1971.

OBJECTIVES FOR THE MIDDLE GRADES ENERGY CURRICULUM

Knowledge Objectives

1. Students will acquire basic concepts of energy conservation, resources, and interdependence.
2. Students will acquire basic concepts of self and human behavior.
3. Students will acquire knowledge of basic processes of energy transformation and use.
4. Students will acquire basic knowledge of policy processes affecting energy decision-making and the impact of various alternatives.

Imagination Objectives

1. Students will develop images of energy situations from their own personal experiences.
2. Students will share concrete descriptions of their images of energy situations with other students.
3. Students will use concepts to describe their imaginary situations, and share those with other students.
4. Students will apply the concepts they develop to their own everyday lives.

Participation Objectives

1. Students will learn basic steps in individual decision-making including information, choices, alternatives, applying values to alternatives, and determining consequences.
2. Students will experience individual decision-making in group settings in their school, home, and community related to energy conservation.
3. Students will develop skills in group decision-making, including identifying rules and appropriate strategies, implementing group decisions, and identifying consequences.
4. Students will gain experience in acting in group situations in their school, home, and community related to energy conservation.

The objectives will facilitate individual decision-making. They will be especially focused on cultivating students' valuing skills in dealing with alternatives and recognizing the consequences of their actions.

The objectives will also focus on group decision-making. They will highlight the rules that made groups different from each other, strategies that can be used in influencing decision-making, and how to implement group decisions.

Students will also identify the impact that group decisions can have on schools, communities and nations as wholes. Group decision-making will also focus on peer relationships, trying to utilize the peer focus of most early adolescents in order to promote effective action.

According to these objectives, effective energy actors at the middle grades level will have skills in imagination which will cultivate their interest and clarify the applications of ideas about the energy problem. They will also have knowledge about energy and the policy process which they will put to use in effective decision-making, both in terms of making a choice and implementing that choice effectively. The activities will involve adolescents in multiple types of situations within and outside the school in practicing effective conservation strategies.

CURRICULUM PLAN

The curriculum plan for the Energy Project involves a basic structure. A core of lessons to be integrated into social studies instruction is the foundation. Major interdisciplinary building blocks take the form of mini-lessons in science, language arts, and practical arts. A teacher's guide and lesson plans are cross-beams linking the entire structure together. The goal of the curriculum is to articulate energy education with standard World Cultures and American History courses in the middle grades.

The plan includes an introductory cartoon book which explains the major ideas and skills in the program and the development of three units of material. The cartoon book constitutes a basic set of materials, roughly 15 to 20 pages long, that will introduce students to imagination skills, basic concepts in the course, including the concepts of conservation, energy resources and interdependence, and skills in individual and group decision-making. The first unit of materials will focus on the World Cultures course and include studies of Sub-Saharan Africa, Europe, Asia and Northern Africa and the Middle East. The second unit will offer materials to be used in American History courses.

The materials are designed to be used flexibly. Regardless of which unit is used by which teacher, everyone will have a common base for beginning the energy materials. Although the American History course is most often used in the eighth grade, the World

Cultures program is more diverse. A teacher might use a chapter on Sub-Saharan Africa and a chapter on Europe, each from different units in the material. This flexibility makes grade leveling of the materials difficult. There are major differences between sixth and eighth graders, as well as among students in any given grade. Therefore, lessons will be designed which include several levels of activity so that different grade levels can use any one or a group of lessons from the energy materials.

The introductory cartoon book and the two units of materials are outlined on the following page. The cartoon book will serve as an introduction. The first unit on Energy and World Cultures will be divided into four chapters. In each of these chapters there will be lessons utilizing students' imagination which initiate the material, lessons on basic energy concepts and basic energy processes as well as policy processes, and finally, suggested participation activities. The lessons and activities will be related to the particular culture which is identified by the chapter heading The second unit on Energy and American History is organized into three time periods. The lessons cover more advanced ideas and skills, but are not dependent on the use of the World Cultures materials.

For each of the major units there are also mini-lessons which involve interdisciplinary activities and linkages to science, language arts, and practical arts classes. Students would be learning about energy conservation through their social studies class. The social studies teacher and the science teacher could then get together for a science lesson which would show basic energy conservation principles. In this way, a science lesson on the transformation of petroleum into gasoline might be linked to a social studies lesson on energy and Sub-Saharan Africa.

The materials also contain a teacher's guide and lesson plans. There are lesson plans for the cartoon book and for each of the two units. There are a total of twelve lesson plans for the World Cultures unit and nine lesson plans for the American History unit. Also included is a related bibliography and a set of reference materials, such as a glossary and background materials necessary to understand some of the technical aspects of the energy problems which are confronted in the materials. Teachers need not have any special expertise in order to teach the materials. The teacher material serves as a resource library for teachers who can use the lesson plans in the teacher's guide, or create their own lessons based on the materials.

CONTENT OUTLINE FOR THE MIDDLE GRADES CURRICULUM.

Cartoon Book Introduction

The cartoon book will introduce students to all of the basic ideas and skills in the curriculum. It will be done as a comic with a running story. Students' skills in imagination will be initiated, basic knowledge in terms of the concepts used in the curriculum will be introduced, and basic skills in individual and group decision-making will be outlined. The cartoon book will be used in conjunction with any or all of the chapters or entire units that are used by teachers in the middle grades.

Energy and Four Cultures

Chapter One: Energy and Sub-Saharan Africa

Students will develop imagination skills and basic knowledge about energy resources in Africa, basic conservation strategies and the interdependence of Africa with other cultures in energy use. They will develop skills in individual decision-making and act in rolas making individual decisions about energy use in their skills.

Chapter Two: Energy and Europe

Students will learn basic imagination skills. They will apply their knowledge of energy conservation, resources and interdependence to the European setting. They will learn basic skills in individual decision-making and apply them outside of their school to their family setting.

Chapter Three: Energy and Asia

Students will apply basic imagination skills. They will learn specifically about India, China and Japan and make comparisons of energy resources, conservation and interdependance in the Asian context. They will learn basic skills in group decision-making and apply them to their family setting.

Chapter Four: Energy and the Middle East

Students will utilize basic imagination skills. They will apply the idea of energy resources, conservation and interdependence to the Middle East context. They will make comparisons based on their knowledge of other cultures. Thay will learn basic group decision-making skills and apply them to their community setting.

Energy and American History

Chapter One: Energy and Colonial America

Students will study a small town during the colonial period. They will develop basic imagination skills. They will apply their knowledge of energy resources, conservation and interdependence to the colonial setting. They will plan community conservation strategies which students can initiate in their community.

Chapter Two: Energy and the Industrial Revolution

Students will learn about the changes in energy use that were accomplished during the beginning of the industrial revolution. They will apply basic imagination skills. They will work with concepts of energy resources, conservation and interdependence during the industrial revolution. They will plan an energy fair reflecting energy uses during the industrial revolution for their entire school.

Chapter Three: Energy and the Post-War Era

Students will study energy use in the period of U.S. ascendancy after World War II. They will use basic imagination skills and apply concepts of energy resources, conservation and interdependence to the post World War II setting. They will initiate a plan for energy conservation which is based on the U.S.'s new position as an energy consumer in the post World War II era.

EVALUATION AND DISSEMINATION

The energy materials have undergone a thorough evaluation. At each stage of the Project the conceptualization, the materials and the policy plans have been reviewed by a steering committee at the Division of Curriculum in the Indiana Department of Public Instruction. Ideas and materials have also been reviewed by an eight-person teacher panel consisting of social studies, science, language arts and practical arts teachers who are working in the middle grades in Indiana. This evaluation mechanism allowed for systematic evaluation by two panels of reviewers. Additional consultants and teacher reviewers were utilized as specific needs arose. A science consultant was used frequently. Materials were also evaluated through presentations at conventions and articles, such as this conceptualization plan.

There was also a systematic pilot testing of the materials in the Project. A pilot test was conducted in the spring utilizing schools across the state of Indiana. A sampler was developed that contains the cartoon book, the chapter from the World Cutures unit on Europe and the chapter from the American History unit on Energy and the Post-War Period. These sampler materials were systematically tested and evaluated and used as models for the development of the remainder of the curriculum materials. A final evaluation was conducted of the use of the curriculum materials when they were produced and used in schools across the state and the nation.

The materials are also being disseminated. Brochures were developed, articles were produced and meetings were attended in which many different individuals, both educators and practitioners, had the opportunity to learn about the materials and to use lessons from the units.

The chief dissemination mechanism involved workshops held across the state including middle grades teachers and administrators involved in social studies, science, language arts and practical arts instruction. These workshops were held in the Fall, 1979, and were attended by participants from a wide variety of groups.

In this way, curriculum development, evaluation and dissemination work hand-in-hand in the Project. Hopefully, this strategy allowed the Project to reach as many teachers and students as possible and to help students to become truly effective energy actors.

INTRODUCTION

ENERGY EDUCATION TEACHER'S GUIDE

The material that follows is designed to help you make the most use of these energy education materials. This introduction is divided into four parts. First, a brief description of the general plan of the materials and their use is given. Second, a part on active involvement illustrates how students can become truly involved with materials in their classroom, across the school as a whole and in community activities. The third part shows ways in which the materials can be integrated into standard social studies courses in American History. Finally a part on interdisciplinary activities demonstrates ways that teachers from various subject areas can get together in order to reinforce students' activities in becoming effective energy actors. All of these parts are designed to highlight dimensions of the materials that will augment and improve instruction in your class.

GENERAL PLAN

The organization of these energy materials can be outlined as follows:

I. Rationale
II. Introduction
  A. Teacher's Guide
  B. Glossary
  C. Resource Bibliography
III. Teacher's Guide to the Cartoon Book
IV. Teacher's Guide for each Chapter/ Adaptations
V. Student Materials for each Chapter

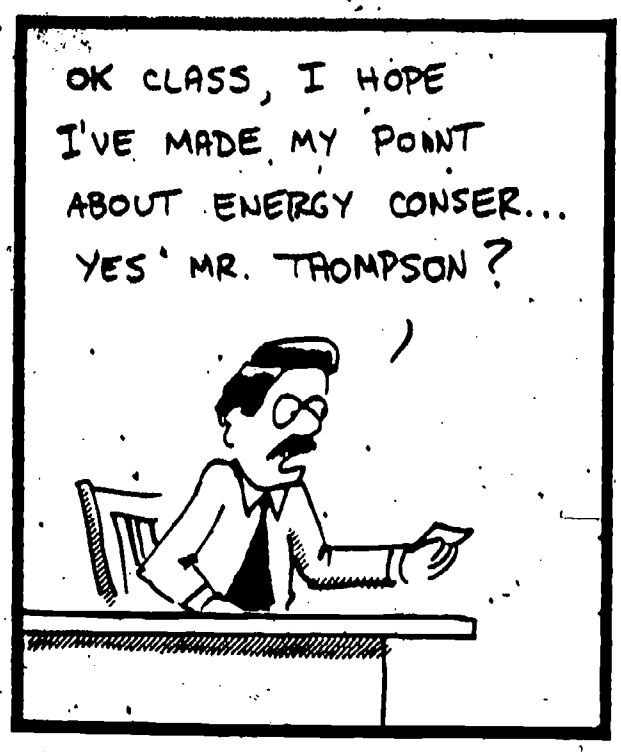
Each part of the materials has a specific purpose and function. Taken together, the materials constitute a base for you to effectively teach about energy and effective action on energy problems.

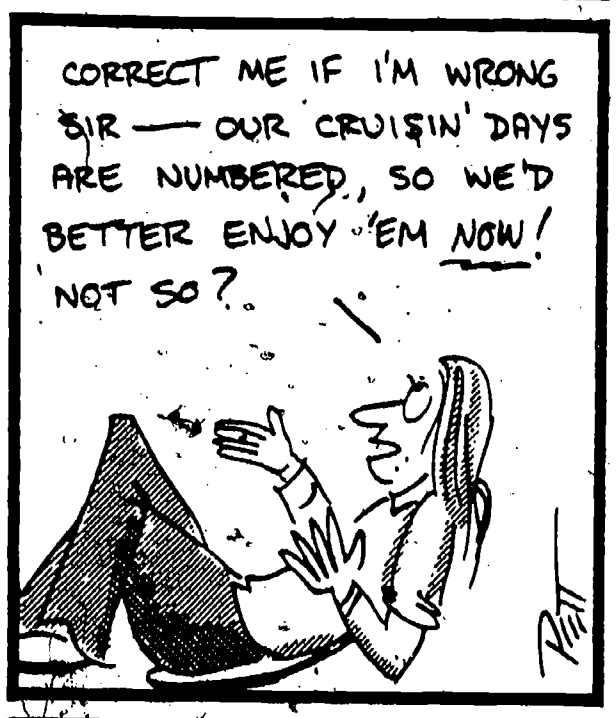
The rationale section explains the philosophy behind these materials. It shows the approach, the general content, the pilot evaluation, and dissemination of the materials. Basically, we are trying to enhance students' abilitites to become effective energy actors.

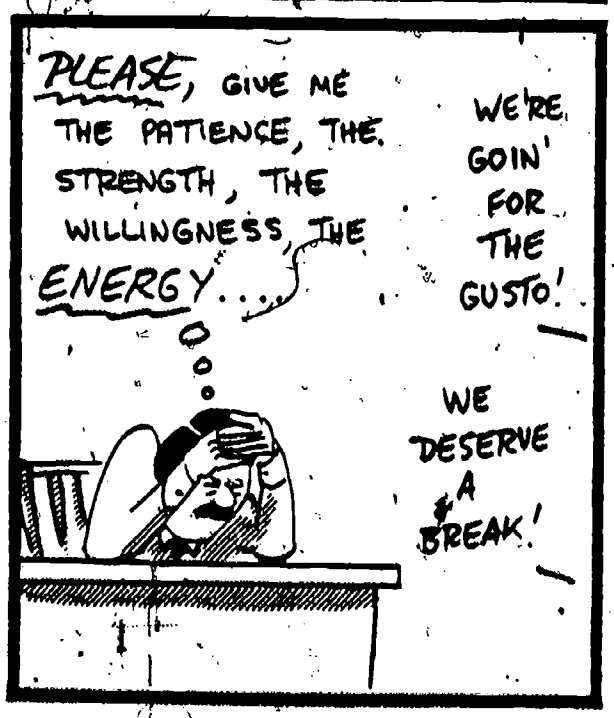
This guide explains how to use and carry out the philosophy described in the rationale. It concludes with a glossary for reference as well as a resource bibliography. This bibliography can help you go farther with the materials or delve into particular topics.

The teacher's guide to the cartoon book offers suggestions for using the student cartoon book, Quantum Conserves, which is separate from this material. The cartoon book is designed as an introduction for any of the American History lessons. It can also be used on its own. It is a basic introduction to the ideas in the course.

There are three chapters in this American History unit: one on the Colonial Period, one on the Industrial Revolution, and one on the Post War Period. There is a teacher's guide with lesson plans for each chapter. These pages follow the division pages. The lesson plans contain objectives and a step-by-step plan for carrying out the lesson. A student assessment instrument is also included for each lesson. If the lesson plans are







used in conjunction with the student materials, you have a complete plan for teaching about energy in your class.

There are also adaptation lessons contained in the teacher's guide for each chapter. The adaptations provide ways of working with teachers from other subject areas in enhancing the materials.

For each chapter, there is also a student materials section following the lesson plans. Student materials will need to be duplicated when more than one copy is needed. The materials are designed to help promote effective energy activity by students as they are studying various historical periods.

ACTIVE INVOLVEMENT

There is an equation here which is important. The equation runs as follows: Knowledge + Participation = Learning. In this program we are trying to teach students about energy and to have them participate in energy conservation. Together these elements make a powerful combination for learning and for establishing effective energy habits. Without knowledge, one cannot act reasonably. Without participation, one does not put one's knowledge to use. Both parts of the equation are equally important for the outcome we are striving to achieve. In this section we will talk about how students can get actively involved in this program in their classroom, at school, in their homes and in their community.

One of the major purposes of the materials is to provide students with activities. We want them to do things in class with objects and with other people. We want them to do games and puzzles and to work actively with the material. We want them to ask questions for which there are not well-defined answers. The purpose here is for each activity that is used in this material to be just that--an activity, or active learning. This will help students to learn more and to learn it better.

The active involvement in these materials can be contained within the classroom. The energy lessons contained in this material are designed to be used in the classroom. However, involvement can also extend beyond the classroom to the school where the class takes on activities or the entire school does. It can also include homes, neighborhoods and community organizations. These types of activities will be explained and suggestions for activities that you might try are included. Some energy lessons contained here will suggest that you move out of the classroom to reinforce learning and stimulate new activities in energy conservation.

Two types of activities are included here. The first type involves your class engaging in particular activities in the school. This means that your class can serve to initiate on energy activities outside the classroom. A second type of activity involves working with administrators, other teachers, other students and existing organizations in order to promote school-wide energy activities that are initiated by more people than those in your class. Both types of activities are described below.

Class-Based Activities

The activities that your class can undertake are numerous. The following twelve suggestions are some ideas on what you might do as a class for class-based activities. You might try some of these activities out as you are doing lessons in this material. Otherwise, you might generate your own ideas based on these suggestions.

1. An Energy Audit. Your class could conduct an energy audit of your classroom or the school by making a list of those things which use energy in the school and then seeing how much energy is used by the items on your list. They might conduct this audit daily or weekly for some time and then determine ways in which they might save on energy use in the school.

2. Energy Aides. Your class might volunteer to help with conservation by patrolling doors and specific rooms to make sure windows and doors are closed. They might prepare a form where they can write down what success or lack of success their efforts have. If the patrol is successful, students might work with students in other classes in setting up a permanent group that would help the school save energy.

3. Lights Out! Students in your class might initiate a campaign to use half the electricity they currently consume in their school. They might determine ways in which the classrooms, libraries, cafeterias and other areas of the school could use less lighting and still function effectively. They should be sure that the lighting changes they make are actually more energy efficient by studying the electrical use of

different types of bulbs and fixtures. They could suggest anything from actually taking out lightbulbs to rearranging classrooms or other areas so that more natural light is used.

4. Energy in the News. Your class might work with the school newspaper staff in order to provide a class poem about ideas for energy conservation. Students might come up with tips on how to save energy as well as information about energy alternatives. You might want to prepare a class newspaper about energy.

5. Dialing Up and Down. The students might initiate a school-wide attempt to use less heat in the winter and less air-conditioning in the summer in the schools. They could monitor thermostats and get a sweater campaign in the winter, or a dress cool campaign in the warmer months, in order to effectively use less energy in heating and cooling in the school.

6. A Paper Drive. Students might start a paper drive with the gathering of paper that has been used for re-use within the school. Paper that has been used on one side can be used on the other side for various uses including memos or scrap paper. Students can set up their own system for gathering the paper from classrooms and other places in the school and redistributing it to administrators, teachers and students for re-use.

7. An Energy Exhibit. Students might set up an exhibit in the cafeteria which shows knowledge about energy and ways in which students might conserve. They could set up, for example, various ways of cooking hot dogs in the cafeteria, or some other moving exhibits, so that students could actually try it out themselves.

8. Take It Home. The class could initiate an energy survey of tips on energy conservation. They could ask people in their school and community to share ideas with them about conservation. They could then make a booklet of these ideas. They could share the booklet with their parents and come up with class results in energy conservation that were chosen by families within the class.

9. Person Power! Students in the class could devise a series of posters to be used around the school on how students could use their own energy rather than mechanical forms of energy in trying to conserve electrical power and other sources. In this way, other students in the school would be exposed to knowledge about their own personal energy. Students who use their own personal power instead of other appliances or machines might be given an award by the students in the class.

10. Energy Survey. Students can conduct a survey of people in their class to see who walks, rides the bus, or comes in a car. They can then determine if there are ways that their transportation can be more energy wise (car pools). They can then extend their activities to other classes in the school.

11. Energy Facts and Figures. Students can use their math skills in drawing graphs and charts on posters which can be placed around the school. Students should collect their own information and then turn it into appropriate graphs in colorful displays.

12. Press Conference. Students can organize a press conference on the energy problem for people in their school. They can present various dimensions of the energy problem and debate alternative solutions. Questions can come from other members of the class and the school. Afterwards, students should discuss the role of the media in the energy problem and its solutions.

School-Based Activities

School-wide activities can be based on participation by the entire school rather than just students from the class. Students can cooperate with other students, with existing organizations, with teachers and with administrators and staff regarding possible school activities. School libraries can be the base for many activities. This will enhance the impact that the students have as well as give others opportunity to join in leading energy conservation efforts.

Some suggestions for school-based activities involving other groups follow. You may want to try out some of these activities or to initiate some of your own.

1. An Energy Fair. Students might want to work with other students in science classes, language arts and practical arts classes or others to establish a date for an energy fair. Students could provide exhibits, whether they are technical or social in nature; and prizes could be awarded for the best exhibits.

2. An Energy Audit. Students might join with other students, teachers, administrators, and staff in the school to conduct an energy audit of their energy needs. Different groups could be assigned to different parts of the school and make an estimate on what energy is consumed. People then might come up with plans for energy conservation.

3. Energy in the News. Students might work with their local newspaper or radio or T.V. station to put on an energy show. They could make a column or page in

their local newspaper or take a 5 to 10 minute spot on the local radio. It would be up to the students in the school to write the script for the show and design it in the appropriate form for use by school participants and community members.

4. An Energy Drive. Students might organize a school-wide energy drive. They might register the energy they are saving on a big thermometer in a central location in the school. The homeroom representatives might be appointed in order to keep track of the number of things people in the school are doing to conserve energy. A rough point system might be devised and prizes given to those who came up with the most ways to conserve energy and actually carried them out.

5. Energy Tips. Teachers or students in the school could be organized to give students energy tips in homeroom classes. A student organization or combined organization might be used in order to provide the tips for teachers to announce. They might be part of regular homeroom announcements.

6. Using Both Sides. Students might conduct a drive in the school to use two sides of a sheet of paper in everything that is done from administrative work through students' essays and other work. They might organize checkposts where students, teachers and/or administrators could show that they have used both sides of the paper and could keep track of the number of times people did use both sides. Again, prizes could be awarded to those who used both sides of the paper the most times.

7. Signs. Students could run a contest on the best energy tips and put signs around the school which would show tips for energy conservation in the school and at home. The winners of the contest would be those with the best tips as well as with the best sign.

8. Neighborhood Conservation. Students in the school could pick a few close neighborhoods in the community and plan a campaign for educating community members in energy conservation. They could then go door to door to survey the people in these neighborhoods and to give them tips on energy conservation.

9. Energy Night. Students might plan one night at school where parents and community members would

attend an energy night. Students would demonstrate ways in which energy conservation could be conducted both inside and outside the school and work with parents and community members on plans.

10. Speakers. A speaker's program could be set up tied to regular events in the school. People could be brought in from the community to talk about energy use and energy conservation and the role of teachers, students, administrators and staff as well as parents and community members in that conservation process.

11. An Energy Club. Some students might want to organize an energy club in their school. The club could initiate school-wide activities. It could also be a major source for energy information for all school participants. Clubs from other schools could also help in organizing community-wide activities.

12. Energy Holidays. Students can list common holidays. They can then choose one and study what people usually do to use energy during the holiday period. They can think of ways that people can conserve energy. They can organize an "energy efficient holiday" and give their ideas to other members of their school.

All of these activities are ways to get direct involvement by students in energy conservation. The hope here is that they will transfer their knowledge from the classroom into their everyday lives and change their habits of energy consumption.

INTEGRATING MATERIALS INTO YOUR COURSES

One of the most important aids to instruction in these materials is their close integration with standard social studies courses. Unless the lesson can be seen as part of the general learning process, students will probably use the lessons and forget them. Lessons have been carefully designed so that they can be used with American History courses. How they can most effectively be used is illustrated in the paragraphs that follow and in the chart on the following page.

A brief outline of the materials can be found on page 8 of the rationale. Basically, there is a cartoon book and three chapters of materials to be tied directly to what you are teaching. The cartoon book can be used anywhere in the American History course. It can be used with or without the other energy materials. Basically, it is an introduction to energy and energy conservation.

In the American History material the cartoon book can be used in any time period. You can use the cartoon book and have students compare the energy resources and conservation methods from that time period to the time when Quantum was conserving. Students can see some root causes for

SUGGESTED USES OF ENERGY MATERIALS
IN AMERICAN HISTORY COURSES
(Grade 8: 1978 Indiana Adoption)

Text Publisher/Title	Cartoon Book	Energy and Colonial America	Energy and the Industrial Revolution	Energy and the Post-War Period
1. Harcourt, Brace, Jovanovich: America: Its People and Values; 1979	Chapter 1	Chapter 4	Chapters 22-23	Chapter 31
2. D. C. Heath: We The People; 1977	Chapter 1	Chapters 3-5	Chapters 15-16	Chapter 21
3. Holt, Rinehart and Winston: The American Way; 1979	Chapter 2	Chapters 4-6	Chapter 16	Chapter 26
4. Houghton-Mifflin: Freedom's Trail; 1979	Chapter 1	Chapters 3-4	Chapter 17	Chapter 25
5. Laidlaw Brothers: Two Centuries of Progress; 1977	Chapter 1	Chapter 3	Chapter 10	Chapters 29-30
6. Charles E. Merrill: America Is; 1978	Chapter 1	Chapters 3-4	Chapters 15-16	Chapter 23
7. Rand McNally: The Free and The Brave; 1977	Chapter 1	Chapters 4-6	Chapters 16-17	Chapter 29

problems in energy conservation and the consequences of over consumption in energy use. The cartoon book is flexible enough that it can be used as an initial set of lessons in energy with any particular period of American History.

In American History classes the American History energy materials can be used. They are divided into time periods. The first chapter is on the Colonial Period. The second is on the Industrial Revolution. The third covers the Post-World War II Period. It would probably be useful to teach each of these chapters when you are studying each of these time periods.

The chart on the preceding page shows the specific texts that have been adopted in the State of Indiana and the place where the authors think you could use energy materials if you would so choose. You, however, are the best judge. There is a close integration between the textbook topics covered on the pages indicated and the types of lessons that we have designed for the energy materials.

INTERDISCIPLINARY ACTIVITIES

Interdisciplinary activities are an important part of this program. The program has a social studies base, but you can see that adaptation lessons have been presented in each chapter of the lesson plans so that social studies teachers might work with science, language arts and practical arts teachers in doing the lessons. These areas were chosen as examples for cooperation. Interdisciplinary activities can and should include math, fine arts, health and other areas. The activities here provide a base for work in many areas. This is important because students' knowledge and participation habits can be reinforced in other classes that they are taking.

In this section, we will talk about some strategies for utilizing the adaptations and doing interdisciplinary activities. Basically, the adaptations are designed to fit the major concepts or ideas in each chapter of the material. The adaptations are rough outlines of activities that might be done in other classes to amplify and reinforce what is being done in social studies classes.

The adaptations can be used in a variety of ways. You can work with a science, language arts or practical arts teacher in doing independent lessons which are interrelated. You might do the main lesson in the energy activities. The science teacher might be doing the science adaptation. This would reinforce students' knowledge. On the other hand, you might decide to team teach the material so that students could work together and each student was getting both social studies and science information.

All of these types of activities are not usually part of the normal routine in middle/junior high schools. They may be difficult to initiate because of lack of time, the problems of group work, and the norms of the school. It may be useful to begin work with one other teacher and then

expand your work gradually and naturally over a period of years. In this way, interdisciplinary activities could gradually become part of the everyday life of your school.

The ideas for interdisciplinary activities included here all involve one common element--group work. As we all know, group work (2 or more people) is not easy; most groups fail. Below are some tips that may be useful for starting a group and for carrying out activities.

Starting a Group

1. Begin with someone you know well.
2. Find someone who has personal or subject matter resources that will easily help you in your common task.
3. Find a common time before or after school or during a prep period to meet.
4. Make the initial meetings short, 15 to 30 minutes.
5. Find a common goal that is concrete and workable as early as possible.

Carrying Out Group Activities

1. Specify your task(s) as clearly as possible.
2. Match tasks with people carefully.
3. Make a reasonable, flexible schedule for work.
4. Design a way to get feedback as you carry out activities.
5. Design a way of evaluating work so that you can determine your successes/failures.

Basically, we will talk about four ways of carrying out interdisciplinary activities here. The first way is to work with one other teacher in planning independent lessons that will reinforce each other. The second way is to use school-based activities that involve a group of teachers and students. The third way is to meet with a group of teachers to plan coordinated lessons on several subjects. The fourth way is to team teach the materials across a variety of subject areas. Each of these ways of carrying out the interdisciplinary activities will be explained below and a case in which it has been successfully accomplished will be described.

Working With One Other Teacher

As a social studies teacher you have important knowledge to bring to students about energy education. However, other teachers also have knowledge from their own subject that is relevant. If you decide to work with another teacher, it is best to pick one who has resources,

such as a person who has seen a solar energy system, which will help you. A science teacher, for example, might know a lot about energy resources that you do not know. You might be studying the Colonial Period and the two of you might together develop activities that would include the social studies aspects of energy resources in Colonial America and the science aspects of energy resources in that period. You might also see if there are teachers who have actually visited some of the places in the United States that you will be talking about.

Here are some examples of activities that you might do with one other teacher:

1. Matching Coursework. Topics can be identified that can be taught simultaneously in different subject areas. For example, a math teacher might use energy data for graphs while a social studies teacher was teaching about an area of the world using that data. Matching topics can be done with any lesson in this material through use of the adaptations or your own ideas.

2. Classroom Conservation. Joint efforts to conserve energy can be undertaken in two or more classrooms. Teachers can share ideas. Students can plan to conserve lighting, heat, paper use, plastics use, etc. They can implement their plans and discuss how their activities vary depending on the particular classroom in which they are working.

3. Field Trip. You can jointly plan a field trip to a local solar or nuclear

energy site, or to another organization working with energy, such as a local utility. For example, both the science and social studies aspects of energy could be seen by a field trip to a local power station arranged by a social studies and science teacher.

4. Media Review. Joint planning of the use of T.V. programs or radio programs for teaching about energy can be carried out. Teachers can assign media programs and jointly plan questions and activities based on both the substance of the programs and the role of the media in the energy question.

5. Inservice Activity. Teachers can jointly plan inservice activities that will reinforce their knowledge about energy. You can use the energy topic as a way of working with other teachers to plan possible interdisciplinary activities during the in-service meeting. You can jointly present the work you have done with one other teacher as a way of encouraging more cooperation with other teachers.

School-wide Activities

Another way you can promote interdisciplinary activities is to initiate one of the school-based activities listed in the previous section or to do one of your own. The basic idea here is to put together a plan for school-wide activities that includes a wide variety of subjects and interaction of students and teachers.

One school-wide activity that has been especially popular is the use of energy fairs to create interest in energy problems. In one school an energy fair was developed by the social studies teacher in conjunction with science, language arts, practical arts, foreign language, physical education and other teachers. The fair lasted an entire day and prizes were awarded for the best exhibits. After the fair was completed the social studies teacher and the practical arts teacher continued their work together in developing lessons on energy education. The practical arts teacher included many different energy lessons in his practical arts classes. The social studies teacher incorporated some of the ideas about appliances and other machines into his social studies lessons. The success of the school-wide event stimulated other teachers to work together in order to bring energy education into their classrooms.

Here are some other ways in which school-wide activities can form a base for interdisciplinary cooperation:

1. Speakers' Bureau. Teachers can work together to form a speakers' bureau for possible guest speakers on a wide variety of topics in many subject areas. The speakers can appear in assemblies, sets of classes

or single classrooms. In this way, teachers could work together to promote energy awareness and information school-wide.

2. Homeroom Activities. A group of teachers from each subject area can plan announcements and short activities centered on energy information and action. These ideas can be circulated to all teachers so that anyone in the school can participate. A weekly energy bulletin could provide news and activities for an entire week.

3. Library Energy Resources. Teachers can work with their school librarian to set up a section of the library devoted to energy information. Many subject areas could be covered. Displays could be designed by students on various energy topics. In this way, teachers and students from many classes could find energy-related material in a single place in the library.

4. Classroom Conservation. Five classrooms could be chosen in the school for a study of energy conservation methods. Students using the classrooms could make suggestions for conservation from the subject they study while in the room. Teachers could then compile a list of suggestions for school-wide use.

5. Inservice Activities. A school-wide inservice day could be devoted to energy education. Teachers could discuss information and activities that could be carried out school-wide in order to get more information and conservation activities into the everyday life of their school.

Group Meetings

Another way to initiate interdisciplinary activity is to work with a group of teachers from different disciplines. One successful example of this type of work could have been initiated by a social studies teacher who was working on lessons in American History. The social studies teacher had three lessons on energy in Colonial America. He worked together with a group of teachers including science and language arts teachers. They used the adaptation lessons for the chapter and created three lessons in each of the other subject areas tied to the ideas of energy resources, conservation and interdependence. The group met once a week after school for a half hour over a period of time, and used the lessons and gave each other feedback on the successes and failures of the units. Throughout a two-month period the teachers enjoyed interacting together and constructing successful lessons that reinforced students' knowledge and participation in energy conservation. The success of the effort was marked by their continuation of their planning group for lessons in the following semester.

Here are some other ideas that an ongoing group of teachers might wish to undertake:

1. An Energy Club. A group of teachers might want to form a teacher energy club. The club could meet at school, or more informally outside of school. Its purpose could be to plan individual, classroom or school-wide activities related to increasing awareness, knowledge or participation in energy conservation.

2. Energy Seminars. A group of teachers might plan a series of seminars that could be offered after school or in the evening on energy topics. They could speak themselves or bring in outside speakers. The seminars could be for students or others in the school. They could also be opened to the community.

3. Energy News. A group of teachers from various subject areas could agree to write a section of the school newspaper, or their own bulletin, on energy issues. They could feed this information on regularly to homerooms, local media, and other sources.

4. Energy Lunches. A group of teachers could work with cafeteria staff to plan an energy efficient lunch. In good weather, it might be a picnic outside with solar hot dog cookers made by the students. Otherwise, signs could be posted in the cafeteria line showing the calorie value of foods and the energy used to produce them. People could be asked to be as energy efficient as possible, write their meals on cards with calories and kilowatts; and prizes could be awarded for the people with the most energy efficient lunches.

5. Inservice Activities. A group of teachers could arrange a section of an in-service day as a kind of energy fair which would inform and involve other teachers in energy conservation. Active involvement would be stressed, and some exhibits might then be transferred into classrooms or other parts of the school building.

Team Teaching

It is possible that you would want to work with other teachers in pairs and combine your students in order to team teach energy lessons. The lessons can be combined with more material from the adaptations in science, language arts or practical arts as well as other subjects. In this way, you would be assured that the same students would be getting the reinforcement material.

Several segments of the energy materials can be team taught by science and social studies teachers. A social studies teacher worked with a science teacher in teaching some lessons on the Post-War Period. The science teacher contributed several science experiments that showed increases in consumption due to mass use of appliances or automobiles. The social studies teacher planned to talk about lifestyle differences. The teachers met before the beginning of the unit during their prep time and planned specific segments of their instruction that were team taught across the classes. They then initiated specific days on which the team teaching effort would take place. Students enjoyed the team teaching. So did the teachers themselves.

Other activities that can set a base for team teaching include:

1. Energy Plays. Students from two classes might work on an energy play which could be performed before both groups together. Teachers could lead the discussion regarding the play. Spin-offs could be developed in several subject areas.

2. Energy Films. Classes can be combined to view several of the excellent films on energy issues. Some of these films are indexed in the resource bibliography contained in these materials. Teachers can jointly discuss the film and use it as a base for their team teaching effort.

3. Energy Panels. A panel of energy experts--students, teachers, community members--could be organized to speak to several classes of students. Teachers could combine classes to prepare questions for the panel. They could also debrief the students after the panel.

4. Energy Debates. Teachers could organize debates across two classes of students. One-side debates could be planned by each class. Representatives from each class would be chosen. Winners would be determined by an objective panel chosen from the combined classes.

5. Energy Simulations. A simulation could be run using combined classes of students. Students and teachers could work together to design their own simulation, or a simulation listed in the resource bibliography could be modified. Teachers could then jointly debrief the simulation to evaluate student experiences.

These are four ways that interdisciplinary cooperation can be promoted in these energy education materials. It is important for reinforcement. It is also important for teachers to get together and enjoy sharing ideas and planning cooperative activities. Their impact can go far beyond a single activity.

GLOSSARY OF WORDS

Anvil: An iron block on which metal is shaped.

Aramco: Arabian American Oil Company.

Appropriate Technology: Machines and methods that best suit a goal, e.g., they are not inefficient.

Benefit: Anything contributing to an improvement in condition; advantage; help.

Body Power: Terminology used to define human energy.

Cartel: An association of business firms or nations establishing a fixed price for a commonly sold good or resource.

Charcoal: Wood partially burned in a kiln from which air is excluded.

Coal: A solid fuel, mostly carbon, formed from the fossils of plants living hundreds of millions of years ago.

Community: A part of a city where people live and act together in doing things.

Competitor: A person who competes, a human rival.

Compromise: An agreement in which everyone gets part of what he/she wants but usually not all.

Consensus Rule: Everyone must agree in order for a decision to be made.

Conservation: The wise use of resources.

Consumer Goods: Products that people buy.

Consumption: The use of any resource.

Cost: The amount of money, time, effort, etc. required to achieve an end.

Crude Oil: Liquid fuel formed from the remains of animals and plants.

Dependence: Something on which one relies and needs.

Development: Growth or advancement.

Demand: The desire for a good.

Desalination: The process of taking salt out of sea water.

Energy: The ability to heat, light and/or move things.

Energy Actor: A person taking action on an energy problem.

Energy Alternatives: Various substitutes for existing energy sources.

Energy Consumer: A person who uses energy or energy products.

Energy Disposer: A person who discards used energy or energy products.

Energy Interdependence: People and groups around the world needing to exchange energy sources and products.

Energy Product: Anything that is made from an energy source and which requires energy for its production.

Energy Resources: Those resources that are drawn upon for energy use.

Energy Shopper: A person who buys or sells energy or energy products.

Energy Sources: The supplies from which we receive energy.

Energy Transfer: A process in which one system supplies another system with energy.

Environment: Something that exists in the surroundings.

Exports: Shipping goods out of one's own country.

Food: The raw materials used by plants, animals and humans for nourishment.

Fossil Fuels: Fuels derived from the fossil remains of organic materials and includes resources such as oil, natural gas and coal.

Geothermal Energy: Energy produced by water flowing over hot rocks deep within earth's crust.

Grist Mills: A grain mill used for grinding wheat or corn into flour and meal.

Heat: A form of energy in motion that flows from one body to another because of a temperature difference between them.

Heritage: Tradition, something transmitted or passed down from people living previously.

Human Energy: The energy produced by a person's body.

Hydroelectrical Power. Energy produced by falling water. See Hydropower.

Hydropower: The energy in stored or moving water.

Immigration: The process of people coming into a country for the purpose of taking up permanent residence.

Import: Goods coming in from another country.

Industrial Revolution: The period of rapid growth and change brought about by new inventions, a cheap labor supply and the use of energy for producing goods.

Inflation: An increase in the amount of money in circulation resulting in a fall in its value and a rise in prices.

Inhibiting Factors: To discourage from being able to do something.

Interdependence: People sharing goods, needs, or affecting one another in some way.

Irrigation: To supply water to land by means of ditches, channels or sprinklers.

Islam: The Muslim religion in which the supreme figure is Allah and the Chief Prophet and founder is Mohammed.

Judaism: The Jewish religion based on the laws and teachings of the Holy Scripture and the Talmud.

Kilowatt: A kilowatt is a unit by which electricity is measured.

Labor Supply: Having people available that can work in the business or industry.

Land Reform: Making more land available for farming.

Lending Institutions: Banks and other establishments that are in the business of lending people the money to start a business and obtain the necessary equipment.

Lifestyles: The way people live.

Majority Rule: Fifty percent (50%) plus one person must agree in order for a decision to be made.

Miles Per Gallon: The number of miles that a car can drive on a gallon of gas.

Motivation: Something, such as a need or desire, that cause a person or people to act.

Muscle Power: The energy produced from humans or animals.

Muslim: Someone who believes in the religion of Islam.

Natural Gas: A gaseous fuel formed from the fossils of ancient plants and animals.

Nonrenewable Resource: A resource that can only be used once because more cannot be found or made.

Nuclear Energy: Energy contained within the nucleus of the atom that can be released by nuclear fission or nuclear fusion.

One-person Rule: One person can make a decision for a group.

OPEC: Organization of Petroleum Exporting Countries.

Paddle Wheel: A wheel placed in water when turned, causes movement.

Perspective: A specific point of view in understanding or judging things or events.

Petroleum: An oily, flammable liquid when refined yields fuel oil, kerosene, gasoline, etc.

Pig Iron: The product obtained from the melting of bog iron.

Plurality Rule: A majority need not agree, but support must be given that is greater than that obtained by the opposition.

Priorities: Things that receive immediate attention.

Promoting Factors: Those things that contribute to the growth of industry, to help bring an enterprise into being.

Prophet: A religious teacher.

Recycling: To reuse a product through reprocessing or determining a new use, i.e., rolled newspapers for fire logs.

Redistribution: To give out again or in a different way.

Renewable Resource: A resource that can be used again and again, such as solar, tidal or wind energy.

Self-reliance: Depending on oneself.

Sisal: A plant grown in Africa used for making rope.

Slag: The refuse (leftover) substance from the melting of metals.

Solar Energy: Produced by or coming from the sun.

Standard of Living: The way people live and whether their needs are met.

Subsistence Farming: Type of farming where only enough crops are raised to feed one's own family.

Sub-Saharan Africa: Those countries in Africa that are located south of the Sahara Desert.

Supplemental Heating System: A back-up system for heating, such as a wood stove.

Supply: The amount of a product available for purchase at a given price.

Tariffs: Taxes on goods coming into a country.

Technology: The system by which a society provides its members with those things needed or desired.

Tradition: A long-established custom or practice that has the effect of an unwritten law.

Transcontinental: Travel across an entire continent.

Transformation: The change in form or appearance from a source to a product.

Wind Power: Energy produced by the wind.

Wood Energy: Energy produced by burning wood.

ANNOTATED BIBLIOGRAPHY

BOOKS

Cottrell, Frederick W. Energy and Society: The Relation Between Energy, Social Change, and Economic Development. McGraw, 1955, 330 pages, $15.00.

Survey which examines the use of energy in low and high energy societies.

Halacy, D. S., Jr. Wind, Sun, and Water: Our Energy Alternatives. Harper, 1977, 192 pages, $9.95.

Easily read. The renewable resources of geothermal, water, tidal, sea thermal energy, wind, biofuels, and solar energy are presented for consideration.

Hammond, Allen L., William D. Metz, and Thomas H. Maugh II. Energy and the Future. American Association for the Advancement of Science: Washington, D.C., 1973, 184 pages, $3.95.

Gives an introduction to each of the present and possible future energy sources. It also covers energy conservation and energy policy.

Michigan United Conservation Clubs. Energy. P. O. Box 30235, Lansing, Michigan 48909.

Provides information on the nature of energy, sources and uses of energy and conservation. There are also some work sheets and ideas for helping others learn more about energy.

National Wildlife Federation. Energy. 1412 Sixteenth Street N.W., Washington, D.C. 20036.

A good eight-page overview of energy supplies, demands, types of sources and alternatives.

CURRICULUM MATERIALS

Bureau of Secondary and Elementary Education. Environmental Education, Energy - Society. (Grades 4-12) DHEW/OE, Washington, D.C. 20009. $3.50.

Numerous student learning activities for various grade levels based on behavioral objectives. Each provides the purpose, suitable level, related subjects and methods along with a resource list.

Coon, Herbert L. and Michele Y. Alexander. Energy Activities for the Classroom - 1976. ERIC Center for Science, Mathematics and Environmental Education, College of Education, The Ohio State University, 1200 Chambers Road, Third Floor, Columbus, Ohio 43212. 1976.

Resource booklet of energy teaching activities divided into grade levels: K-3; 4-6; 7-9; 10-12.

Crouch, William J. Energy Puzzles. Hayes School Publishing Company. Inc., Wilkinsburg, Pennsylvania. 1975, 18 pages, $2.50.

Eighteen spirit duplicating masters about energy sources. Good Basic information.

Curry, Wendell, et. al. Energy Crisis Teaching Resources. Oregon Board of Education, Salem, Oregon, 1973, 59 pages, (ED 085 316)

Many very useful activities to be used in stressing individual responsibility towards energy crisis problems.

Department of Energy, Technical Information Center. The Energy Challenge. (Grades 5-8) P. O. Box 62, Oak Ridge, Tennessee 37820. 1976, No charge.

Twenty-four duplicating masters of student activities about energy in the past, present and future. Teaching guide included with these six energy units.

Division of Science Education. Environmental Education: Strategies for Wise Use of Energy. North Carolina Department of Public Instruction, Raleigh, North Carolina. 27611, c. 1974.

Designed for use at all grade levels, therefore activities are grouped K-3, 4-6, 7-12. An appendix contains charts, glossary, bibliography, checklists.

Energy and Conservation Education: Activities for the Classroom. (Grades 6-8). Energy and Man's Environment. 0224 S.W. Hamilton, Suite 301, Portland, Oregon 97201. 1977, $25.00.

This is a comprehensive multi-disciplinary publication in a looseleaf binder with 58 specific activities each organized around the headings of title, concept, objective, time, subject matter, area, grade, implementation and materials.

Environmental Education Project. Energy. ESEA Title III, Section 306 Topeka Public and Parochial Schools, 1601 Van Buren, Topeka, Kansas 66612. (ED 093 649)

Objectives are listed along with activities that meet the stated objectives. Teachers select only those appropriate to the objectives for their students.

Fowler, John W. Energy - Environment Source Book. National Science Teachers Association, 1742 Connecticut Avenue N.W., Washington, D.C. 20009. 1975.

Designed for teachers who wish to incorporate a study of energy into their teaching. It is divided into two volumes each with many charts, tables and figures.

Materials Distribution, Center for Teaching International Relations. Teaching About Energy Awareness: 33 Activities. University of Denver, Colorado 80208. 1978, 179 pages, $7.95.

Most lessons include an introduction, objective, grade level, time and materials needed, procedures and student materials. Some good ideas for short lessons.

Minnesota Department of Education. Energy Activities for Junior High Social Studies. 640 Capitol Square Building, 550 Cedar Street, St. Paul, Minnesota 55101. 1977, No charge.

Seven well-done activities that can be easily simplified for use in upper elementary classes. Especially good for value clarification in relation to energy use.

Smith, Stephen M., Editor Energy - Environment Mini-Unit Guide, National Science Teachers Association, Washington, D.C. (ED 111,664)

Materials designed to stimulate decision making in young children and to make teaching more interdisciplinary. It is filled with many activities and guidelines.

Superintendent of Documents. Energy Conservation: Understanding and Activities for Young People. U.S. Government Printing Office, Washington, D.C. 20402. Stock #041-018-00091-7. 1975, 20 pages, $.85.

This is a booklet that provides brief background information followed by suggestions for activities and projects that can be adapted for teacher use. The topics are What Is Energy, Energy Conservation, and Uses of Energy.

U.S. Department of Energy - The following are interdisciplinary student/teacher materials in energy available through the U.S. Department of Energy, P. O. Box 62, Oak Ridge, Tennessee 37830, No charge.

Bringing Energy to the People: Washington, D.C. and Ghana. Grades 6-7. 1978, 63 pages.

Four lessons that are primarily oriented toward social studies. The climate, location, energy dependency and services of two countries are compared. Emphasis on map- and chart-reading skills.

Energy Conservation: Understanding and Activities for Young People. Grades 7-9. 1975, 20 pages.

This unit discusses the meaning of energy, its sources and limitations, and suggests conservation activities.

Energy, Engines and the Industrial Revolution. Grades 8-9. 1977, 82 pages.

This unit focuses on the period of 1700-1860 in the United States. The contribution of engines to the Industrial Revolution is described.

Energy History of the United States. Grades 7-8. 1978, 117 pages.

This unit charts the growth of American energy use and traces the history of the major sources of energy (coal, wood and oil) in the United States.

Mathematics in Energy. Grades 8-9. 1978, 64 pages.

This unit is designed to infuse energy concepts into math. It deals with conversions, various statistics and the manipulation of energy units, such as BTU's, watts and calories.

Organizing School Energy Contests.

Helpful brochure encouraging the formation of school energy contests. Guidlines are given as to the processes involved.

Tips for Energy Savers.

Helpful booklet filled with many useful and simple ways to save energy. Designed for individuals and families, but also contains a teaching guide for teachers to help students bring these tips to the concern of the family.

Transportation and the City. Grades 8-9. 1979, 46 pages.

This unit discusses the impact the automobile has had on small towns and how it influenced the growth of big cities, such as Los Angeles.

FILMS

Amron Nowak Association for Department of Energy. "Running on Empty - The Fuel Economy Challenge." 27 min., color, 1978.

This film deals with the automobile and ways to conserve energy.

Department of Energy, Office of Public Affairs. "Challenge of the Future." 29 min., color, 1978.

This film deals with the options that face the United States. A variety of different resources and the laboratories where they are being studied are examined.

Hugh Whittington for Department of Energy. "Energy - The American Experience." 28 1/2 min., color, 1978.

This film deals with energy from a historical perspective over the last 200 years. New resources are also discussed.

Owen Murphy Production. "Conservation - Investing In Tomorrow." 6:25 min., color, 1978.

This film deals with some of the ways we can conserve energy.

Owen Murphy Production. "Transportation - The Way Ahead." 7:45 min., color, 1977.

This film deals with America's dependence on the automobile and the future.

USDA Motion Picture Service for ERDA & U.S. Department of Agriculture - ARS. "Sun Power for Farms." 12:23 min., color, 1977.

This film deals with solar energy and its potential. It deals with various solar energy projects around the United States.

TEACHER'S GUIDE

THE CARTOON BOOK

Introduction

The purpose of the cartoon book is to introduce the objectives of the middle grades segment of the Energy Education Curriculum Project. It is through the use of the cartoon book that students will acquire the main ideas that are further developed in the other three units.

The use of a cartoon book format as an instructional tool is not new to education. Teachers have been using visual depictions, especially political cartoons, to teach concepts for many years. As developers interested in motivating students to learn more about energy, we feel that a cartoon book can help meet this objective. It is designed to be entertaining but at the same time encourage intellectual thought and discussion. We also feel that the cartoon book can facilitate student activitiy in the classroom, school and community.

Although the story takes place on another planet, the parallels to our own are obvious. We encourage you to help your students see the connections as well as make applications to their own lives.

The cartoon book introduces three basic objectives. They are: 1) knowledge, 2) participation and 3) imagination.

1) Knowledge

The knowledge objectives include three concepts related to energy. They are:

a) Interdependence
b) Energy Resources
c) Conservation

a) Interdependence is the idea that people and events affect our lives. How we live, what we think, and what we do is related to how other people live, how other people think and what other people do. Interdependence is also mutual need. We need other people and their resources. We need energy resources as well as the resources of our schools, homes, communities, our nation and our world.

b) "Energy resources" is defined as any sources from which we receive energy. There are man-made resources, human resources, and natural resources (all of which are related to energy resources.) Not everyone has access to the same resources and they are used and developed in different ways.

c) Conservation is the wise use of resources. Using less of an energy resource is one way to conserve. The efficient use of energy resources is another way.

2) Participation
The participation objectives focus on decision making skills. Throughout the cartoon book characters are seen participating in the process of individual as well as group decision-making.

3) Imagination
The imagination objectives encourage students to create and expand their thinking about energy, its use and alternative possibilities.

The Story

The story takes place on a fictitious planet called "Quantum". The basic theme of the story is what happens when the production and distribution of energy resources on the planet are halted. Because of this, people adapt their behavior to conserve energy. This situation proves to be a learning experience for all and one to which we can relate.

The story opens with a view of the planet. Quantum is much like Earth in that many people are overconsuming energy. This overconsumption is causing problems for there is concern about unequal distribution and the diminishing availability of energy.

To deal with this situation the people of Quantum have elected representatives to make energy decisions that will affect everyone. There exists a satellite called the "Interdependence" which orbits Quantum and serves to regulate the production, use and distribution of energy resources. The satellite is computerized and without it, large-scale energy use would be impossible.

The elected energy specialists who control the Interdependence are introduced. Their title is QuEST which stands for Quantum Energy Saving Team. Their job is to set energy use and distribution priorities for the coming decade. The members of the QuEST are:

1) "Mega Watts" -- This character is a scientist with great energy expertise.
2) "Dr. Drat" -- This character is alienated and angry because of the way energy is currently being used and distributed.
3) "Omni" -- This character is the imaginer. Through Omni we can explore different ways to view energy and alternative conservation strategies.
4) "Dyad" -- This character is our decision-maker and compromiser. Dyad helps us to see the process of gathering evidence, considering alternatives and facilitating bargaining and compromise.
5) "Zoic" -- This character represents environmental and conservation concerns.
6) "The Incredible Bulk" -- This character represents overconsumption.

We see them meeting aboard the Interdependence. They realize that they are wasting energy by traveling to the Interdependence every time they wish to meet. They decide to go to a system of meeting via multi-media panels. This way they can communicate with each other without leaving their homes.

QuEST continues to meet via multi-panels and their differing views on energy priorities become evident.

Zoic reflects about the conditions which existed on Quantum before the QuEST and the "Interdependence." Omni imagines about all the different meanings of the concept of energy.

Meanwhile Dr. Drat becomes so frustrated that he decides to construct a plot to take over the control of the "Interdependence." He tricks the other members of the QuEST so that they will not be available when he recomputerizes the "Interdependence" redirecting energy resources from the over-consumers to those in need.

As fate would have it, just as he starts to alter the flow of energy resources, a series of human and natural disasters renders the "Interdependence" inoperable. We now see Quantum without large scale energy resources.

At first there is chaos and panic. People are very dependent on energy and the crisis causes quite a shock. However, as time passes, people begin to cooperate and conserve. Their life-styles change and eventually they realize that alternate forms of energy can be used to meet their needs.

The QuEST meets again. At first they comment that their condition is only temporary for eventually the "Interdependence" will be repaired. Very quickly they realize that even when it is repaired, if they return to their old energy habits, they will be right back where they started.

The story ends with the QuEST recognizing that the people on Quantum have learned invaluable lessons about energy conservation from their crisis. They realize that the distribution and use of energy must be more equitable and efficient. Problems will always exist and solving them will not be easy. Everyone has learned a great deal, especially that conserving energy is a matter of changing people's energy habits.

Teaching Strategies

There are many learning opportunities in the cartoon book. The following suggestions are meant to serve as a guide for discussion and activity. We hope that you will build on these ideas and create learning activities which best meet your needs and particular classroom, school and community situation. These suggestions are also written so that students of varying abilities can successfully participate.

Pages 1-5 Main Ideas

1. Energy resources and use
2. Over-consumption
3. Interdependence
4. Differing opinions on energy priorities

Objectives

1. Students will be able to give examples of energy resources and use.

2. Students will be able to identify examples of over-consumption.
3. Students will be able to define the concept of interdependence.
4. Students will be able to identify the differing opinions on the use of energy as represented by the members of the QuEST.
5. Students will be able to apply these ideas to their own lives.

Instructional Strategies

1. Students could be asked to speculate about the nature of "Quantum" society as related to its dependence on energy. How is this society similar to our own? Ask students to write down examples of ways in which we depend on energy and discuss their ideas.

2. Have your students make two lists, one stating the benefits obtained from energy resources and the other disadvantages or negative results. Discuss the examples given in the cartoon book and those on their lists.

3. Help your students define the term "over-consumption." Alternative ideas could include the wasteful or over-dependency on energy intensive appliances. What are some examples of over-consumption shown in the cartoon book? Why is The Incredible Bulk an over-consumer? Relate this idea to things they are familiar with. What are examples of over-consumption in the classroom, school and community. Magazine advertisements often show examples of overconsumption. Students could make collages from these.

4. The satellite is called the "Interdependence." Have your students define the concept and explain why the satellite is so named. Next ask the students to pick out examples of interdependence from the cartoon book. How are the people mutually dependent on energy? How does the amount of energy available and the amount charged for its production affect the cost of energy to the consumer? Have your students ask their parents what it costs every month for electricy, gas and oil for their home. Has the cost changed in the last year? What about the price of gas for the car? How have price changes affected their life-styles?

5. The QuEST decides to meet via multi-media panels rather than travel to the "Interdependence." Do you think this actually saves energy? What are examples of using energy to save energy?

6. List on the board the names of the six main characters in the cartoon book. What are the problems involved in making group decisions that affect others? Have your students imagine that they are members of the QuEST. Have several students role play a QuEST meeting. After they have role played, ask the class to identify aspects of group decision-making such as stating positions, the use of evidence, negotiation and compromise. What have they learned about group decision-making and the problems involved in establishing energy policy? Relate this to the present situation in this country and the world. Why is it necessary to set energy priorites for the future now?

Pages 5-7 Main Ideas

1. Conflict
2. Imagination and the meaning of energy

Objectives

1. Students will relate the past conditions on "Quantum" to those potentially and currently on Earth.
2. Students will be able to imagine about the meaning and uses of energy.

Instructional Strategies

1. Zoic reflects on the history of Quantum before the "Interdependence" and the QuEST. Discuss with your students the feasibility of Earth experiencing wars over energy. Can they ever imagine a time when our world would go to an international energy policy board? What would be the advantages and disadvantages? What are their feelings about mandatory conservation laws? What laws would they want to see passed if any? How would they propose these laws be enforced?

2. Omni talks with others about the meanings of "energy." Using what he says as a base, have the students write down or share verbally "imagined" thoughts about energy. Students could do a survey of their schoolmates, other teachers and families, asking them what energy means to them. All ideas should be encouraged. The survey results could then be compiled. The point is that there are many different ways to think about energy.

Pages 7-12 Main Ideas

1. Decision-making
2. Conflict

Objectives

1. Students will be able to identify examples of decision-making.
2. Students will give examples of conflict over energy policy seen in the cartoon book.
3. Students will be able to relate these ideas to their own lives.

Instructional Strategies

1. Ask your students why Dr. Drat is so aggravated with the members of the QuEST. Why is it so difficult for the QuEST to make decisions? Relate this problem to an example occuring now such as the debate over gas rationing.

2. Dyad doesn't want to act without consulting the others. Dr. Drat has decided to take charge himself. What are the advantages and disadvantages of group decision-making and individual decision-making?

3. Dr. Drat decides to "take from the energy rich and give to the energy poor." Discuss with your students the unequal distribution of energy resources on Earth. Some students could be encouraged to do research

on a country where energy is not readily available. How are lifestyles different from our own? Ask the students to offer suggestions for making more energy resources available to those in need. Discuss the problems of cost, transportation and adaptation from country to country.

4. Given our present situation on Earth, it is highly unlikely that one set of circumstances could occur to halt the production, use and distribution of energy resources. However, even though Quantum's situation is fictitious, it is one we can learn from. Discuss with your students how circumstances over which we do not have control can affect us and force us to deal with energy shortages. Factors such as wars and revolution, lack of supply, price, lack of knowledge, embargoes, strikes, etc., do affect us. How do they feel about these situations? Have your students write their own scenarios about what would happen on earth if energy was not available. How do they think people would react?

Pages 13-16 Main Ideas

1. Decision-making
2. Conservation
3. Cooperation

Objectives

1. Students will be able to pick out examples of individual and group decision-making about energy use.
2. Students will identify examples of cooperation and conservation.
3. Students will offer suggestions of ways they can conserve energy.
4. Students will summarize what the people of Quantum are learning from their experiences.

Instructional Strategies

1. Have your students identify the conservation measures being taken on Quantum. Have your students offer additional conservation strategies that they could use. What are the costs and benefits of conservation? How has life changed on Quantum and can they see these changes occurring in their own communities?

2. The people on Quantum believe that their situation is only temporary. Do you think our current energy situation is temporary? What happens to Quantum remains an open question. Have your students work individually or in groups to write a continuation of this story. What will happen if the "Interdependence" is not repaired? What will happen if it is?

3. The main point on the last page of the cartoon book is to help students realize that people make the difference. Decisions about energy use and resources are ours to make. What are the QuEST and Quantumites learning from their experiences? How is The Incredible Bulk acting as a model? Have your students outline their own energy conservation strategies. How can they

convince others in their school, family and community to conserve energy? Help them write strategies to do so. Check with your students every week on their progress. Discuss with your students the costs and benefits of conservation.

Additional Activities

Objective

1. Students will create their own learning opportunities from the cartoon book.

Instructional Strategies

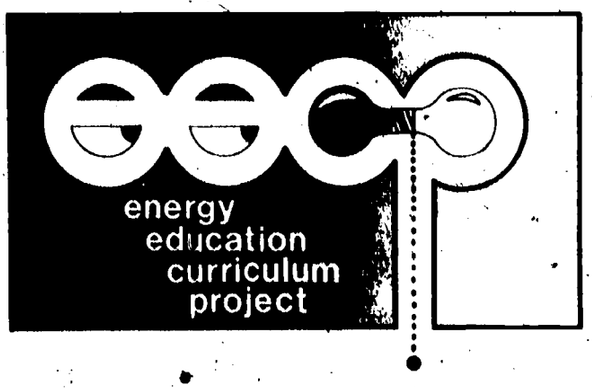
1. Have your students draw their own cartoon pictures or stories, either with their own characters or those from the cartoon book. How are their stories similar and different from the energy situation on Quantum? On Earth?

2. Ask your students to pick one of the characters in the cartoon book and write a story describing their energy habits and lifestyle. What attitudes about energy use, production and distribution does their chosen character represent?

3. Discuss with your students what would have been the future on Quantum had the "Interdependence" not broken down. What decisions would have been made by the QuEST and how would they have been implemented? Relate this to the implementation of the U.S. and other countries' energy policies.

There are several terms used in the cartoon book that your students may need help with. Discuss with your students these terms and the meanings they have as related to the story.

1. abundant - well supplied, more than sufficent
2. abuse - to misuse, to hurt by treating badly
3. consumption - the using up of resources, goods or services
4. disable - to make unfit for use
5. inhabitant - a permanent resident
6. institute - to set up, to construct. A place specializing in advanced study in technical subjects.
7. pyramid - any structure with a square base and four sloping triangular sides meeting at the top, as those built by the ancient Egyptians for royal tombs. Some people believe that the pyramid shape signifies power.
8. restore - to bring back to a former or normal condition
9. system of distribution - how goods, resources or services are divided among people and regions.



Energy and Colonial America

LESSON ONE: YOU IN COLONIAL AMERICA

TEACHER'S GUIDE

Introduction:

These three lessons are designed to fit into the regular curriculum when Colonial American history is the content area. Using this focus students will apply the concepts of interdependence, energy resources and conservation to Colonial America. Students will also relate these ideas to today.

This first lesson covers the three concepts mentioned and asks students to use their imaginations in considering what it would be like for them if they had lived during the Colonial time period. Students will become aware of energy dependence and interdependence and how it relates to their lives today. Students will be asked to explore their own opinions about energy use during the Colonial period as compared with today.

Objectives:

1. Students will be able to imagine what their lives would be like if they had lived during the Colonial period.
2. Students will be able to compare the energy resources available during the Colonial time period with those of today.
3. Students will be able to recognize the interdependence among family members and the natural environment during the Colonial period.
4. Students will be able to compare and contrast dependence and interdependence on energy resources during Colonial times with today.

Time: One to two days.

Instructional Strategies:

1. Review with your students those areas of North America that were claimed by many European countries. Focusing on the English colonies, ask your students to state things we have in our culture that have been passed down. Things such as family traditions, religion, language, belief in democratic freedoms and our economic system could be examples.
2. As an extension of Activity #2 you may wish to have some students trace their own family heritage and share their findings with the class. Some students might do research on a particular culture which has passed down its heritage. Germans, Dutch or particular English families could be investigated. A few days before this lesson and activity

ask your students to find out about their family history if they can. If they do not know and cannot find out, have them make up a family tree.

3. In Activity #2 students are asked to use their imaginations about what their lives would be like if they had lived during the Colonial time period. Help students to make possible connections to their own family members as well as make up jobs and lifestyles that would be appropriate. For example, a student's father may like to work with his hands or with wood. If he had been living during the Colonial time period he might spend a lot of time making furniture or building onto their Colonial home.

4. Discuss with your students all the jobs Colonial Americans had to do. They had to depend to a great extent on human energy. How would their lives be different than they are today? In the discussion students should become aware of the interdependence that existed for Colonial families.

5. Relate this idea to the dependence that Colonial Americans had with their natural environment. Students should be able to make a list of Colonial America's energy resources.

6. You might wish to obtain drawings of Colonial American scenes showing the use of these energy resources. Students could be asked to examine these drawings pointing out the energy resources being used. Using these drawings students could discuss the dependence that existed on resources found in their immediate environment.

7. Discuss with your students the differences and similarities of Colonial energy resources and those available today. In what ways are the similar resources used, produced, and distributed differently? How have their lives been affected by the production, use and distribution of the current energy resources such as electricity and nuclear power?

8. You could go one step further to talk about the future of energy resources production, use and distribution. If you have used the cartoon book "Quantum Conserves" you could use some of the ideas covered there. Some students may wish to do research on future energy resources comparing and contrasting Colonial life with the future as well as present conditions. How will lifestyles change given future energy possibilities and use?

9. Activity #5 will help the students become aware of our energy dependence and interdependence today. Using the Colonial time period as a reference point, they will see the similarities and differences. Discuss with your students the benefits and disadvantages of Colonial life and life today as it relates to energy availability and use. Encourage them to think about how life has changed because of energy resources.

10. As an extension activity students could do research on hours spent and energy used doing tasks in Colonial America. They could construct a time-study chart for then and now to see how time is related to energy resources and use.

Student Assessment: Correct answers for the assessment instrument for "You in Colonial America" are:
1. A, 2. B, 3. B, 4. A, 5. B, 6. C

STUDENT ASSESSMENT

ENERGY AND COLONIAL AMERICA

Lesson One: You in Colonial America

1. The main energy source for heating and cooking in colonial America was

   A. wood.
   B. solar.
   C. coal.
   D. oil.

2. Compared to families in America today, families in colonial America used

   A. less animal energy.
   B. fewer energy sources.
   C. less human energy.
   D. more energy sources.

3. Which of the following is the best description of interdependence between families and the environment in Colonial America?

   A. Families were independent and did not require energy resources.
   B. Families were very dependent on energy resources found in their immediate area.
   C. Families were very dependent on energy resources found in other countries.
   D. Families were independent and used only their own human energy.

4. What sources of energy were available to settlers?

   A. wood and water
   B. coal and wood
   C. animal and steam
   D. human and coal

5. Which of the following is an example of family independence in Colonial America?

   A. Families needed each other.
   B. Many things needed for survival were produced within the family.
   C. Families traded or purchased products within their community.
   D. One family's actions affected the community.

6. The chief source of light in Colonial America was

   A. light bulbs.
   B. wood fires.
   C. animal fat.
   D. coal lanterns.

LESSON TWO: ENERGY RESOURCES: MANUFACTURING AND TRANSPORTATION IN THE COLONIES

TEACHER'S GUIDE

Introduction:

Lesson Two will help students become aware of the importance of energy resources in the growth of the American Colonies. Energy resources is the main concept taught. There are no prerequisite skills needed for this lesson. A basic knowledge of Colonial life and the lack of technology there would be helpful.

Objectives:

1. Students will learn about the growth of manufacturing in the American Colonies.
2. Students will be able to identify inhibiting and promoting factors of industrial growth.
3. Students will recognize the importance of energy resources in promoting the growth of manufacturing in Colonial America.
4. Students will learn about transportation in the Colonies.
5. Students will compare energy resources used for travel in Colonial America with those of today.

Time: One to two days.

Instructional Strategies:

1. Activity #1 is designed to help students think about how energy used for manufacturing affects their lives. What things they play with is only one example. Your students could be asked to write down what other manufactured products they use every day and what energy resources are needed for their production.
2. Activity #2 is a hypothesis forming exercise. Encourage your students to think of all the reasons they can why manufacturing was slow to develop in the Colonies. As an extension exercise students could do their own research on these or even trace the development of a particular industry started during Colonial times. Possible industries could include the weaving, hatmaking, shoemaking or baking industries.
3. Discuss with your students those factors limiting and aiding the growth of manufacturing in Colonial America. You may need to explain these factors in greater detail. Emphasize

the interdependent nature of these factors. Review with your students the few energy resources available to Colonial Americans and discuss how this was a major factor inhibiting industrial growth.

4. Go over the puzzle answers for Activity #3. Ask students to give examples of the factors limiting and aiding growth. What raw materials would be important? Ask them to make a list or verbally suggest those energy resources that they feel would contribute most to industrial development. Would they include fuel, and if so why. Discuss the importance of energy resources to the growth of manufacturing.

5. Ask your students to select a country today that does not have easily available energy resources. Avoid the stereotype of a "backward nation." Many Asian, African and Latin American countries are developing. Much of their ability to develop an industrial capacity rests on the fact that energy such as petroleum is very expensive today. We had coal, which was cheap, even by past standards. Have your students research a country's energy needs and the problems they are experiencing because energy resources are not available. Students should share their findings with the class. Again, reinforce the importance of energy resources to development.

6. The section on "Colonial energy resources and industrial growth" focuses on the mining industry and the use of water power in the mill industry. Other small industries could be investigated, such as ship building, the transportation of agricultural products and the beginnings of the textile industry. This will take them into the early 1800's but will reinforce the importance of energy resources and development.

7. Students could be asked to think about how the development of manufacturing, as small as it was during the Colonial times, affected the desire and ability of the American colonists to declare their independence in 1776. Wanting to be able to produce more of their own goods and being able to obtain cash from the goods they did manufacture and export, contributed to the spirit of independence.

8. Activity #5 could be expanded to include world travel or traveling they do with their families. They could be asked to relate the idea of energy resources and transportation to the products they can buy in a store. Their community's dependence on transported goods could also be discussed. Future possibilities of energy resources used in travel could be investigated, i.e., the electric car. How would this innovation affect them and the world situation.

Student Assessment: Correct answers for the assessment instrument for "Energy Resources: "Manufacturing and Transportation in the Colonies" are:
1. D, 2. C, 3. D, 4. B, 5. D, 6. B

STUDENT ASSESSMENT

ENERGY AND COLONIAL AMERICA

Lesson Two: Energy Resources: Manufacturing and Transportation in the Colonies

1. Compared to today, transportation in Colonial America could best be described as

   A. less difficult.
   B. more dependent on oil.
   C. less dependent on animals.
   D. more time consuming.

2. A Colonial American wanted to start a manufacturing business. Which of the following was available to help the business?

   A. good transportation
   B. technical know-how
   C. demand for manufactured products
   D. mercantilism

3. A Colonial American wanted to start a manufacturing business. Which of the following made that difficult?

   A. great demand for manufactured products
   B. desire to be less dependent on England
   C. increased immigration
   D. few sources of cheap energy

4. The trade relationship between the Colonies and England was called

   A. technology.
   B. mercantilism.
   C. immigration.
   D. manufacturing.

5. The energy resource used in manufacturing iron during Colonial times was

   A. water.
   B. steam.
   C. bloom.
   D. charcoal.

6. The mining industry grew in Colonial America because of the availability of

   A. ships.
   B. charcoal.
   C. grist.
   D. water.

HIDDEN WORD PUZZLE:

LIMITS TO THE GROWTH OF COLONIAL MANUFACTURING

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

HIDDEN IN THIS PUZZLE ARE THE UNDERLINED WORDS FROM ACTIVITY #3. THEY MAY GO FORWARDS, BACKWARDS, UP, DOWN, OR EVEN DIAGONALLY. CAN YOU PICK THEM OUT?

5

HIDDEN WORD PUZZLE:

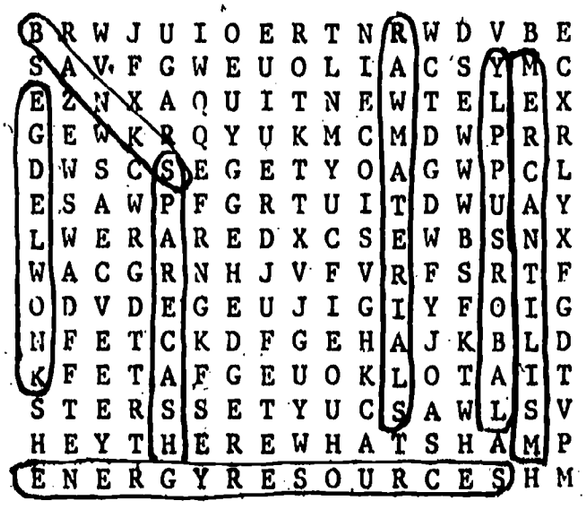
AIDS TO THE GROWTH OF COLONIAL MANUFACTURING

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

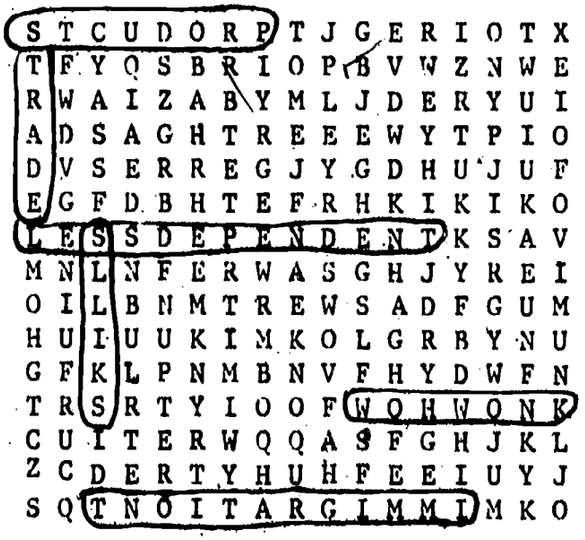
HIDDEN IN THIS PUZZLE ARE THE UNDERLINED WORDS FROM ACTIVITY #3. THEY CAN GO FORWARDS, BACKWARDS, UP, DOWN, OR EVEN DIAGONALLY. CAN YOU FIND THEM?

KEYS

① FOR PUZZLE ON LIMITS...



② FOR PUZZLE ON AIDS...



LESSON THREE: SELF-RELIANCE

TEACHER'S GUIDE

Introduction:

This lesson employs the concept of self-reliance in obtaining energy resources and conservation during the Colonial period. Students will become aware that although Colonial Americans had to depend on their natural environment for energy resources, they were self-reliant. Colonial families had to depend on themselves to obtain the needed energy resources. Also in this lesson, students will learn about group decision-making. Students will have an opportunity to practice group decision-making and relate those skills to energy conservation strategies today. There are no prerequisite skills needed for this lesson although role playing experience may be helpful.

Objectives:

1. Students will learn about the concept of self-reliance.
2. Students will relate the concept of self-reliance to energy use during the Colonial period.
3. Students will apply the concept of self-reliance to energy conservation.
4. Students will learn the steps of group decision-making.
5. Students will make group decisions concerning energy use today.

Time: Two to three days.

Instructional Strategies:

1. Discuss with your students ways in which they are self-reliant today. Point out the importance of this value and the reasons for its practice in Colonial times. Examples of self-reliance in Colonial America can include a family providing for their own food, making their own clothing, chopping their own wood for heat, and clearing their own farm land.
2. Go over the steps of group decision-making with your students. Using the family car situation discuss with your students the steps the family takes. Ask students to provide cases from their own personal experience about decisions they have made using one or more of these steps. Raise an issue with students, possibly one the student council is considering, which reflects a great deal of differentiation across students. Talk with them about the complexity of making a group decision, given the differences in preferences and priorities.

3. Next introduce your students to the role play activity in Activity #4. You may have to help them get into groups and adapt roles. If you wish you may write up descriptions about the family members for each group. These can be the same or different for each group. It may help to give personalities to the Colonial family members to help the students get started with their group decision-making. For example, different family members may want to do some of the tasks on the list but start out refusing to do others. Fathers or Mothers may take leadership roles and try to "assign" the children certain tasks. Emphasize that everyone should have a say if the "group" decision is to be truly group oriented. Conflict may develop but the students should try to work it out. When the students have finished, discuss with them how each role play worked out. Help the students realize the difficulties that can arise and the benefits to be gained in the process of group decision-making.

4. Discuss with the students the different types of energy required for these tasks and their answers to the questions in Activity #4.

5. Have your students participate in another role play and group decision-making exercise for a family today. How energy is used in a family will help them practice group decision-making as well as become aware of conservation opportunities. The questions that accompany Activity #5 will provide students with opportunities to examine their own thoughts about energy dependence, self-reliance and interdependence. Question #7 can be used to have your students develop conservation strategies for their classroom, school, home and community. Students could be encouraged to come up with suggestions of ways to implement their ideas. They could write letters, talk with administrators and other students and/or draw up plans and implement conservation in their homes. Energy savings resulting from their participation should be noted. The benefits and costs of such conservation should also be discussed. How are their efforts at conservation demonstrating the concept of self-reliance.

Student Assessment: Correct answers for the assessment instrument for "Self-Reliance" are:
1. A, 2. B, 3. B, 4. B, 5. C, 6. C

STUDENT ASSESSMENT

ENERGY AND COLONIAL AMERICA

Lesson Three: Self-Reliance

1. Self-reliance in Colonial America is best shown in which of the following examples?

   A. A family came to the colonies to "make it on its own."
   B. A farming family shared tools with other farmers.
   C. A craftsman came to the colonies to receive free supplies.
   D. A family came to the colonies for religious freedom.

2. Colonists can be described as self-reliant because

   A. they were given free energy resources.
   B. they had to depend on themselves to get energy resources.
   C. electric companies provided heat and light.
   D. England provided transportation to the colonists.

3. A newly settled family had to decide how much wood they were going to cut for use in the winter. They asked their neighbors how much wood they had used the previous winter. This action is an example of

   A. making a choice.
   B. gathering information.
   C. examining the consequences of a decision.
   D. stating alternatives.

4. Compared to today, the colonists were

   A. less self-reliant in their energy use.
   B. more self-reliant in their energy use.
   C. more dependent on technology.
   D. more dependent on energy resources from other countries.

5. Which of the following energy resources were available to Colonial Americans?

   A. animal, wind, coal
   B. animal, water, oil
   C. human, animal, water
   D. human, water, coal

6. Which of the following questions involve stating alternatives?

   A. How much wood do we need for the fire?
   B. Who wants to compromise?
   C. What other source of energy is available?
   D. How much energy will the fire produce?

ENERGY AND COLONIAL AMERICA
ADAPTATION LESSONS FOR
SCIENCE, LANGUAGE ARTS AND PRACTICAL ARTS

These adaptation lessons are designed to facilitate cooperation among teachers on energy education. The first set of adaptations focuses on our dependence on energy resources. The second set deals with the concept of self-reliance and energy conservation. The third helps students to recognize how energy resources affect the industrial growth of a society and how that in turn affects life styles.

ADAPTATION LESSON: DEPENDENCE ON ENERGY RESOURCES

Idea. The idea in these lessons is to help students recognize the importance of energy resources in their own lives. This dependence, as well as the degree of dependence, will help students become more conscious of how they use energy resources.

Objectives:

1. Students will be able to identify energy resources they depend on.
2. Students will be able to recognize the degree of this dependence and how it affects their lives.

Science Classes. Science classes can provide unique opportunities for students to learn about energy resources. To help students understand how energy resource availability has changed, provide them with the list of energy resources used during the Colonial period from Lesson #1 of this chapter. Ask students to compare these with those available today. What are the impacts on the natural environment of the use of today's energy resources? Students could list ways they are dependent on energy resources and compare the dependence on the environment for the Colonial family and families today.

Language Arts. Colonial literature depicting life in the 1600 and 1700's can provide an opportunity for students to identify energy resources available at the time. Current literature can be used as well. Students could compare the energy resources available as well as the dependence. Ask students to write a play with characters from Colonial times and today talking to each other about energy resources. They should keep in mind the comparisons and contrasts of society's dependence on energy resources for the two time periods. Students could also debate the topic of: The United States should become less dependent on foreign energy resources.

Practical Arts. Ask students to identify the energy resources they depend on today. What appliances and machines do they depend on that use energy resources? Have students construct or make something without the use of electric tools or a machine. For example, students could learn to spin thread and weave cloth, build a bookcase without electric power tools, dye cloth with natural ingredients, cook over an open fire or even do laundry by hand. How have today's energy resources changed the way people live? Do they think this dependence is beneficial and what are the costs?

ADAPTATION LESSON: ENERGY RESOURCES: MANUFACTURING AND TRANSPORTATION

Idea. These adaptation lessons focus on the idea of industrial growth and transportation as related to the energy resources available. Students will compare the lack of energy resources during Colonial times to those we have today. Students will recognize the importance of energy resources in the development of manufacturing capability and transportation.

Objectives:

1. Students will recognize the importance of energy resources to the development of manufacturing and transportation in a community, our country and the world.

Science Classes: Select one energy resource and have your students trace its use and development from its beginning. What technological adaptations have been made and how have scientific developments contributed to the growth of industry and transportation in this country and world? What future scientific breakthroughs can your students identify that would benefit industry and society in relation to the use, production and distribution of energy resources. For example, discuss the innovation of the electric car. Students could be encouraged to do research on such technology and how these efforts will affect our ability to produce and use energy resources more efficiently.

Language Arts: There are many pieces of Colonial literature that focus on the lifestyles of people as related to the jobs they do and the technology available at the time. From a story they read, ask your students to compare lifestyles during Colonial times with another time period. How have available energy resources affected how people live? How have energy resources changed the jobs people hold? What is the relationship between the growth of industry and lifestyles?

Have your students write a story about traveling in the Colonies. Encourage them to imagine what it would be like and write a creative piece. How does what they write relate to the use of energy resources and transportation facilities?

Pratical Arts: Students should select one invention or commonly used technique that has facilitated industrial growth. Have students identify the energy resource used and how energy has changed the way people live. Tools, home appliances and other labor-saving devices could be examined in relation to the use of energy resources and lifestyles.

ADAPTATION LESSON: SELF-RELIANCE AND ENERGY CONSERVATION

Idea. The main idea in these adaptations is for students to recognize how the concept of self-reliance can be applied to energy conservation strategies. Students will examine advantages and disadvantages of self-reliance and conservation.

Objectives:

1. Students will be able to define the concept of self-reliance.
2. Students will be able to apply that concept to energy conservation.
3. Students will examine the advantages and disadvantages of self-reliance and energy conservation.
4. Students will develop conservation strategies.

Science Classes. The first two sections from Lesson Two of this chapter on "Self-Reliance" and "Energy and Self-Reliance" can be used to introduce the concept. Using a list of energy resources available today, ask students to state ways in which they can become more self-reliant.

Have students make soap, the kind that was used during Colonial times. They will need to do research on making charcoal and leaching it to obtain the lye to be mixed with animal fat. What are the chemical processes involved in making soap? Have students compare this process with the process of making soap today. If possible, obtain the chemicals and make soap used today. How have energy resources and the availability of chemicals produced through the use of energy resources changed the soap industry? Contrast the idea of self-reliance in making your own soap and the dependence on energy resources today. How can conservation decrease this dependency?

Language Arts. Using stories from the Colonial period, have students identify examples of the concept of self-reliance. Ask students to identify ways in which people in the story were self-reliant as related to the production, use and distribution of energy resources. Using a story from current times, compare energy resources and self-reliance. How has it changed? How have people's lives changed? Ask students to identify conservation strategies that could increase self-reliance. What would be the advantages and disadvantages for themselves, the nation, the world?

Practical Arts. Help students identify tools and household equipment used during the Colonial period. Compare these with appliances used today. How has self-reliance changed through the use and availability of energy consuming products? Have students calculate the amount of energy home appliances consume. Students should explore ways in which conservation strategies would conserve energy and enable individuals to be more self-reliant. What would be the advantages and disadvantages to such conservation? How would this conservation increase America's self-reliance? How does the use of energy in a family affect the family budget?

ENERGY AND COLONIAL AMERICA

LESSON ONE: YOU IN COLONIAL AMERICA

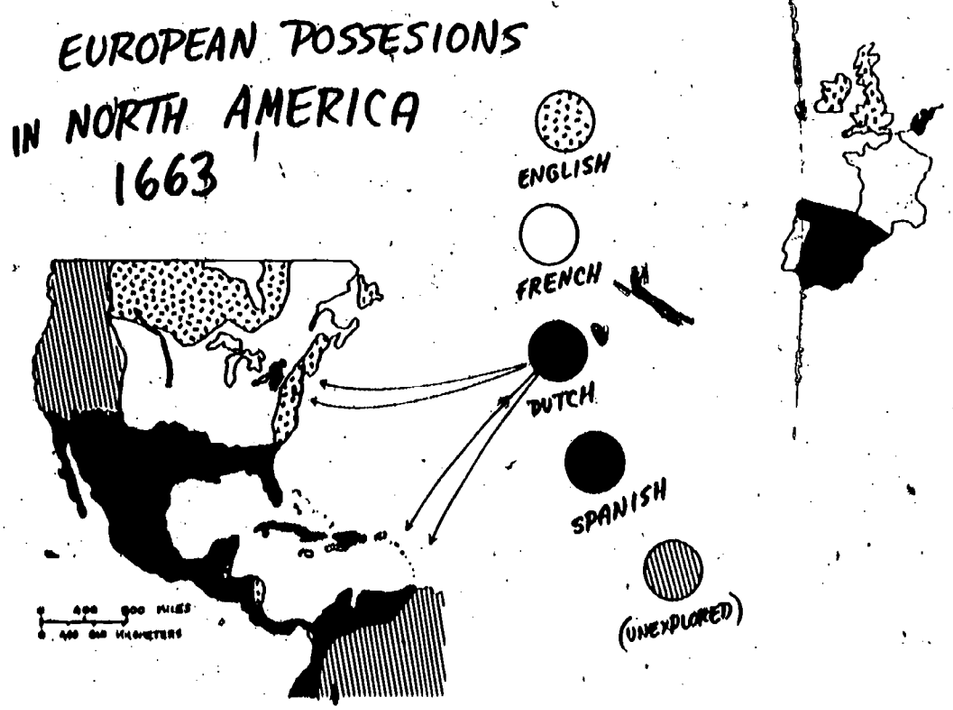
Lesson Objectives

- To imagine about life in Colonial America
- To compare energy resources during the Colonial period with those of today
- To recognize the interdependence among family members and the natural environment during the Colonial period
- To compare and contrast dependence and interdependence of energy resources during Colonial times with today.

ACTIVITY # 1

During the 1600's and 1700's many people came from all over the world to settle in the "new world." North America was claimed by many countries. Look at Map #1. On a piece of paper write down what kind of energy you think was used to bring people to North America. How long do you think it took using this or these forms of transportation? Now write down the kinds of energy used to bring people today. How long does it take today? How has the use of energy with transportation changed, and what are some of the results of these changes?

MAP # 1

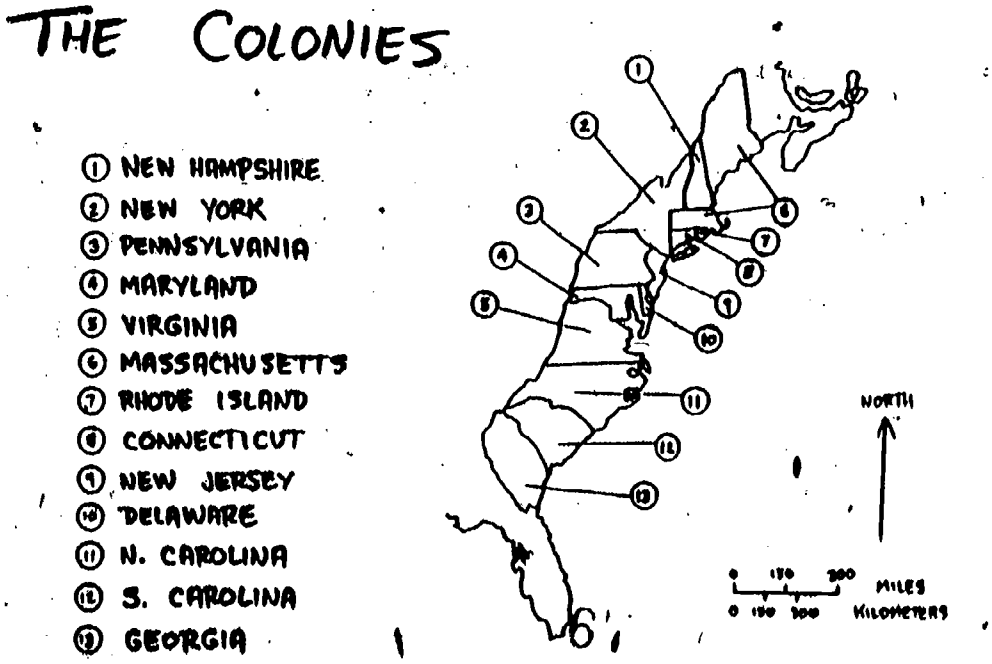


THE THIRTEEN COLONIES

The thirteen colonies were governed by the English officially until our Declaration of Independence in 1776. Map #2 shows the thirteen colonies. Although the thirteen original colonies were governed by England, many other European people settled there. Native Americans were already living here and their lives changed when the Europeans came. In addition, people from Africa were brought to the colonies as slaves. Those who came willingly came searching for religious freedom, land, profit and a chance to start a new life.

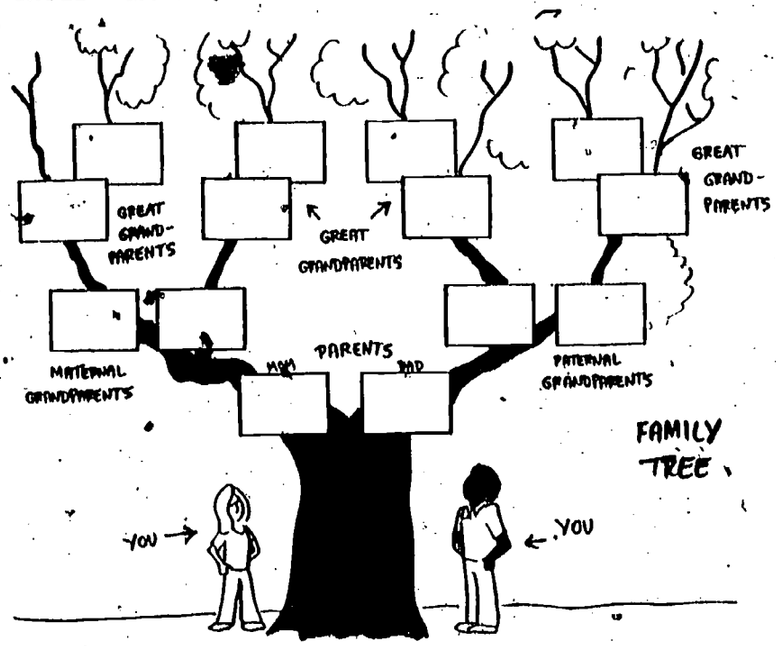
How the colonial people lived is part of our American heritage. Think for a moment about heritage. Heritage is like history, for it deals with the past. However, heritage is more than just events of the past. It includes the traditions and customs that have been passed down from generation to generation. The people who came to the colonies brought with them languages and religions that are still with us today. For example, the people from England spoke English which we still speak today. The ideas and habits of your past family members are also part of our American heritage.

MAP # 2



ACTIVITY # 2

Imagine for a moment what your life and the lives of your family members would be like if you lived during the Colonial period. One way to help you imagine this is to construct a family tree. Using this "tree" as a model draw one on a piece of paper. Fill in the names of your family members as far back as you can remember. Or, make up a family for yourself and put their names on the tree.



Think about your immediate family members and the things they do now. What do you think they would be doing if they lived back then? Project your family of today back to colonial times. Take each member of your family and make up a statement about his or her life as if they and you were living in Colonial America. Remember, things such as jobs and lifestyles were very different then. Most people were small farmers. Some owned shops, some were wealthy, while some worked for others. Did your family live in the New England Colonies, the Middle Colonies or the Southern Colonies? Who would obtain food and how, who would spin the thread to weave cloth, who would collect firewood, do the cooking, teach others to read? What did your family do for entertainment? For example, say your father today likes to work with wood. Maybe he would be a carpenter or would be adding on to your house in the colonial times.

COLONIAL INTERDEPENDENCE

While imagining about your family living in Colonial America you thought about tasks that were divided up among family members. Each person in your family was dependent on others to do the things necessary for survival in Colonial America. This is an example of interdependence. Families in Colonial America were interdependent because they needed each other. What one member did affected others. Families were also interdependent within a community. Although many of the things needed for survival were produced in the home, people within communities shared and exchanged for things they were not able to produce themselves. The extent that people traded or purchased products depended upon where they lived. Some of the things needed could be bought from England but, for the most part, those were the luxuries.

Just as individuals and families were dependent on each other, so too were they dependent on the environment. People had to obtain the necessities from what was available to them.

ACTIVITY # 3

On a piece of paper write down what things from nature you think were used to produce the following necessities:

HEAT -
LIGHT -
SHELTER -
CLOTHES -
TRANSPORTATION -

Share your ideas with the other members of the class. How were these things in the natural environment obtained? Also, write a paragraph about the dependence of Colonial Americans on their natural environment for survival.

COLONIAL AMERICA'S ENERGY RESOURCES

Energy resources available to Colonial America were very limited. Water power was an important resource used to run paddle wheels. These wheels turned other wheels which provided energy to grind corn and wheat. River currents were used to transport goods on rafts and barges. Horses were also used to pull river barges. Wind power drove ships that also moved Colonial exports and imports.

A type of charcoal that could be obtained from wood was used for heat. Charcoal was produced by burning wood at high temperatures and low oxygen. However, wood was the main energy resource for heating and cooking. Human energy was of prime importance in Colonial America. Men, women and children labored long hours in the fields and home to produce the necessities of life. Animal energy was also used. Horses, mules, oxen and cattle pulled plows and wagons. Animals also provided transportation and drove other equipment to produce energy. Candle power provided most of the light for homes. Candle wax was made from boiled animal fat. In some areas, especially in New England, whale oil was used in lamps.

Let's follow a typical morning of a Colonial family and see how they used energy. Elizabeth is the mother of five children. She arises first this spring morning just as the early rays of the sun begin to peek through the window. She takes small pieces of wood to light a fire for the morning breakfast. Her husband, John, takes an empty bucket to the nearby stream and returns with water. He then milks the family cow, feeds the chickens and "washes up" while Elizabeth prepares porridge (oatmeal) for breakfast. Dried apples stored in a burlap bag in a hole in the

ground are also served for breakfast. The older children begin their chores by feeding the horses and cows and cleaning the barn. The eldest two boys will help their father plant today. With a pick, shovel and hoe they follow their father to the field. There they attach the horse to the plow. While their father walks behind the horse and plow, the two boys break up large chunks of dirt and remove rocks.

Elizabeth and one of her daughters also begin their chores. Melanie is learning how to spin wool into thread using a spinning wheel. The thread will then be weaved on a hand loom into cloth. The cloth will then be sewn by hand into clothes for the family.

Elizabeth tends to the younger children and then begins a project that will take all morning, making candles and soap. Animal fat, when boiled over open fire, is called tallow. Thread is tied onto sticks and these wicks are hand dipped into the tallow again and again. As each coat of tallow dries another dipping adds another layer to the candle. The heated animal fat is also used to make soap. Soap is made from heated animal fat and lye. Lye comes from leaching wood ashes. Water is dripped through wood ashes and this liquid is added to the animal fat. The mixture hardens and then is broken into bars. By noon it is time for another meal. It will have to be "left overs" today for everyone has been too busy for major cooking efforts. Still, the wood pile is getting lower; and someone will have to chop more before the day is over.

ACTIVITY # 4

Read the story again. What sources of energy can you find? How is energy used to produce other things? Discuss your ideas with your classmates.

COMPARING AND CONTRASTING COLONIAL AMERICA AND TODAY

Fortunately for all of us today we do not have to spin our own thread, make our own candles or depend solely on wood to heat our homes. In this way our lives are very different today than they would be if we lived during the Colonial period. Our lives today are also very different in relation to dependence on natural resources, especially energy resources.

ACTIVITY #5

Here is a list of energy resources we depend on today. Copy the list on a piece of paper. Put a check next to the energy resources that were available during the Colonial period.

TODAY	COLONIAL AMERICA
natural gas	_____
coal	_____
oil	_____
wind	_____
water	_____
solar	_____
nuclear	_____
tidal	_____
hydro-electric	_____
wood	_____

Which ones did you check? Can you think of any that the Colonial Americans depended on that we do not today? Name them and share your ideas with your classmates.

_____

_____

DEPENDENCE AND INTERDEPENDENCE

Just as energy resources are very different today than they were during Colonial America, there is one major energy similarity. That similarity is that we are still very dependent on energy resources and

the products that we can produce from our natural environment to provide us with the energy we need. In fact, we are very interdependent. We depend on others to supply us with energy resources, and others depend on us to purchase energy as well as supply products produced from the energy we consume. Interdependence today, like that of the family during Colonial times, means that we must depend on others and the things around us. Interdependence also includes the idea that other people and other events affect us. What we do also affects others.

ACTIVITY # 6

Go back to your family tree and the jobs of your Colonial family members. In a page or two write the answers to the following questions, comparing and contrasting your Colonial family and your family today. Discuss your views with other members of your class.

1. In your opinion, is your Colonial family more or less interdependent with raw materials found in the environment than your family today? How?

2. In your opinion, is your Colonial family more or less dependent on energy resources than your family today? How and why?

3. What benefits do you see to the lifestyles of Colonial Americans with regards to dependence on energy resources?

4. What disadvantages do you see to the lifestyles of Colonial Americans with regards to dependence on energy resources?

5. Would you like to have lived back then? Why or why not?

ENERGY AND COLONIAL AMERICA

LESSON TWO: ENERGY RESOURCES: MANUFACTURING AND TRANSPORTATION IN THE COLONIES

Lesson Objectives

- To identify how energy was used in manufacturing in the Colonies
- To identify limits and aids to the growth of manufacturing in the Colonies
- To compare and contrast the use of energy for transportation in the Colonies with today.

ACTIVITY # 1

Think about the ways you spend your free time. What "things" do you play with? Do you like to ride your bicyle, play with computer games or play pinball? Make a list on a piece of paper.. Are these things that you play with manufactured? If so, think about how they are made.

Now pretend you are living in Colonial times. Think about how your free time would be spent differently if you lived back in the 1700's. What toys would you play with then? How has energy used for manufacturing changed the way you spend your free time? Talk with your classmates about these ideas and keep the differences in mind as you learn about manufacturing in the Colonies.

MANUFACTURING IN THE COLONIES

Industrial life in Colonial America was slow to develop. This was only natural in a wilderness or frontier community where the prime objective was basic survival. Farming, therefore, was most essential and the easiest way to make a living. The farmer was a "jack-of-all trades," including a carpenter, mechanic, primitive engineer, tanner, hunter and trapper. The farmer's spouse was equally as versatile

around the house or farm, making soap, candles, butter, clothing and the like. Since farmers were able to provide for these basic needs, large manufacturing enterprises took longer to be developed.

On a small scale, however, goods were produced for sale in the Colonies. Artisans, people with skills in a trade, came to the Colonies to set up many kinds of small business. Bootmakers, weavers, blacksmiths, printers and silversmiths contributed to the community's life and development. These small businesses were among the first signs of manufacturing in the Colonies.

ACTIVITY # 2

We know that manufacturing was slow to develop in the Colonies. Before we learn the "whys" of this, take a few minutes to guess for yourself. Write down on a piece of paper what you think were the reasons why manufacturing was limited during Colonial times. Don't worry about being right or wrong. Just think about life in Colonial America and what you think is needed for industry to develop. What, for example, is needed to produce those things you play with from Activity #1? Compare your guesses with those of others in your class. Which ones on your list are you still willing to keep? Think about your guesses as you read further.

LIMITS TO THE GROWTH OF MANUFACTURING

If we think about things needed for manufacturing to begin to develop, we can get an idea of why manufacturing was slow to develop in the Colonies. Raw materials are needed, knowledge of how to produce goods is needed, people are needed and energy resources are needed.

One of the main things absent during Colonial times was available resources of cheap energy. There were no engines, let alone gas or coal.

Another limit was the absence of spare cash with which the farmer could buy manufactured articles. There were no banks to lend money to start businesses. Transportation facilities were poor; and it was next to impossible to develop manufacturing near the source of labor, water power and raw materials. Machinery was scarce and expensive. Advertising was difficult. There was also a lack of knowledge. The technical know-how was just not available.

Another prime factor working against manufacturing was the relationship the Colonies had with the mother country, England. This relationship was called mercantilism. Under this system the Colonies were to exist for the benefit of the mother country. The mother country was to receive from the Colonies raw materials and products from the land such as tobacco, lumber, cotton and wool. They would then manufacture items from these raw materials and sell the finished product to the Colonists. All goods had to be transported on English ships and foreign trade could only occur with the consent of the mother country. The English government passed many laws forbidding the manufacture of goods that would compete with the finished products that England produced.

AIDS TO THE GROWTH OF MANUFACTURING

Still many factors worked to develop industry in the Colonies. One factor was the great need in a new country for many articles of everyday use such as furniture, wooden plates, spinning wheels, churns, buckets, hoes, plows, wagons and carts. A second aid was the desire on the part of the Colonies to be less dependent on England. There was a great deal of resentment toward the laws passed in England designed to prohibit manufacturing in the Colonies. The Colonists needed things to exchange with the mother country to get what they wanted. The Colonists wanted to

be able to obtain a higher price for their goods so they could buy more of what they wanted. Eventually these conditions, along with many others, caused such conflict that the Colonies broke with England in 1776.

Another factor promoting industrial growth was continued immigration. More and more people were coming to the Colonies. They brought with them knowledge of manufacturing and trade. They also had important skills in working with tools. As more people came to the Colonies, people wanted goods that had to be produced.

ACTIVITY # 3

To review, here is a list of things limiting the growth of manufacturing in Colonial America.

1. Lack of energy resources
2. Lack of spare cash
3. Lack of banks to lend money
4. Lack of labor supply
5. Lack of raw materials
6. Lack of knowledge
7. Mercantilism

Find the words that are underlined in this puzzle. Remember, the words you find were things that were not available or were slow to be developed in Colonial America. Mercantilism was an economic arrangement that discouraged industrial development. Use the sheet of paper your teacher hands out.

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

Here is a list of things aiding the growth of manufacturing in Colonial America.

1. Need for products
2. Desire to produce goods to trade
3. Desire to be less dependent on England
4. Increased know-how and skills
5. Increased immigration

Find the words that are underlined in the list in this puzzle. Use the sheet of paper your teacher hands out.

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

COLONIAL ENERGY RESOURCES AND INDUSTRIAL GROWTH

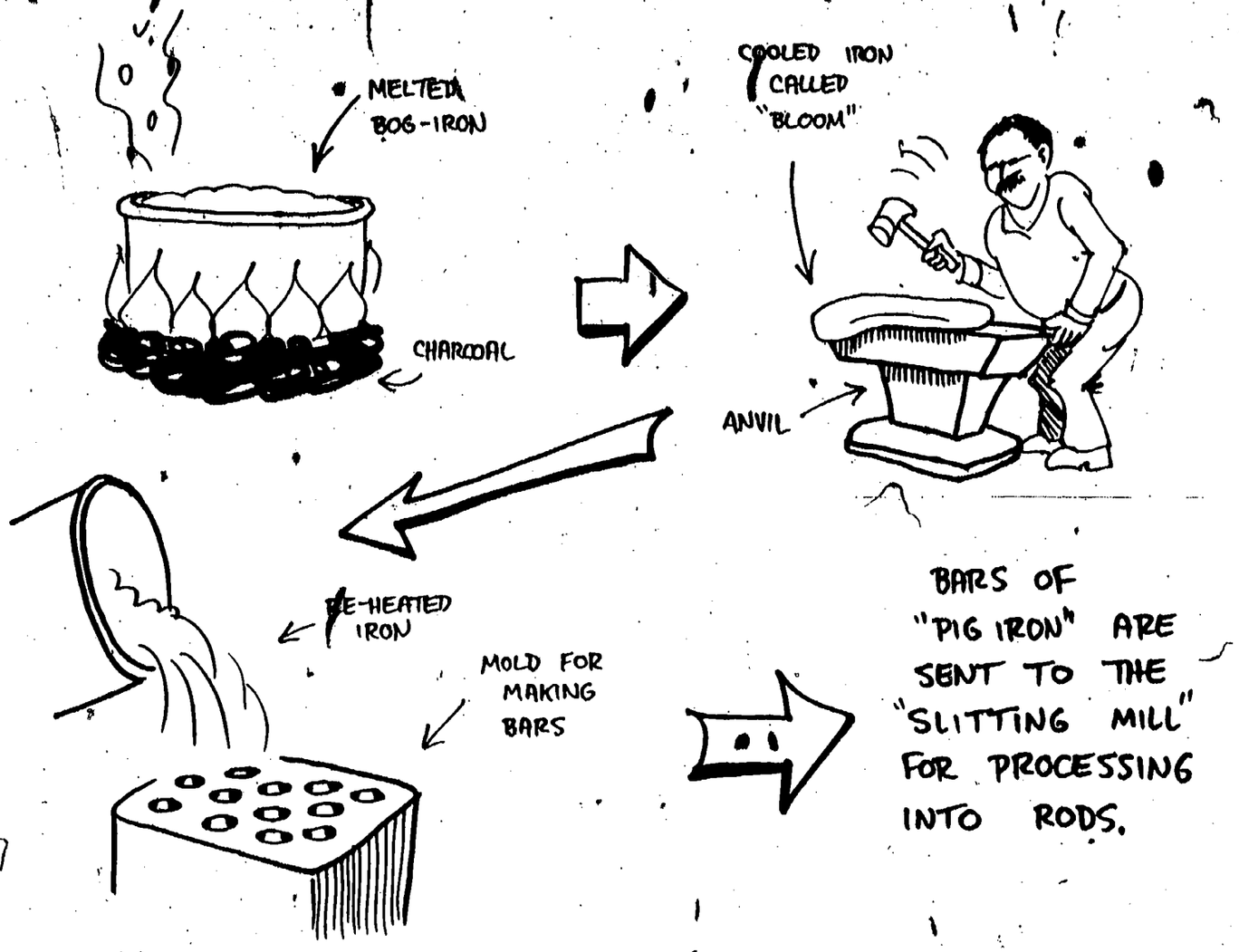
We are now going to look specifically at two types of industrial development in the Colonies. One, the growth of the mining industry, and the other, the use of water power as related to the mill industry.

The Mining Industry. The early settlers in the Colonies devoted much of their time to seeking gold, silver and other precious metals. Significant amounts were not found.

On the other hand, iron ore could be found in all the Colonies. There was a widespread demand for iron, which was used to manufacture crude tools, farming equipment, nails, pots, weapons, rims for wheels and the like. By 1775, the Colonies were producing about one-seventh of the world's supply of iron, and their production of pig and bar iron exceeded that of England.

In order for this growth to occur, a primitive energy resource was used. That energy source was charcoal. It was formed by burning wood at high temperatures and low oxygen. Using charcoal, bog iron, which was found in marshes, was melted to a semi-fluid state called a bloom. The bloom was cooled and then hammered on an anvil. This hammering removed the waste called slag. Wrought iron was the result. The wrought iron was then heated again and poured into molds to make bars. The bars of pig iron might then be sent to a "slitting" mill where, at white heat, they were rolled into small rods. From these rods the local blacksmith or farmer could make the products needed.

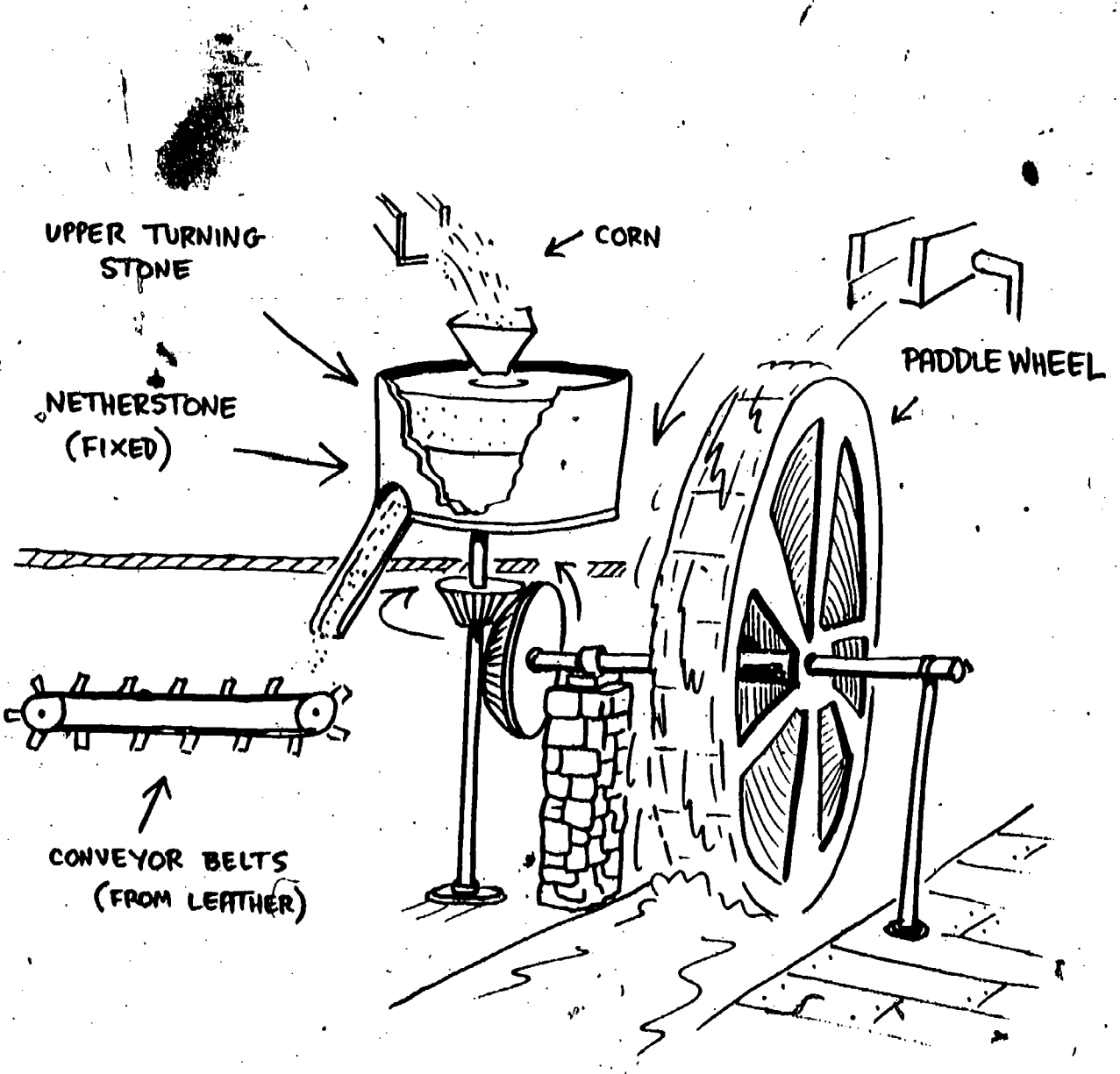
Once the Colonists had the raw material (bog iron), the energy source (charcoal for heat) and the know-how, the English could not prevent the growth of the iron industry in the Colonies.



ACTIVITY # 4

You have just learned about a crude process of turning a raw material into a product that could be used in everyday Colonial life. Pick a product that you use frequently. Try to keep it simple but make it something you depend on and that has to be manufactured. On a piece of paper trace its production from start to finish. What are the raw materials needed? What energy resources are used to produce it? What energy resources are used to transport your product? Would you be able to have this product if you lived in Colonial times? Why or why not?

Water Power. As you can see, few of the energy resources today were available to the Colonial Americans. One of the main energy resources in Colonial America was water power. Water power was key to the development of the mill industry. Grist mills for grinding grain and corn into flour were found in all the Colonies. These mills were run by water power. Overshot or undershot water turned the water wheel placed in or by the flow of the stream. This picture shows how water power turned a paddle or water wheel that then turned the stones that ground the grain.



These mills, because of the water power available, were among the earliest establishments in a new community. People from the community brought their grain to the mill. Other stores and shops then grew up by the stream and mills. These first community mills were small. However, during the 1700's large merchant mills, converting over a hundred bushels of grain a day into flour, manufactured flour for the export trade. Bake ovens were usually associated with the mills.

These two industries were very important, particularly in the Middle Colonies. Almost half of the exports from New York and Pennsylvania from 1764 to 1766 consisted of flour and baked goods.

ENERGY AND TRANSPORTATION: THE COLONIES AND NOW

We have talked about how energy resources affected the growth of two industries in the Colonies. Another way to learn about energy in the Colonies is to investigate transportation. Learning about transportation then and comparing it with today can tell us some things about how we use and depend on energy.

The early settlers were primarily dependent on water for transportation. A great majority lived on or near a river or stream, and practically every family had a boat of some kind. Flatboats were used for transporting heavy cargoes. The sources of energy used to propel these means of transportation were human and wind. Oars, paddles or poles were used. Wind was used for sail power. Even so, water travel was slow. A trip from New York to Carolina took four to five days. For the transatlantic voyage three to eight weeks were needed.

Land transportation was also very difficult. The first roads used by the settlers were nothing more than Indian trails. They were narrow and frequently winding. By the middle 1700's, Colonial roads did improve.

One could travel the 711 miles from Boston to Jamestown, Virginia, by stagecoach in about two weeks covering fifty miles a day. Energy sources used for land transportation included human and animal.

People walked or later, when the roads were better, horses and mules were used. Animals carried people and pulled wagons, carts and stagecoaches.

ACTIVITY 5

Here is a list of energy resources used for transportation during Colonial times. Copy it on a piece of paper. Then make a similar list for today. What are the energy resources and means of transportation that are used today?

Wind -- sail power

Human -- paddling, poling, rowing, walking

Animal -- horses and mules to carry people or pull wagons, carts and stagecoaches

Next do a time study. Compare traveling from Boston to Jamestown in 1750 with today. How long did it take then and how long would it take now?

Answer the following questions for discussion in class.

1. How has the use of energy resources for transportation changed from Colonial times to today?

2. How have these changes effected the way people live?

3. What would be some of the effects if we did not have the present day energy resources available for travel?

4. What are some ways we can help ensure that we have energy resources available to travel in the future?

ENERGY AND COLONIAL AMERICA

LESSON THREE: SELF-RELIANCE

Lesson Objectives

- To relate the concept of self-reliance to energy use during the Colonial period
- To explain how energy conservation is an example of self-reliance
- To be able to identify the steps in group decision-making
- To make decisions concerning energy use today.

ACTIVITY # 1

Think about yourself. You are an individual, different from everyone else. What you think and do every day is different from what other people think and do. One of the things that makes you unique is how you take care of your needs. On a piece of paper write down the things you do for yourself during a typical day. Your list should include things such as fixing your own breakfast, walking to school, doing your homework or making your bed. Your list can also include things you have made yourself such as model air planes or drawings.

SELF-RELIANCE

Having thought about yourself you are now ready to learn about a value held by Colonial Americans. From Lesson One you learned about our American heritage. This lesson will also deal with our heritage but instead of talking about how people lived from day to day, we will be talking about a value they held. A value is a belief you hold. You may value hard work or honesty or free time to do exactly what you want to do. Values are principles that guide your behavior. Not everyone holds the same values or acts on their values in the same way.

Just as a particular language, in our case, English, is passed on from generation to generation, so too are values passed on. Values are taught to you by your parents, friends, teachers, the things you read and even the TV. Groups of people also have similar values.

There is one particular value that was held by many Colonial Americans. This value is "self-reliance." This is the belief that one's success depends to a great extent on one's own efforts, skills and abilities. People immigrated to the New World for many reasons. One of these was a belief that they could and should "make it on their own." In Europe, what you could do with your life was usually tied closely to your family background. Only the wealthy had a chance to receive a formal education. People were limited in many ways because their position in society was fixed. Land was scarce and opportunities for advancement and change depended on factors over which a person did not have control.

People came to America and still come today looking for a chance to work hard and succeed through their own efforts. This is not to suggest that Colonial Americans did not help each other or share. In fact, the early settlements were very much cooperative efforts. Colonial Americans believed in self-reliance, but they were also interdependent with their surroundings. What they did affected the lives of future generations as well. Still everyone was expected to do his or her share. Because people had to work so hard and depend on their natural environment to survive, the value of self-reliance grew and became part of our American heritage.

ACTIVITY # 2

Go back and look at your list of the things you do for yourself every day. How are these things examples of your own self-reliance? Share your ideas with other members of your class. Are all of you self-reliant in the same ways? What are the similarities and differences?

ENERGY AND SELF-RELIANCE

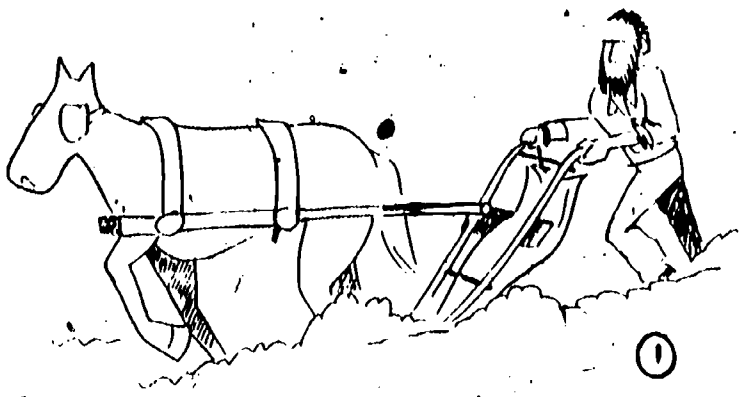
How Colonial Americans used energy resources can be related to the concept of self-reliance. We know that people living during the Colonial period were dependent on energy resources, such as wood and water power. People were also self-reliant because they had to obtain these energy resources for themselves. They had to depend on themselves to get the energy resources they would need. There were no electric bills every month, because there was no electric company to provide for lights, heat and cooking energy.

ACTIVITY # 3

Here is a list of energy resources available to Colonial Americans.

WOOD	ANIMAL
WATER	ANIMAL FAT
WIND	
HUMAN	

Match up these energy resources available with the pictures on the next page. To do this, copy the list on a piece of paper. Next to each energy resource put the number of the picture which corresponds. Now pick any three energy resource and picture combinations. Write down how you think the work being done reflects the value of self-reliance? How are the people depending on themselves to obtain and use the energy?



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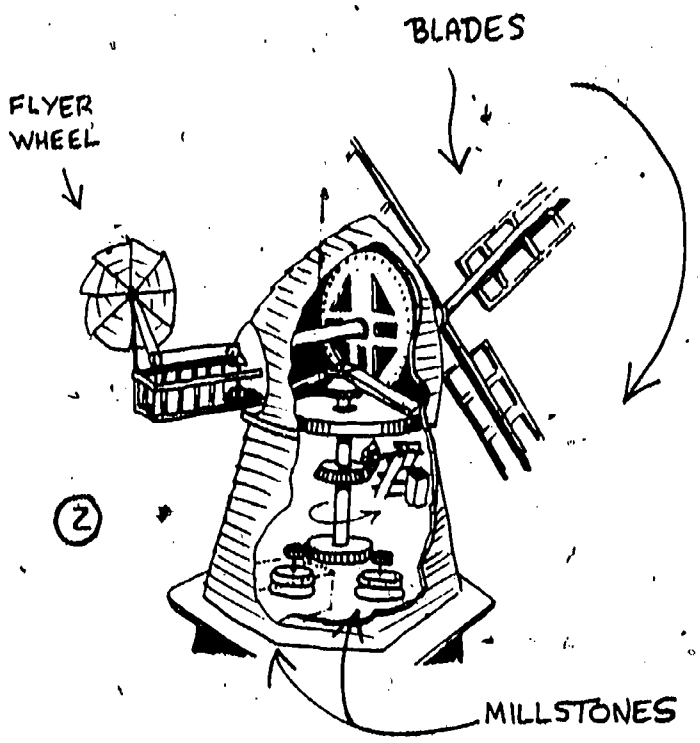

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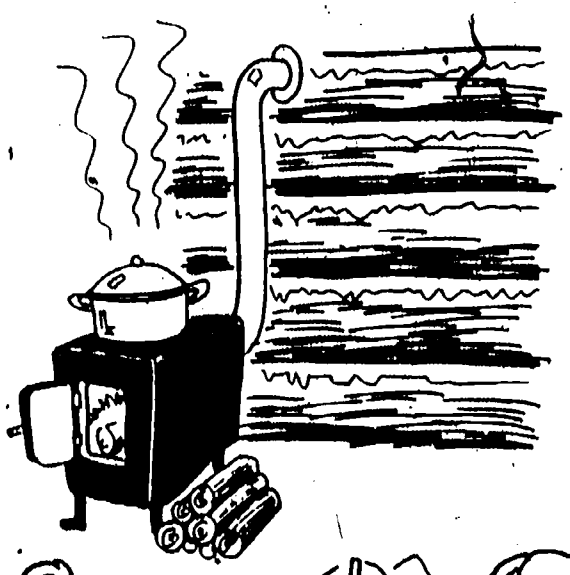

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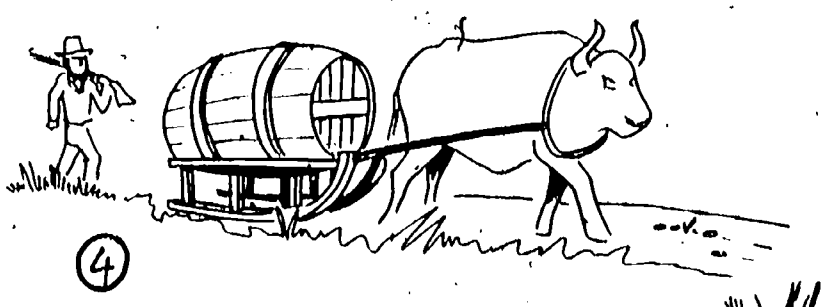

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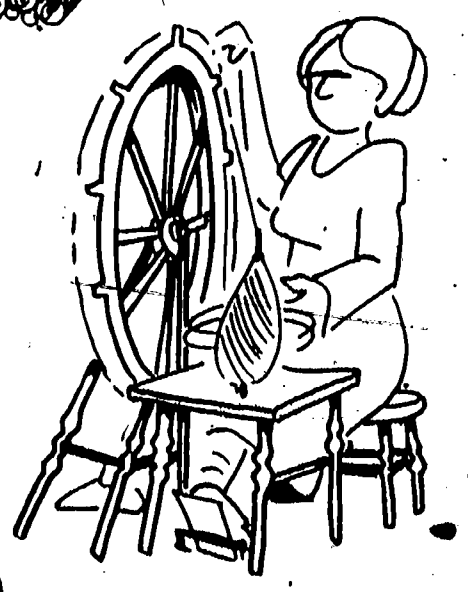

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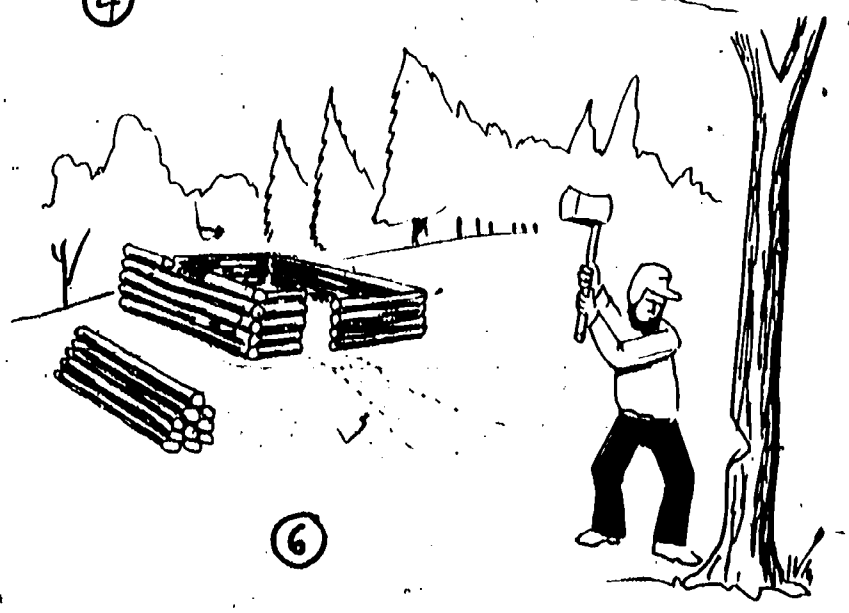

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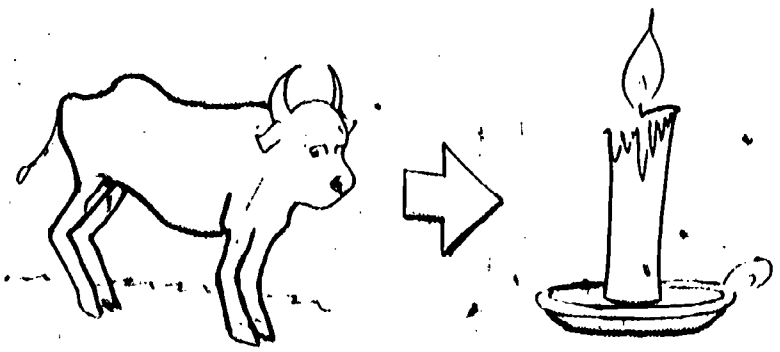

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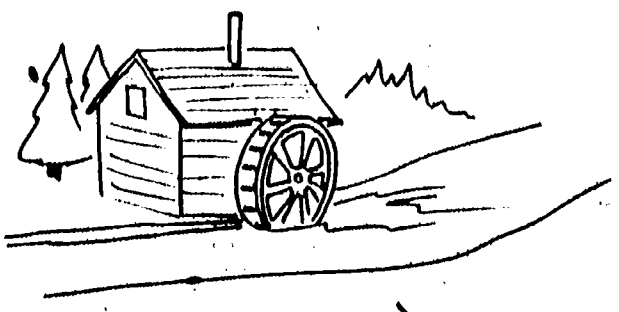

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MAKING DECISIONS ABOUT ENERGY USE

Group Decision-making. Although Colonial Americans were firm believers in self-reliance, they still had to work together. Part of living in any group, whether it be a family, a society in 1750, or today, means participating in group decisions.

Group decisions in Colonial times were often concerned about who would do which chores. In addition, group decisions had to be made as to how the available resources, including energy, would be used.

There are four basic steps to group decision-making. They are:

1. Gathering information
2. Stating alternatives
3. Making a choice
4. Examining the consequences of a decision

Gathering information means finding out what has to be done and obtaining the knowledge needed. This can include stating the question to be answered. Information can be obtained from many sources such as books or the opinions of the group members. Stating alternatives means examining all the possible decisions that could be made. Next comes actually making a choice from your list of alternatives. Once a choice has been selected, the consequences of the decision need to be examined.

This may seem like a complicated process, but we all engage in these steps every day. An example will help you to understand this process.

The family car. Your family is eating breakfast together one Saturday morning. Your family owns one car and on this particular day, family members have to go different places at different times. The group decision that needs to be made is how the family car will be used to best meet everyone's needs.

To gather the information your family discusses each person's plans to find out who is doing what, when and where. Once everyone has stated his or her need for transportation, alternatives need to be clarified. What are the other possible means of transportation? Is it possible for some members to take a bus, catch a ride with a friend or even change their plans? Next, a decision has to be made concerning the use of the family car. Priorities and needs are weighed. It may not be possible for everyone to get his own way; compromises may have to be made. A compromise is when different people in the group give up part or adjust what they want in order for a mutual decision to be reached. Before the family goes about their business, the consequences of the decision should be examined. For example, how much gas will it take for everyone to have access to the car? This may lead your family back to Step 3, which is making another choice, or to reaffirming the original group decision.

Your family has practiced group decision-making. Everyone has had a chance to have a say, and the decision reached considers everyone's needs. Just as your family today makes group decisions, so too did Colonial families.

ACTIVITY # 4

Pretend you are a member of a family living in Colonial America in 1700. You live in a small farming community in

rural New Jersey. Work with three other members of your class for a decision-making activity. There are four members of your Colonial family -- a mother, a father and two children ages 14 and 15. Take this list of some of the tasks that need to be done for your family to survive.

1. Planting and harvesting the garden and fields
2. Taking wheat or corn to the local grist mill to be ground into flour
3. Making boots and shoes
4. Making candles from animal fat
5. Cutting wood for heat and cooking
6. Carrying water
7. Spinning thread and weaving cloth
8. Cooking
9. Tending the fire

In your family group, decide how these tasks can be divided. Go through each step of the decision-making process. Gathering information may include who is best suited to do each chore or how much time each chore will take. Clarifying alternatives will mean looking at the possible ways your family can divide up the tasks. Can water be carried by one person or will it take two family members? Making choices will include actually dividing up the chores. Examining the consequences of the decision will include discussing what effects the decision will have on each family member.

This role play will require that you put yourself in the "place" of the Colonial family. The chores to be divided are very different from the ones you do today but the idea is the same. As a group you need to make decisions.

Once you have divided up the list, think about the energy that has to be used. Which tasks require human energy, animal energy and/or energy from the natural environment?

Discuss in your family group the following questions:

1. How and why is each type of energy important to the survival of your Colonial family?

2. How is your family self-reliant or dependent on energy resources?

SELF-RELIANCE AND CONSERVATION

One of the major types of decisions that had to be made in the Colonial family and community was how to conserve energy resources. Wasteful use of any resource could be dangerous. Self-reliance also meant using energy wisely, for no one would provide it for you. Candles took a long time to make because the wicks had to be dipped by hand. The animal fat used to make candles was hard to obtain and had to be used wisely. Wood used for heating and cooking also had to be conserved. Each family was self-reliant in that they obtained their own supply of wood. Chopping wood was a difficult task. Fires did not burn full blaze at night. Coals from the previous day's fire were saved and used to start the morning fire for cooking.

ACTIVITY # 5

Again work with your Colonial family group. However, instead of pretending you are a Colonial family, your group is a family living in Indiana today. On a piece of paper make a list of the things that need to be done for your family to survive today. Also make a list of the types of energy resources that you depend on today. Who gets these energy resources and how are they obtained? How are the energy resources distributed in your family such as the use of electricity and gas for the car? Practice your group decision-making skills.

Your new list of tasks for your family should be very different from the one for your Colonial family. For example, you still need clothes but how do you get them and what are they made from? Check the labels in your clothes. All synthetic fibers use some kind of chemical, many of which come from petroleum. You don't dry your food but keep much of it in the refrigerator. You don't cook over an open fireplace but use a gas or an electric stove.

Think again about self-reliance and energy. Discuss the following questions:

1. How has the dependence on others changed with regards to the production, use and distribution of energy resources?

2. Are we self-reliant when it comes to energy resources today?

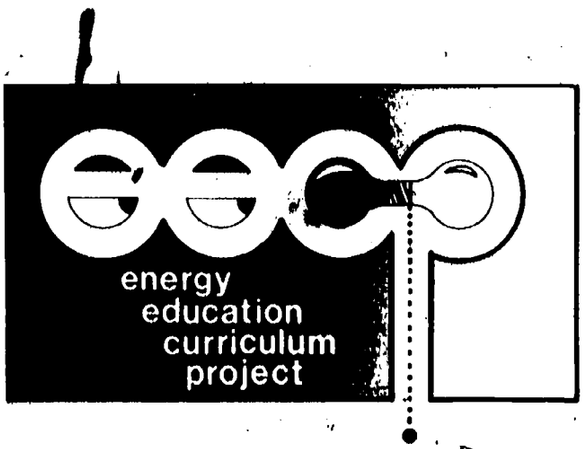
3. What advantages and disadvantages are there to self-reliance in energy that you learned from being a family in Colonial America?

4. What are the advantages and disadvantages for the dependence on others for energy resources that we experience today?

5. How do you feel about today's dependence?

6. Should we and could we become more energy self-reliant within our families?

7. How can we become more self-reliant by conserving our energy resources today?



Energy and Industrialism

LESSON ONE: CHANGE AND INCREASED USE OF ENERGY RESOURCES

TEACHER'S GUIDE

Introduction:

This lesson considers the changes that took place in the United States during industrialization: this time period is approximately from 1860 to 1920. The main emphasis is on changes in sources of energy as the country moved from a rural agricultural economy to an urban industrial one. Students are asked to imagine what life might have been like during this period of industrial growth and change. Through the use of charts and graphs, students are asked to identify the different energy resources that became important during this time period. Students are expected to be able to read and interpret tables and graphs.

Objectives:

1. Students will identify the energy resources used during the Industrial Period.

2. Students will become aware of how the type of energy resources changed during the Industrial Period.

3. Students will become aware of the increased use of energy resources during the Industrial Period.

4. Students will be able to compare life styles and energy resources in the Industrial Period with life styles and energy resources today.

5. Students will be able to identify how changes in energy resources caused changes in life styles utilizing what is available to eat and drink.

6. Students will develop skills in interpreting tables and graphs and identifying changes in energy resource use.

Time: Three to four days.

Instructional Strategies:

1. Introduce this lesson with a large group (total class) discussion about life in the United States during the period of industrialization. In order to focus on changes that have occurred since this period, direct the attention to life styles that did not have the advantages of today's conveniences in the preparation and preservation of food. Activity 1 should serve as an opportunity for students to imagine how life styles have changed and what relation energy has played in these changes. Any snack foods representing the

mid 1800's to 1900's would be simple home prepared cakes, cookies, bread and natural fruit in season or dried. Point out that such ideas as standard measurements and recipes were not even common during this period so that each family had to develop their own pattern for cooking, etc. Improved transportation and food storage began to promote marketing on a regional basis but the development of national markets was a change that occurred along with industrialism and did not exist prior to this period. Other discussions could be held on the cost of food because of transportation and packaging or the sanitary conditions of today's food. Estimated costs of different snacks could be figured by students who might be interested.

Question 7. The answer should include some of the following ideas: transportation costs, packaging costs, labor costs.

Question 8. Included here should be the homegrown versus store purchased. The use of probably a wood fire or stove and today's modern electric popcorn popper. Again, transportation and packaging can be referred to.

2. Students should read the material "From Wood to Coal" and "Oil and Natural Gas Become Important" as presented in Lesson One. Also have the students complete Activities #2 and #3.

Answers to Activity #2:

1. Wood and Coal
2. 1870 (Coal is no longer 100% of nonwood fuel.)
3. 1910, 76.8% of all fuel
4. Wood consumption has declined by 90.9%.
5. Coal consumption increased to a high of 77% in 1900 but has decreased as a percentage of all fuel consumed since 1900 to only 18.6% in 1977.
6. Consumption of all other fuels has increased from 1% of total fuel consumption in 1870 to 81.3% in 1977. Total increase is 44.7%
7. Answers will vary but should reflect the students' awareness of some of the alternative energy resources being developed. For example, the use of coal could increase again.
8. Answers will vary but should be consistent with answer 7.

Answers to Activity #3:

1. Wood, coal, natural gas, hydro-electric power, oil and nuclear power

2. Wood and coal, wood and coal, oil, natural gas and coal

3. The changes in the type of fuel consumption were the decline of wood and the increase of first coal, oil, and finally natural gas. The answers will vary in the explaining why, but should include a reference to the development of machines such as the gasoline engine and the use of more efficient fuels such as oil and natural gas.

4. Solar power, wind, geothermal. Most of these were not developed to a point where they were making a significant contribution to energy use in 1977.

These activities could lead to a discussion about the changes from a dependence upon wood as a fuel to the use of fossil fuel as well as today's interest in developing solar and nuclear power. Another point to discuss is the renewed interest in and use of wood as a source of fuel in heating homes. Wood, a renewable resource, cannot provide all the needs for energy but is a reasonable alternative for many people to supplement their main source of heat. A discussion of the environmental effects the increased interest in wood might have would be a very valuable topic.

3. Students should read the remaining text and complete Activity #4. This reading assignment provides additional information on how the use of energy resources has changed. This would be a great opportunity to include a reference to the current energy crisis, our dependence upon oil and oil products and how or what alternatives might help to relieve the crisis.

   Activity #4 provides an opportunity for the students to compare lifestyles today and in the past. Using their imaginations, they can also identify some values. You may want to show a filmstrip or a movie that shows the way of life between 1860 and 1920. This would serve as a springboard for ideas that the students write in their diaries. The Industrial Revolution In America is an example of a filmstrip you might use.

This is also a good opportunity to review the content presented in the lesson. A film that you can use for a review and an enrichment lesson is Energy: The Fuel and Man, 1977. Students should be able to demonstrate their knowledge of energy resources used during the Industrial Period, how the use of energy resources changed, changes in lifestyle as a result of changes in energy consumption and industrialism. Students could share their diaries with one another in small groups or as a whole class. If there is time, this would be a good opportunity to present skits which represent the contrast in lifestyles.

Student Assessment: Correct answers to the assessment instrument for "Changing Energy Resources and Increasing Use" are:
1. B, 2. D, 3. C, 4. B, 5. A

STUDENT ASSESSMENT

ENERGY AND INDUSTRIALISM

Lesson One: Changing Energy Resources and Increasing Use

1. During the early Industrial period, what change occurred in the main energy resource?

   A. Oil replaced coal.
   B. Coal replaced wood.
   C. Water replaced wind.
   D. Charcoal replaced water.

2. The Industrial Revolution is best noted for the

   A. development of nuclear energy.
   B. development of the windmill.
   C. change from a urban economy to a rural economy.
   D. change from animal power to machine power.

3. Which of the following best shows the change in major energy resources from 1850 to the present?

   A. oil, wood, coal
   B. coal, wood, oil
   C. wood, coal, oil
   D. wood, oil, coal

4. During the Industrial Period, what development occurred in energy resources?

   A. Few new energy resources were developed.
   B. Many new energy resources were developed.
   C. Few supplemental sources were developed.
   D. Many animal sources were developed.

5. Compared to previous years, energy resources used during the Industrial Period included more

   A. fossil fuels.
   B. solar alternatives.
   C. animal power.
   D. nuclear power.

LESSON TWO: INVENTIONS AND CHANGE

TEACHER'S GUIDE

Introduction:

In this lesson, students are asked to identify inventions as well as recognize how these inventions changed our consumption of energy resources during the period of industrialization. The growth of interdependence, both in the United States and on an international level, is discussed. Students are also asked to identify their values concerning the use of electricity. In addition, they use their imaginations to consider what life might be like if some of these inventions had not taken place. There are no prerequisites.

Objectives:

1. Students will be able to identify at least eight inventions that were developed during the industrial period of the United States (1860-1920).
2. Students will be able to explain orally or in writing how new inventions contributed to an increase in the demand for energy.
3. Students will be able to identify some renewable and non-renewable energy resources.
4. Students will be able to identify certain values regarding energy use in their home.
5. Students will be able to imagine what life was like without the electric light.
6. Students will recognize how new inventions led to greater interdependence both in the United States and internationally.

Time: Two to three days

Instructional Strategies:

1. Introduce students to lesson two and ask them to complete Activity #1. Perhaps the class could work in groups of three to develop a consensus response to the questions and then each group or triad share their responses with the large group. You may want to monitor them by asking "are there answers that differ from the ones already given?" Discussion and answers will vary but emphasis should focus on conservation; making use of renewable resources; development of possible solutions to the problem; can we maintain our current life styles and standard of living, or even improve it, with present sources of energy?

ELECTRICAL APPLIANCE CHECKLIST

Me	Parents	Grand-parents	Electrical Appliance	Ranking of Importance
			Automatic clothes dryer	
			Automatic clothes washer	
			Automatic coffeemaker	
			Black and white TV	
			Blender	
			Air conditioning	
			Color TV	
			Crockpot	
			Dishwasher	
			Blanket	
			Calculator	
			Games	
			Can opener	
			Clock	
			Fan	
			Furnace	
			Garage door opener	
			Hot dog cooker	
			Knife	
			Stove	
			Toothbrush	
			Vacuum cleaner	
			Lamp	
			Corn popper	
			Water heater	
			Hair dryer	
			Microwave oven	
			Power saw	
			Radio	
			Space heater	
			Refrigerator	
			Toaster	
			Trash compactor	
			Stereo	
			Power drill	

2. Pass our the Electrical Appliance Checklist to your students. Activity #2 provides an opportunity for students to become aware of just how much their use of electricity is different from that of their parents and grandparents. In completing Activity #2, the students are also asked to identify some of their own values in relation to the use of electricity. There are no right answers here, but discussion should be centered around how the students' lifestyles and dependence on electricity differ from previous generations, what they identify as important uses of electricity and what reasons they give for those changes. The newspaper articles will also vary. However, they might include the convenience of the excess use of electricity and also the lack of exercise people get because of so many gadgets. Encourage the students to share their ideas.

3. Have the students read "Inventions Create Change in Way of Life." Discuss the way lifestyles changed as a result of inventions and how new industries were created as well. You might ask the students to identify other inventions that they think have changed their lifestyles more recently. This could include a discussion of the television, the airplane and the computer as well as others. The idea of interdependence should be stressed and students should also see how lifestyles change as a result of interdependence.

4. Have the students complete Activity #3, "Life Without the Electric Whatever". This activity should reinforce the discussion on lifestyle changes. Have the students share their stories with the class. This could be accomplished either in writing or orally. There are no right answers, however the students should be able to recognize that some activities might have to be altered as a result of no electric lights or other electrical appliances. In addition, timing could be a topic of discussion. Using daylight hours to complete certain tasks could be discussed. This could go in many directions depending on the class and how much time is available. Interested students might research and build an electrical system model.

5. Have the students either read or review the remaining material. Next, have them complete Activity #4. The timelines should be creative and informative. Examples of different information should be shared so the entire class can see what different time lines look like. Emphasize that these tell a story about someone or something. This can also be tied in with a review of the lesson.

Student Assessment: Correct answers for the assessment instrument for "Inventions and Changs" are:
1. B, 2. A, 3. A, 4. D, 5. C

STUDENT ASSESSMENT

ENERGY AND INDUSTRIALISM

Lesson Two: Inventions and Change

1. During the Industrial Period, most inventions required the use of more

   A. renewable resources.
   B. nonrenewable resources.
   C. human energy.
   D. animal energy.

2. How do lifestyles of today compare with lifestyles one-hundred years ago?

   A. We depend less today on renewable resources.
   B. Fewer goods are available today.
   C. We depend more today on non-renewable resources.
   D. We depend less on others for food.

3. Which of the following are renewable resources?

   A. wind and water
   B. solar and oil
   C. fossil fuels
   D. coal and gas

4. New inventions contributed to

   A. more use of charcoal.
   B. less use of electricity.
   C. more use of wood.
   D. less use of animals.

5. The eighth grade class visited the Ridgeview Electrical Generating Plant. Which of the following would not be used in the plant to generate electricity?

   A. moving water
   B. burning fossil fuel
   C. forced air
   D. steam from nuclear power

LESSON THREE: TRANSPORTATION AND CHANGE

TEACHER'S GUIDE

Introduction:

This lesson will focus on the changes that took place in transportation during the period of industrialization between 1860-1920. As the modes of transportation changed from horses to fuel-powered vehicles, our dependence on non-renewable resources increased. This has resulted in a need to develop conservation strategies in order to stretch the resources. Students are asked to examine the influence of transportation in their daily lives at school as well as to explore their own values in relation to the use of the automobile. Through the use of a simulation, the students develop a problem-solving strategy and role play the presentation of the solution to either a city government or school board.

Prerequisites: ability to read charts

Objectives:

1. Students will be able to identify changes in transportation patterns.
2. Students will recognize the role of the automobile in changing the American Lifestyle.
3. Students will identify some of their values in relation to the automobile.
4. Students will be aware of and able to discuss how they depend on the automobile.

Time: Three to four days

Instructional Strategies:

1. Have the students read and do Activity #1. This is an introduction to the study of transportation and how it influences them in their school environment. By discussing the questions and the answers which they suggest, some recognition of society's dependence on transportation, in particular the automobile, should result. The students should begin to identify the changes that have occurred as we changed from horse to fuel-powered vehicles. Their description of how their school would function will vary depending on whether they attend a neighborhood school or a consolidated school. You may want half of the class to write a paragraph about the different types of schools and to compose answers. This would give the students a sense of the problems different people face. The more advanced student could probably handle this more easily.

2. Read "From Horse to Steam Engine." This information could be further developed. Some of the students with high interest could make a report on the early history of their own community and what changes in transportation actually occurred during this time period. They could present their findings to the class. Some questions that they might consider would be, was the town built on a river? Did it happen to begin as a railroad town? What types of transportation are available? This type of information will, of course, vary. Resources for them to use would be the public library, the Chamber of Commerce or even community leaders.

3. Have the students read and carry out Activity Two. This activity provides an opportunity for the whole class to become involved. First, discuss problem-solving with the class. Next, form small groups of 5-6 and have each group decide on their own problem. Here you could guide them so that each group has a different concern. This may not be practical but the important issue is that each problem should be related to transportation. School transportation could easily be a topic for at least one group to tackle. When the groups have worked out their solutions they should present them to the rest of the class. They should role play their problems out. If appropriate, they should be encouraged to contact city officials and/or the school board with their results.

4. Have the students read the rest of the material that starts with "From Steam to Gasoline." Next, they should do Activity Three. The answers to this activity show the rapid growth of the automobile as an important means of transportation. They should become aware of the influence the automobile has had on our lifestyles as well as recognize the increased need for conservation of energy resources.

Answers to Activity #3:

1. Increased sales, increased registration

2. 1,255,859

3. 871,228

4.-7. Answers will vary. Students should be able to support whatever answers they give.

Students could make graphs of this data to show the increase of sales and registration of automobiles and trucks and may want more up-to-date information. A good source is Historical Statistics of the United States: Colonial Time to 1970. This is a two-volume set published in Washington, D. C., 1975.

5. Have the students re-read the information on how the automobiles changed the way people lived as well as the material on conservation. Next have them complete Activity #4. The answers to this

activity will vary according to what each student thinks is important. It should be pointed out that decisions are often made on what the person values. The class could chart the answers of all the people in the class to find out what the students as a whole felt was most important and what was the least important. A class discussion of question six could be organized as a debate if the class seemed capable of handling it. A filmstrip you might use to review the lesson and chapter is called Transportation in America. It is a series of five sound filmstrips and each runs about 13 to 14 minutes.

Student Assessment: Correct answers for the assessment instrument for "Transportation and Change" are:
1. A, 2. C, 3. A, 4. B, 5. C

STUDENT ASSESSMENT

ENERGY AND INDUSTRIALISM

Lesson Three: Transportation and Change

1. As a result of the development of the railroads

   A. towns were built near the rail lines.
   B. long distance travel became more difficult.
   C. coal decreased as an energy resource.
   D. less electricity was used as an energy resource.

2. Which of the following actions can conserve gasoline?

   A. accelerating quickly
   B. warming up the engine before driving
   C. maintaining speed limits
   D. using the choke frequently

3. Which of the following best shows the order that forms of transportation developed during the Industrial Period?

   A. horse, railroad, automobile
   B. horse, automobile, railroad
   C. automobile, railroad, airplane
   D. automobile, airplane, railroad

4. "Look at all these new shopping centers," exclaimed Betty. "Why has our city spread out like this?" What is the best answer to Betty's question?

   A. The invention of electricity made heating easier.
   B. The development of the automobile made travel easier.
   C. The development of nuclear power boosted manufacturing.
   D. The introduction of mass production increased prices.

5. The invention of the gasoline engine resulted in a greater use of

   A. steam.
   B. coal.
   C. oil.
   D. electricity.

10

ENERGY AND INDUSTRIALISM ADAPTATION LESSONS FOR SCIENCE, LANGUAGE ARTS, AND PRACTICAL ARTS

Three adaptations are presented here. They focus on energy resources, energy resource use, invention and transportation. All of these topics are central to the study of the Industrial Revolution. What we want students to see is that the increase in inventions and transportation increased energy use as a result of industrialism. We hope that social studies teachers will work with science, language arts, and practical arts teachers in order to do these lessons. Students will not only learn about energy, but they will apply it to their everyday lives.

ADAPTATION LESSON ONE: USING ENERGY RESOURCES

Idea. The idea here is for students to see new uses of energy resources that resulted from the Industrial Revolution. They should see how they operate with the new uses and how they might operate without them. It should increase their awareness of the intensive use by Americans of energy resources. They should be able to list a variety of ways that they use energy resources and how they themselves are part of high consumption patterns.

Objectives:

1. Students will know basic changes in the use of energy resources.
2. Students will adapt their findings to their own everyday lives.

Science Classes. Present the students with several objects from your science class. Help the students to trace when they began to intensively use these objects and how that energy use has increased over time. Have them document the increases in the use of these objects and then talk about what they can do to conserve energy in their use of these objects in their own everyday lives. Students might want to trace nutrients in two sets of snack foods. They could use the snacks they brought to social studies class.

Language Arts. Students should write essays on the uses of energy, including both renewable and nonrenewable energy resources. They should demonstrate ways in which they can increase their use of renewable energy resources by substituting them for the nonrenewable resources they currently use.

Practical Arts. Students should study how food habits have changed as a result of the invention of major appliances. They might want to do a kind of "eating tree" where they trace across history the development

of appliances and certain kinds of foods. An intensive study of the fast food industry would make the same point. In industrial arts classes, students should trace how the development of cars has increased energy use and energy consumption.

ADAPTATION LESSON TWO: ENERGY AND INVENTIONS

Idea. The purpose of these activities is to focus on inventions and show how inventions during the industrial revolution increased our energy consumption. Students will also attempt to develop conservation plans based on their knowledge of their own use of inventions.

Objectives:

1. Students will learn about basic inventions they use everyday.
2. Students will see how conservation can be applied to their use of these inventions.
3. Students will develop conservation plans based on their knowledge of inventions.

Science Classes. Have students study a scientific invention. They should put together a collage of pictures of the uses that are made of this invention. They should be able to explain how our energy use increased or was reduced as a result of this invention. Then you should lead a discussion of how the invention might be used more efficiently in order to have energy conservation. Students should be encouraged to carry out the energy conservation measure that is suggested.

Language Arts. Students should study one famous scientist and write an essay on the contributions the scientist made and how the scientific invention increased energy use. Two resources for this are: American History and Juvenile Books; A Chronological Guide by Seymour Metzner, 1966; and American Historical Fiction and Biography for Children and Young People by Jeanette Hotchkiss, 1973. They should then develop an energy conservation plan based on these inventions and show how they might conserve energy in their everyday lives.

Practical Arts. Have students develop a history of a trade or a group of similar trades and the change in the energy required. Students could either draw or find pictures of the various stages of the trade. An example would be to trace the history of steel making and the car. In home economics, a history of the development of foods could be assigned. Have the students share their answers with the entire class.

ADAPTATION LESSON THREE: ENERGY AND TRANSPORTATION

Idea. The idea here is to demonstrate to students the growth of transportation and its contribution to increased energy use. Students will see how transportation has grown and involved more and more energy use and how people need other people in transportation in order for goods and services to be delivered to them.

Objectives:

1. Students will analyze how transportation has increased energy use.
2. Students will see How transportation increases, have increased our interdependence.
3. Students will develop a conservation plan based on their knowledge of interdependence.

Science Classes. Have students do calculations on cars, trucks, trains and planes and the mileage each form of transportation gets. They should do research on the scientific improvements of the various transportation methods. Share the answers with the entire class.

Language Arts. Students should write a poem about any vehicle used for transportation. They should take the role of that vehicle and explain the energy that is used and the needs and important services that are performed by the vehicle and its contents. They should then determine ways in which they might conserve transportation energy used to bring them basic goods and services. As an alternative, students could write a speculative story on why roller skates are becoming popular again.

Practical Arts. Students should study specific goods that are being used in their classes, either in home economics or industrial arts. They should trace where they come from and how they get to the school. They should be able to make an estimate of how much energy is used in transporting those goods. They should then determine how they might conserve on the use of these goods and, therefore, reduce the amount of transportation that is needed for these goods and services.

ENERGY AND INDUSTRIALISM

LESSON ONE: CHANGING ENERGY RESOURCES AND INCREASING USE

Lesson Objectives

- To learn the energy resources used during the Industrial Period
- To become aware of how the use of energy resources changed during the Industrial Period
- To compare life and energy resources in the Industrial Period with life and energy resources today
- To recognize how change in the use of energy resources causes changes in lifestyles including what is available to eat and drink

ACTIVITY # 1

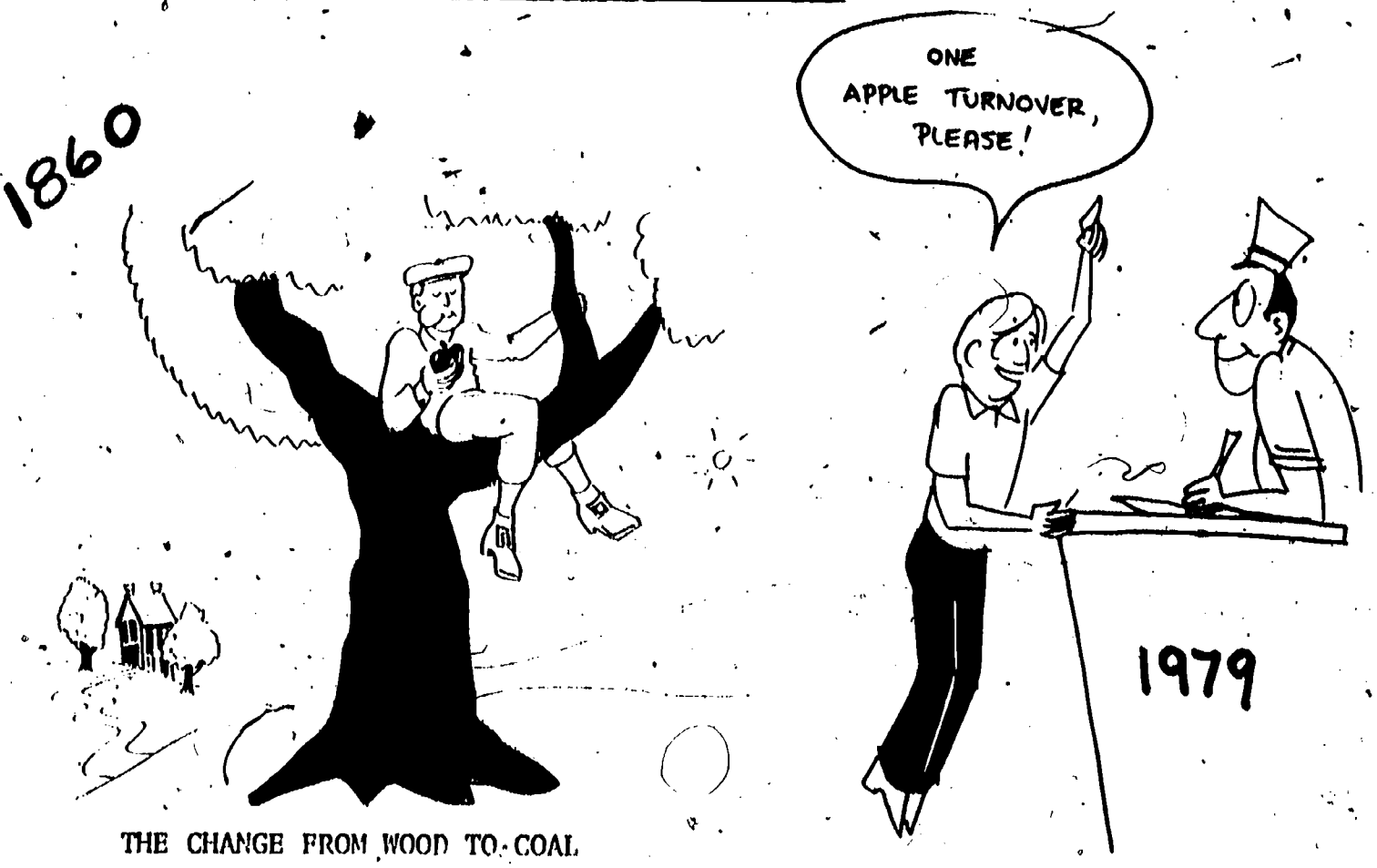
Before you begin this lesson you need to stop and think about life in the mid-1800's to the early 1900's. Try to imagine what it might be like. Remember, this was the beginning of change from muscle power to machine power. After you have thought for awhile, think about the type of food you might have eaten during this time period. Remember that life was fairly simple and that most of the foods during this period were grown by the families themselves. One example might be a piece of homemade bread with jam. Another might be an apple or other fruit. Now think of the type of food you and your family eat today. For class tomorrow, bring with you two different snack foods. One should be an example of a snack that you would eat if you were living in the mid-1800's or early 1900's, and the second should be one you would eat today.

1. Compare the various snack foods your classmates bring in.
2. Which time period has more variety?
3. Why do you think this is so?
4. Discuss the reasons only certain foods were available in the 1800's.
5. What changes occurred to bring about changes in the types of snacks kids eat?

6. Describe in a brief paragraph, on a separate piece of paper, the type and amount of energy used to prepare the different snack foods you brought to class.

7. Compare home-grown snacks with snacks purchased in stores. What added factors or expenses have to be included to cause the price of today's snacks to increase?

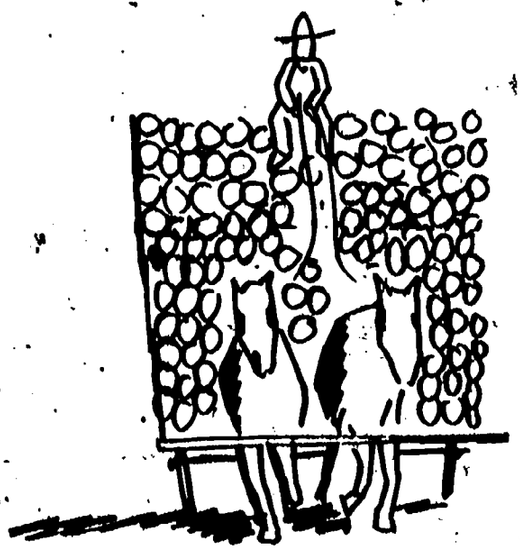
8. Imagine the snack popcorn. How would popcorn have been obtained and prepared in the 1800's? How is it obtained and prepared today? What are the differences?

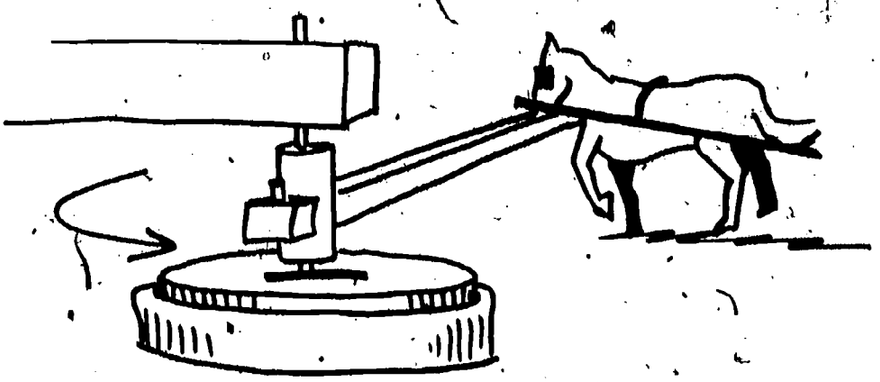


THE CHANGE FROM WOOD TO COAL

Industrialism or the Industrial Revolution period in the United States from approximately 1860 to 1920 meant a complete or drastic change. Changes occurred in every aspect of life. In the United States it largely meant a change from a rural or agricultural economy to an

industrial one. Big cities, new sources of power, large use of machines and great new inventions all began to emerge. From the time of the earliest settlement of America by the Europeans until the 19th century, work was mostly performed by muscle and/or animal power. Energy to heat homes and to cook was provided by wood, and light sources were found in fish and animal fats burned in simple lamps or as candles much as they had been for centuries before.





Beginning in the early 18th century, new inventions revolutionized the way work was to be accomplished and thus created a need for changes in energy resources. One of the major developments was the steam engine introduced in England and later applied to a variety of transportation innovations such as the steamboat and the locomotive in the United States.

The steam engine provided a major change in the ability of people to do work without using muscle power. It also made us less dependent on the water wheel, which required the presence of flowing water in order to be used. The steam engine was fueled by wood in its early days. However, steam generated by the use of wood soon became too ineffective because of the increasing demand for more and more power. A different resource, coal which is a fossil fuel, soon replaced wood as fuel to run the steam engine. Fossil fuels are fuels derived from the fossil remains of organic materials and includes oil, natural gas and coal. After 1860 coal became the source of fuel to power the industrial revolution. As a result, from 1860 to 1910 coal was the major energy resource used in the United States. See the following table:

TABLE

	Wood as the Percent of All Fuel Consumption	Coal as the Percent of All Fuel Consumption	All Other Fuels as the Percent of All Fuel Consumption
1850	91.0	9.0	0
1860	84.0	17.0	0
1870	73.0	26.0	1.0
1880	57.0	41.0	2.0
1890	36.0	58.0	6.0
1900	21.0	71.0	8.0
1910	11.0	77.0	13.0
1920	11.0	73.0	16.0
1930	6.0	58.0	26.0
1940	5.0	49.0	45.0
1950	1.0	37.0	62.0
1960	1.0	23.0	76.0
1970	.1	18.9	81.0
1977	.1	18.6	81.3

Sources: "Historical Trends in Coal Utilization and Supply, Energy Policy and Competition." Petroleum Industry Research, Inc., 1961; and the Annual Report to Congress, Vol. III, "Statistics and Trends of Energy Supply, Demand and Prices." Energy Information Administration, Department of Energy, 1977.

ACTIVITY # 2

Examine the table on the preceding page and answer the following questions on a separate piece of paper.

1. What sources of fuel were used in the United States in 1850?
2. In what year did other sources of fuel become available in the United States?
3. In what year was coal at its highest level as a percentage of all fuel?
4. What has happened to wood consumption as a percent of all fuel consumption from 1850 to 1977? By how much?
5. What has happened to coal consumption as a percent of all fuel consumption from 1850 to 1977? By how much?
6. What has happened to the consumption of all other fuels from 1870 to 1977? By how much?
7. Predict what you think the table will look like in 1985.
8. Briefly state why you think the percentages will be what you have predicted.

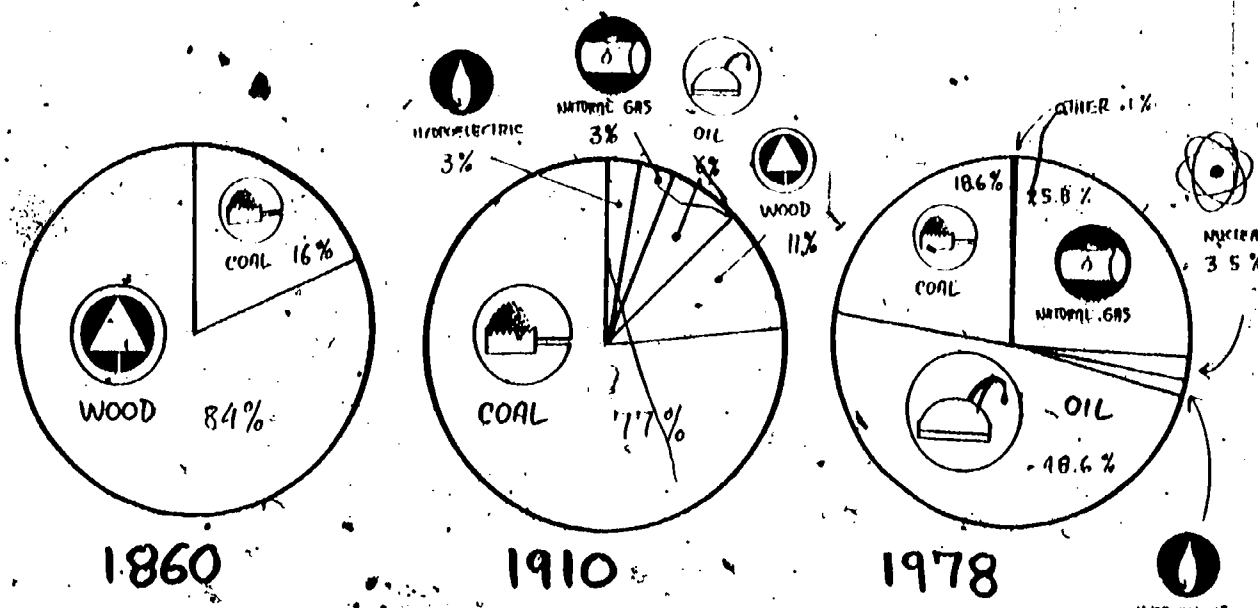
OIL AND NATURAL GAS NOW BECOME IMPORTANT

Edwin Drake's success in drilling for oil at Titusville, Pennsylvania, in 1859 set the stage for the next change in mankind's major energy source. Previously, seepage oil had been a source of fuel for lighting; but America now was rapidly becoming dependent on oil for heating and transportation as well. And as almost every American is aware, oil provides a major portion of our energy needs today. The automobile and gasoline engine cannot be left out of the discussion of the increased demand for oil. However, these will be dealt with in greater detail in Lesson 3.

Natural gas, which is often a byproduct of drilling for oil, is another energy resource that has contributed to the growth of industry in the United States.

The following circle graphs show the changes in fuel consumption from 1860 to 1977.

TOTAL FUEL CONSUMPTION BY SOURCE
(UNITED STATES)



SOURCES: ①HISTORICAL TRENDS IN COAL UTILIZATION AND SUPPLY, ENERGY POLICY AND COMPETITION
PETROLEUM INDUSTRY RESEARCH INC. 1961
② ENERGY AND EDUCATION, OCT. 1978

ACTIVITY # 3

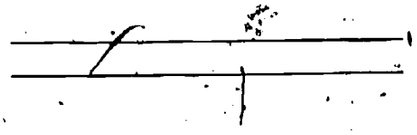
Study the graphs and answer the questions that follow on your own paper.

1. What are the energy resources represented on the graphs?

2. What energy resources are most important in 1860? In 1910? In 1977? Why do you think their importance has changed? Explain your answer.

3. Briefly summarize the differences and explain why you think these differences occurred.

4. What energy resources, if any, are you aware of that are not shown on these graphs? Why do you suggest they are not included?

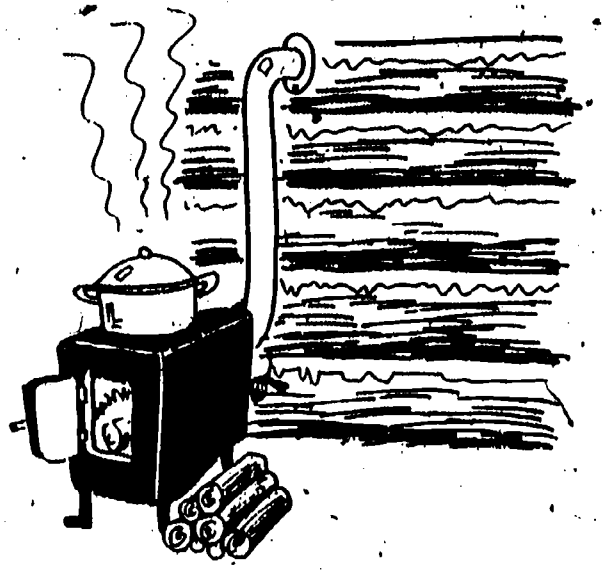


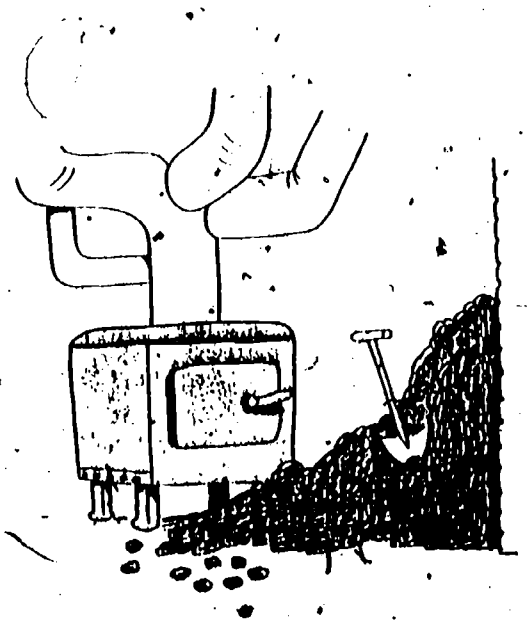
CHANGING ENERGY USE

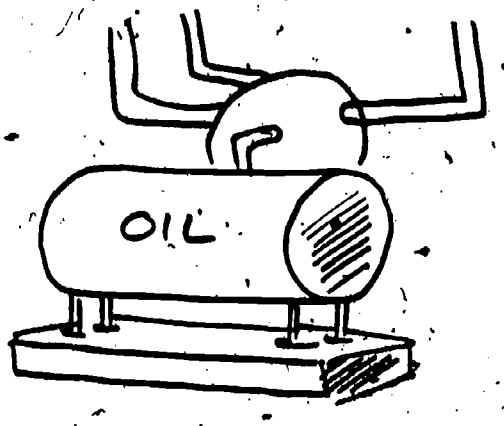
Changes in the use of energy resources during the 1800's were related to industrial development and the new sources of power needed to run the machines for industry. As the United States changed from a dependence upon water powered machines to the steam engine, the change from wood to coal as a source of fuel began. Although we did not use wood as a fuel to power industries, it continued to be a major source of fuel for heating homes and cooking. Today there seems to be a renewed interest in the use of wood for these purposes. More and more people are buying wood stoves as supplemental heating sources. A supplemental source is a backup or additional source of heat. Some people even cook on these occasionally. This has created a greater demand for wood and as a result, the cost of wood has increased.

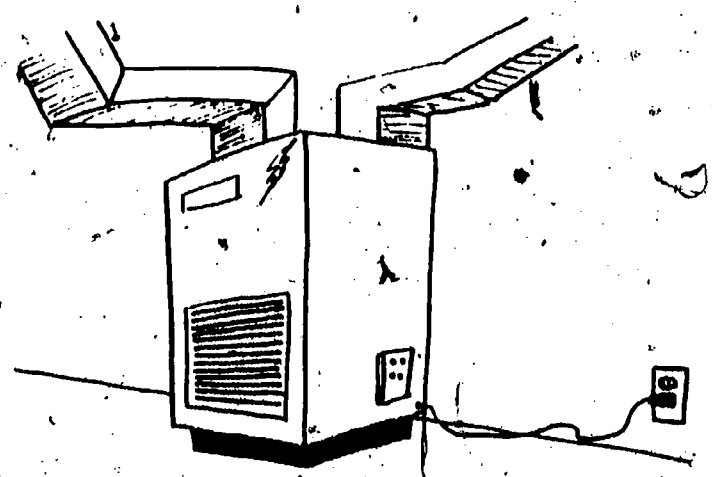
Other changes that influenced the use of energy resources included the development of refining methods that provided kerosene for home

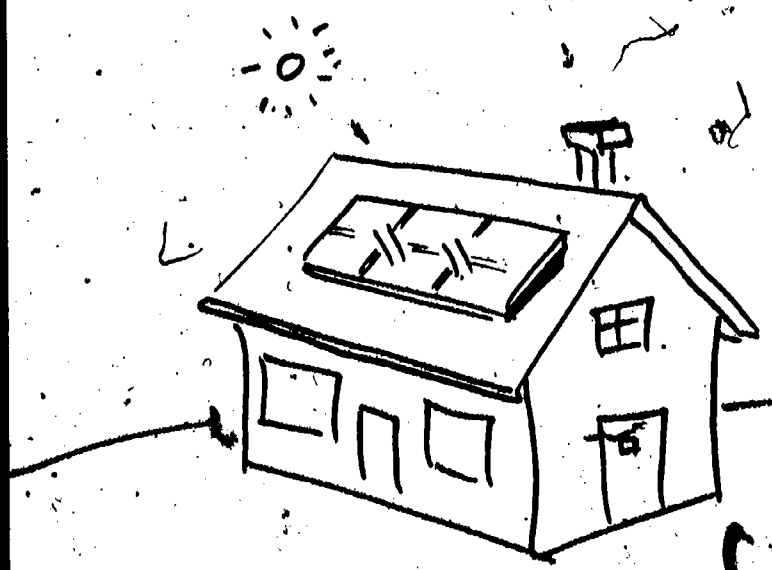
DIFFERENT HEAT SOURCES

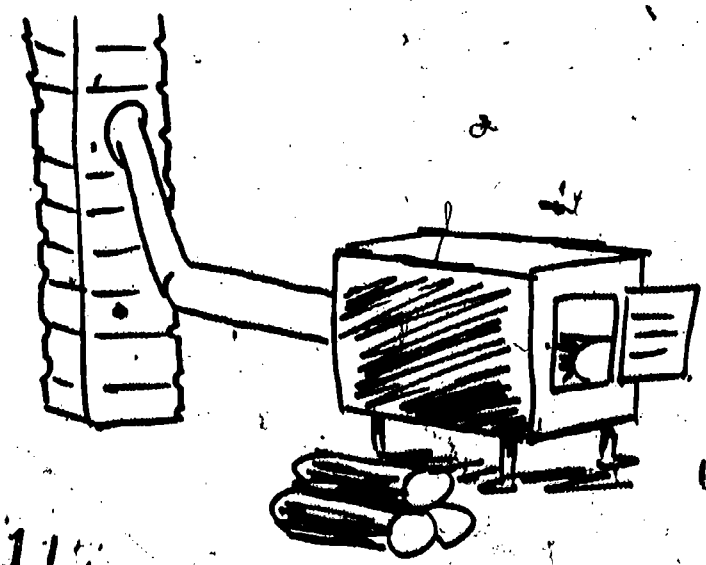












lighting and cooking. Gasoline powered the newly developed internal combustion engine. There was also development of many non-fuel-related uses of oil products including plastics, paints and fertilizers to name a few. In addition, further changes in the use of energy resources include the use of coal as a fuel in generating electrical power and the development of processes to convert coal into non-solid fuels such as natural gas or oil. Recently, new energy resources such as nuclear, geothermal and solar have been researched; and their uses are being developed. There has even been a trend to renew more water power and wind power.

ACTIVITY # 4

1. Imagine that you are a young boy or girl and you are living during the Industrial Revolution Period. Pretend that you write in a diary each day or night.
2. On a separate piece of paper, write a page in your diary about your day. Include what you do during the day and the types of energy resources you are dependent on.
3. Next, imagine that it is today and you write in your diary each day or night. Include what you do today and the energy resources you use and depend on.
4. When you finish, compare the different types of activities as well as the energy resources available.
5. Would you like to have lived during the Industrial Revolution? Why or why not?
6. What were some of the interesting things that happened during that time period?

ENERGY AND INDUSTRIALISM

LESSON TWO: INVENTIONS AND CHANGE

Lesson Objectives

- To identify at least eight inventions that appeared during the Industrial Period of the United States
- To learn how new inventions contributed to a great demand for energy use
- To identify renewable and nonrenewable energy resources
- To identify at least three values you have regarding energy use in the home
- To imagine what life was like without the electric light

ACTIVITY # 1

When Theodore Roosevelt became President in 1901, he told his fellow Americans in a special message to Congress, "The mineral wealth of this country, the coal, iron, oil, gas; and the like, does not reproduce itself. . . If we waste our resources today, our descendants will feel that exhaustion a generation or two before they otherwise would. . ."

After reading the above statement, write a response on your own paper. Include the following:

1. Was President Roosevelt right?
2. What proof do you have that he was or was not right?
3. Could the same statement be made today? Support your answer.
4. What would your congressman say in a statement if he was speaking about energy resources today?
5. What evidence do you have that the energy crisis we are feeling today is a result of our ancestors' waste? Give specific examples.
6. Mention ways you can do something about the energy problem.

Some energy resources are inexhaustible. These resources will always be there -- like the sun and wind. These are known as renewable resources. Wood is also a renewable resource, but new trees must be planted to replace ones that are used. And some energy resources, once they are used, cannot be grown or created again -- like coal and oil. Once they are gone, they are gone. These are called nonrenewable energy resources. These nonrenewable resources are the ones to which President Roosevelt was referring in his message to Congress in 1901.

As a result of industrialism and the many new inventions, energy resources became very necessary and were being used in great quantities. Electricity is a secondary form of energy because it must be generated by a machine that is powered by moving water; by burning fossil fuels or by a nuclear reactor to create steam. Electricity is being used in much greater quantities than it was in the late 1800's and early 1900's. Our lifestyles have changed greatly as a result of all the new electrical devices. Lifestyles are the way people live.

ACTIVITY # 2

On the next page is a list of electrical appliances that are available in many homes today. Your teacher will pass out a copy of the list. Place a check in the column under "Me" for the appliances you have available, a check in the column under "Parents" for those items your parents had at your age and another check in the column entitled "Grandparents" if the item was available to them at your age. An item may have anyway from one to three checks in front of it.

Imagine that you are to write an article for the school newspaper on the advantages and disadvantages of all the new electrical appliances. Use the bottom and backside of your appliance list to write your article.

Automatic clothes dryer	Knife
Automatic clothes washer	Stove
Automatic coffeemaker	Toothbrush
Black and white TV	Vacuum cleaner
Blender	Lamp
Air conditioning	Corn popper
Color TV	Water heater
Crockpot	Hair dryer
Dishwasher	Microwave oven
Blanket	Power saw
Calculator	Radio
Games	Space heater
Can opener	Refrigerator
Clock	Toaster
Fan	Trash compactor
Furnace	Stereo
Garage door opener	Power drill
Hot dog cooker	

From the list above, rank in order the ones you feel are most important to you. Start with (1) being the most important and (35) being the least. Give the reasons for the five you chose as the most important and the five you chose as the least important. Mark your ratings on the list your teacher has passed out.

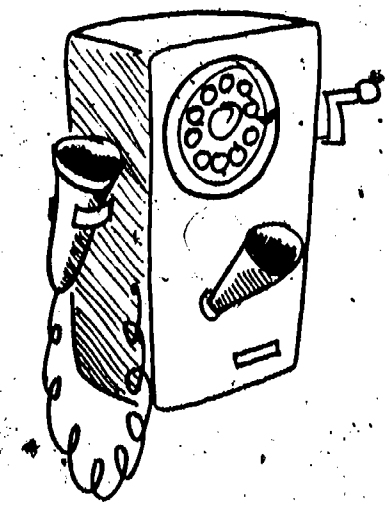
INVENTIONS CREATE CHANGE IN WAY OF LIFE

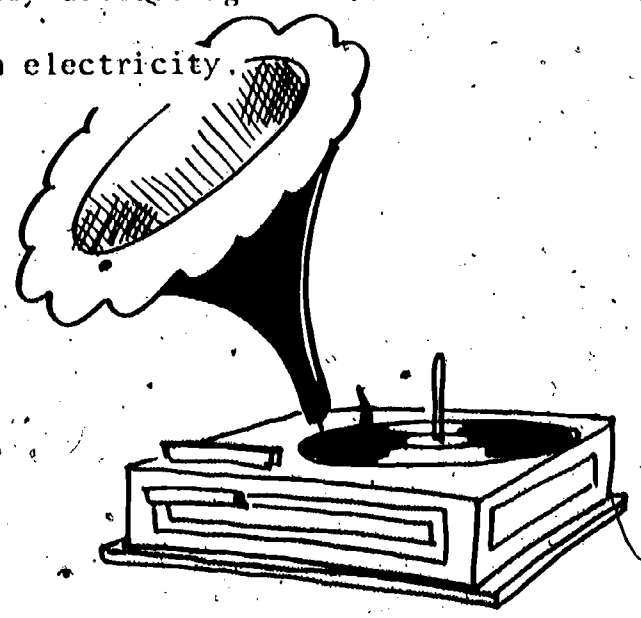
There were other inventions during this time, both in Europe and America, that had a great influence on the way Americans live today. A few of these were the reaper, the telegraph, the steel plow, the Bessemer process for steel making, the passenger elevator, the steam engine, the telephone, the electric light and the combine. Life in the United States would be very different if any one of these had not been invented. For example, the reaper, invented in 1832 by Cyrus McCormick, was instrumental in changing farming methods. It allowed the farmers to produce more food and thus have the ability to feed those who did not farm. By 1848 the production of farm machinery was rapidly becoming an industry. By 1900 over 1,356,000 telephones were in use. It is interesting

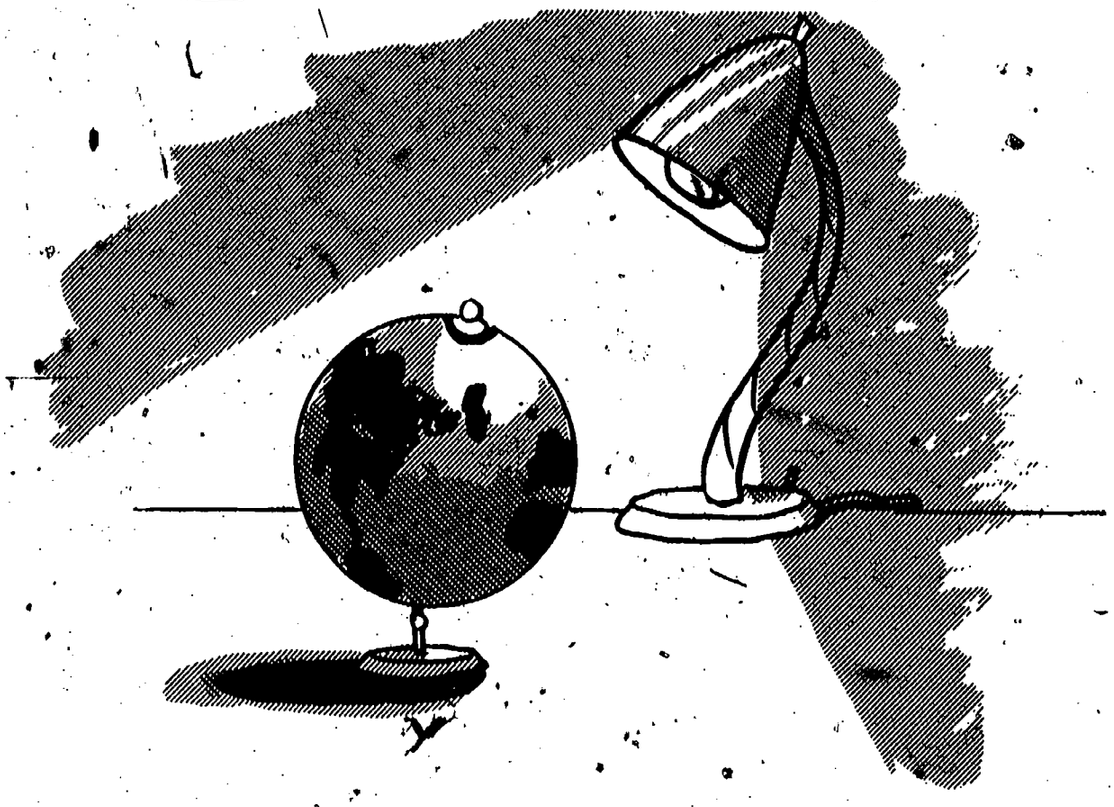
to note that Bell entered his invention in the 1876 Philadelphia Centennial Exposition and won the contest for the best new electrical invention of the Fair.

These inventions increased interdependence among various groups during the Industrial Period. The farmers were dependent on the factory worker for a market to sell their increased food products. The workers were dependent on the farmer to provide the food they neither had the time nor resources to raise themselves. At the same time, the sharing of ideas and inventions, by both Europeans and Americans who worked to meet the needs of their respective societies, illustrates interdependence on an international level.

The electric light changes the world. The invention that probably most influenced the introduction of electricity into the American home and business was the practical incandescent electric light. Incandescent is an adjective meaning glowing from heat. Thomas Alva Edison invented the electric light in the 1870's. He also developed the electrical generator and wiring as well. In brief, he created the whole electrical system. Edison, in his life, invented over 1000 items, including such things as the toaster, the phonograph, the projector, the motion picture camera and film, to name a few. When Edison died in 1931, it was suggested that all the electricity in the United States by shut off for two minutes out of respect for his great achievements. However, it was quickly decided against because the United States was already too dependent on electricity.







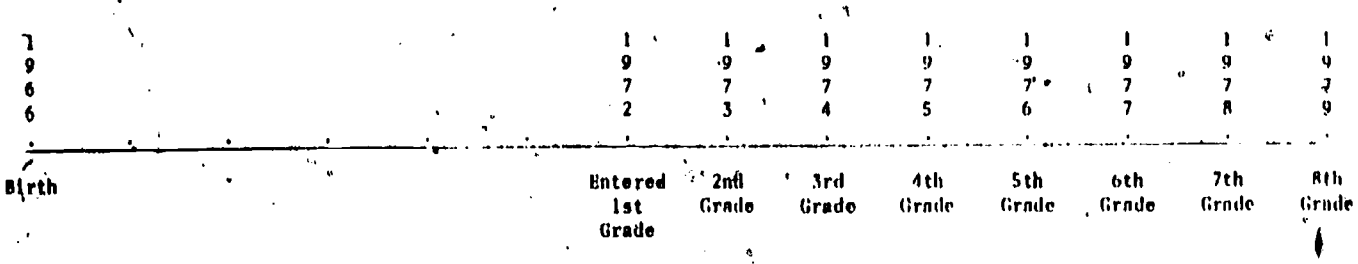
ACTIVITY # 3

While lighting may not seem important to us today, we often overlook how much it really means to us. To complete this activity, you will need to use your skills in observation and your imagination. For a given time decided upon by you, your teacher and your parents, try to live without using any electric lights. If this is not possible, do without a television, an electric stove or something similar. During the time period, make notes about your experience. Include your feelings. Think about what alternatives you have to sources of light other than electric (battery, by the way, is a form of electrical energy). Mention what activities had to be changed because of the lack of electric lights or your substitute. Finally, write a report on "Life without the electric (whatever you chose)" -- use your notes as a base for the report. Be creative. After you have completed this assignment, try to imagine what the experience would be like at different times of the year. Discuss your ideas with your classmates.

Energy Interdependence. As a result of industrialism our lifestyles have changed so that today we are much more interdependent than our ancestors of 100 or more years ago. We depend on others to raise, process and transport the food and other products which we use everyday. We are constantly provided with everything from mass produced tennis shoes and houses to potato chips. Many goods have become available to more and more people at prices they can afford. However, problems can also arise from interdependence. For example, many of the products we depend upon require oil in order to be produced. Consequently, as oil shortages occur, prices increase and supplies diminish. Alternative energy resources could help to solve this type of problem. In the past, while new inventions created problems they also help to resolve others. Perhaps new inventions could give us some relief to our present day energy demands -- can you think of any such inventions?

ACTIVITY # 4

A time line is a line drawn to represent certain information. For example, a simple time line of your school life might look like this;



A time line can show any information you want to communicate. Using information from Lessons One and Two and your school library, draw a time line of energy resources and their development in American History. As alternatives, you may decide for yourself what the time line will show or you may want to show the development of different electrical appliances. (Refer to Activity #2, Lesson Two.)

Share your time lines with the rest of the class.

ENERGY AND INDUSTRIALISM

LESSON THREE: TRANSPORTATION AND CHANGE

Lesson Objectives

- To identify the changes in transportation patterns
- To become aware of the role the automobile has played in changing American lifestyles
- To recognize your own values concerning the automobile
- To recognize your own as well as society's dependence on the automobile

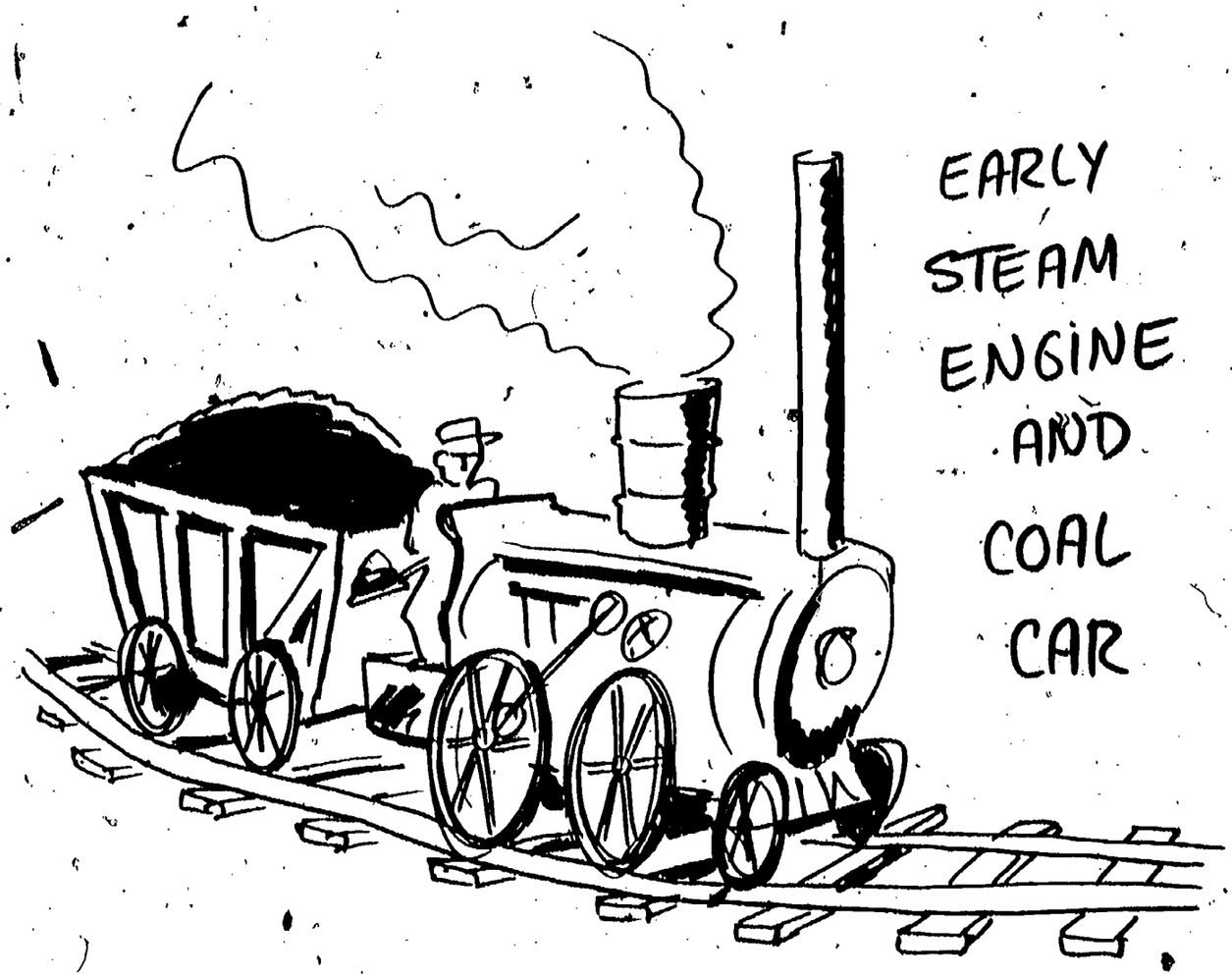
ACTIVITY # 1

Think about transportation for a minute and how it affects your life and the life of others around you. On a separate piece of paper write your answers to the following questions.

1. How did you get to school this morning?
2. Name two other ways you might get to school.
3. Think about the cafeteria for a moment. How did the food served in the cafeteria get to the school?
4. How did the desk that you are sitting in get here?
5. In a paragraph, describe how the school and you would function if the only form of transportation was walking or animal power.

FROM HORSE TO STEAM ENGINE

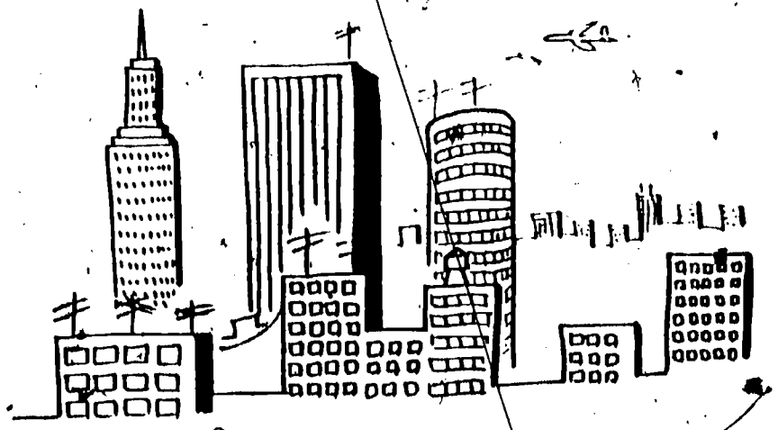
Frederick Lewis Allen, an American author who wrote about the changes that took place in American history between 1900 and 1950, suggested that if a person from 1900 visited a large American city in 1920, the first question they would likely ask is, "Where are all the horses?"

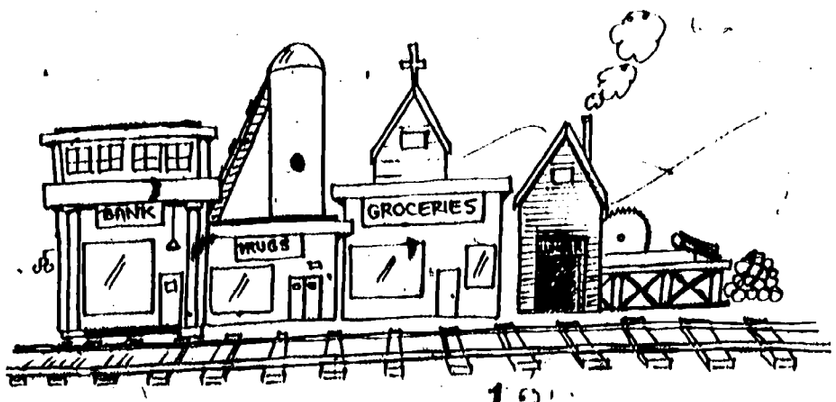


As late as 1900, Americans were still very dependent upon the horse and horse drawn vehicles. Most towns had a livery stable and blacksmith shop as a center of activity. However, another form of transportation was emerging. The steam engine had been used successfully to power river boats and ocean going ships. It also was used to pull wagons and coaches as well. These initially ran on wooden rails laid across the ground. As improvements such as iron and steel rails were developed the steam-powered railroads quickly became an important form of transportation. Railroads had grown from 35,085 miles of track in 1865 to 260,000 miles in 1920.

The development of such an extensive system of transportation contributed to the changes that took place in the United States during this period. People and goods were no longer limited to the 10 or 15 miles a day that a horse and wagon could travel. In addition, long distance travel and shipping were no longer limited to rivers or uncomfortable stagecoach or wagon rides. Yet, even with the increase in the railroads, the expansion of population and travel did tend to be limited to areas only along or near the rail lines.

Throughout the country, small towns of 500 to 1000 people sprang up. The towns were located along the rail lines, usually 8 to 10 miles apart. All the towns looked very similar because each had a mill, a grain elevator and stock pens. They often had a bank, a drugstore, a





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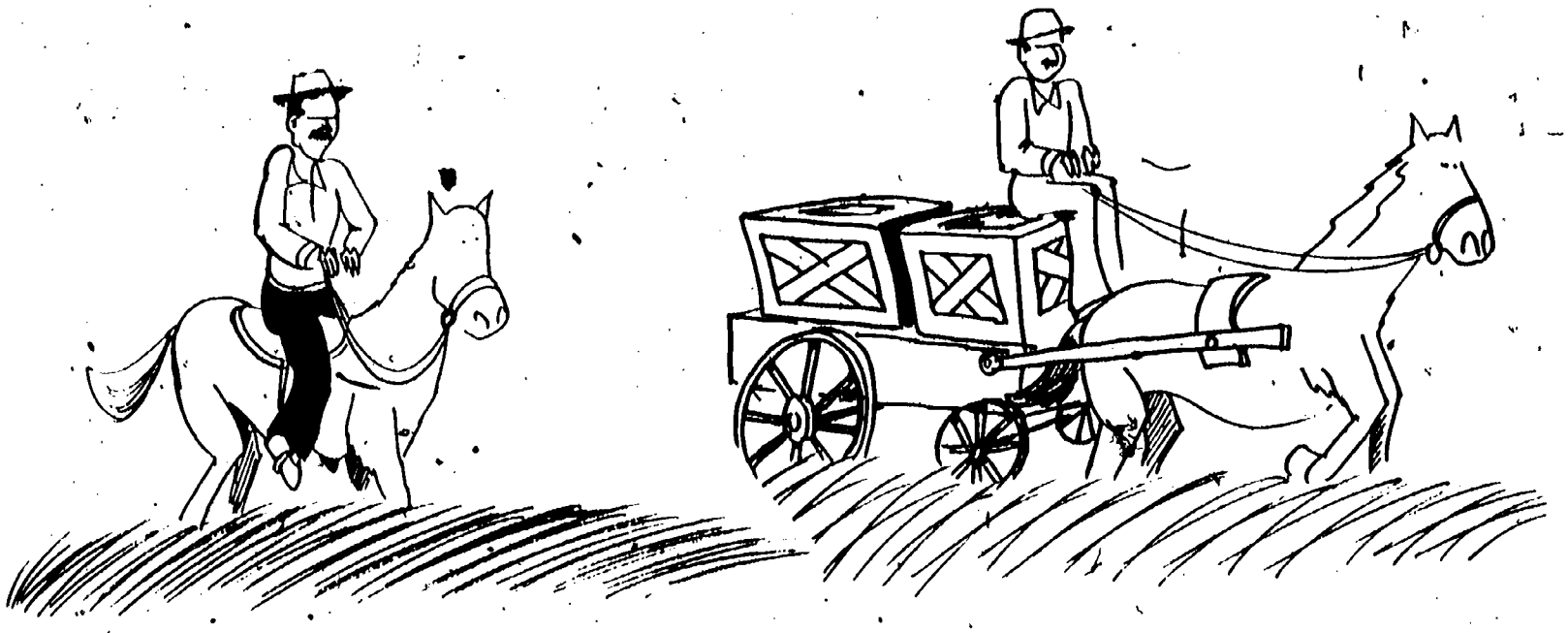
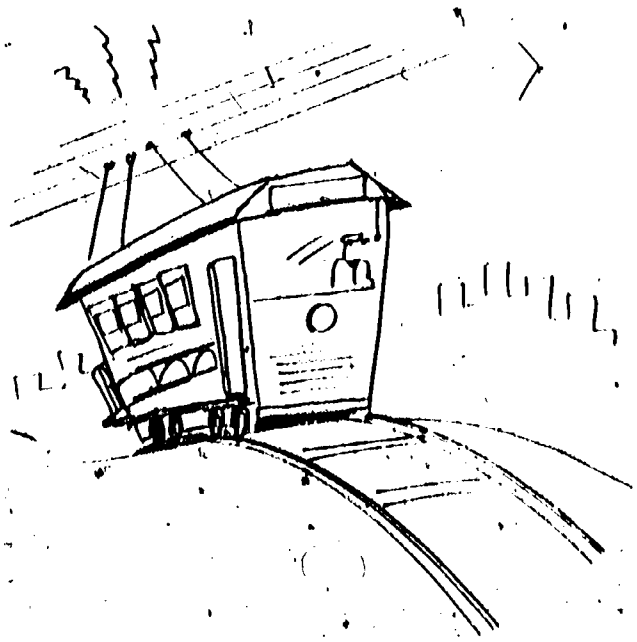
grocery store, a general merchandise store, a church and a lumberyard as well. Schools were built in each town and students either walked or used horses in order to get to school. This lifestyle was very common outside the major cities.

Cities began growing in response to the demand for more workers in the developing industries. As more and more people moved into the cities, the need for city transportation systems increased. At first, there was the horse drawn trolley and later, there were cable cars and electric trolleys. These provided a means of moving people from place to place. Goods, however, were still usually moved through the crowded streets by horse drawn wagons.





ACTIVITY # 2

1. Think about the problem of transportation and how people move from place to place in your community. If you wanted to make a choice about how your community should provide for passenger travel in order to conserve energy, think about what choices you might recommend. In making choices or trying to solve problems, there are many things to consider. Imagine that you are to advise the mayor about conserving energy and providing transportation needs in your city. First, think of as many alternative solutions as possible. For example, you might decide to allow only buses to drive in the downtown area, or you may decide that carpools must be formed or a fine will be issued, etc. After you have thought of as many alternatives as possible, the second step is to collect as much information as you can about each suggestion. That is, would it be possible to allow only buses in certain areas? What would people do with their cars? How much energy would this save? The idea is to find out as much as possible about each alternative so you can choose the most appropriate solution. The third step is to actually choose a solution based on all the information. Remember to consider all the alternatives and the negative and positive aspects of each.

2. When you have gone through the above process, you will then act out the situation. With other classmates, appoint a mayor, a city council and a group of concerned citizens who are worried about energy and transportation. Whatever part you play, you must be informed about the problems in your city and have some ideas and responses in mind. Present the situation as a class project.

3. If you live in a rural area, imagine that the school superintendent has asked for your advice on how to conserve on school transportation. Perhaps you could invite the person in charge of buses to speak to the entire class or someone could contact the transportation office and get the information. Afterwards, be sure to follow the steps given above to make a decision in trying to solve the problem. You can act out this situation as well. Appoint a superintendent, a school board and a group of concerned citizens. Present your ideas to the class.

FROM STEAM TO GASOLINE

The gasoline engine which was invented in Germany soon provided another major change in transportation. This engine was smaller and lighter than the steam engine. It could be moved from place to place more easily. By 1890, inventors in both Europe and America were experimenting with the use of this gasoline engine in wheeled vehicles called "horseless carriages" or using the Greek word "auto" (self) and French word "mobile" (moving), the automobile.

ACTIVITY # 3

The increased use of the automobile in the United States during the 1900's can be seen in the following chart.

GROWTH OF THE AMERICAN AUTOMOBILE INDUSTRY 1911-1929

Year	Factory Sales		Total U.S. Vehicle Registration
	Auto	Truck	
1911	199,319	10,681	639,500
1915	895,930	74,000	2,490,932
1920	1,905,560	321,789	9,239,161
1925	3,735,171	530,659	20,068,543
1929	4,455,178	881,909	26,704,825

Refer to the above chart and answer the following questions on your own paper.

1. What trends do you see from 1911 to 1929 in the factory sales of autos and trucks? What trends for total U.S. registrations?
2. How many more autos were sold in 1929 than in 1911?
3. How many more trucks were sold in 1929 than in 1911?

4. If the horse and wagon or even the railroads had remained as the main source of transportation in the United States, what differences can you cite in the way we live today?

5. Describe the types of jobs you think most people might have if there was no automobile.

6. Do you think we would still have an energy crisis as we know it today if we did not have the automobile? Explain your answer.

7. Imagine what the future in 10 years will be like. Will there be cars? Describe your image on a piece of paper.

The automobile really changed the way people lived in all parts of the world, especially the United States. Although Henry Ford did not invent the automobile, he is given credit for putting American "on wheels." The reason for this is because he began the mass production of the car. In 1909 Ford had sold his Model T for about $800; but because of the improved production methods he developed, by 1920 it could be sold for about $300 -- a price that the average American could afford.

Since that time, Americans have become very dependent on the automobile. In fact, it is said by some that the automobile is responsible for our current energy crisis. Because of the availability of the automobile, people began moving further and further away from the center of the city. Suburbs soon devloped and we saw the beginning of what is now referred to as "urban sprawl." People became even more dependent on the automobile for transportation as well as other uses.

As a result of all the oil used in the automobile, both by the manufacturer and the consumer, conservation or the wise use of the car appears to be a necessary strategy. While new sources of energy are

being researched and developed, the American people can make an important contribution by using their automobiles more thoughtfully. One expert has stated that if each automobile owner would drive 5 miles less per day, over 1 million barrels of oil could be saved per day.

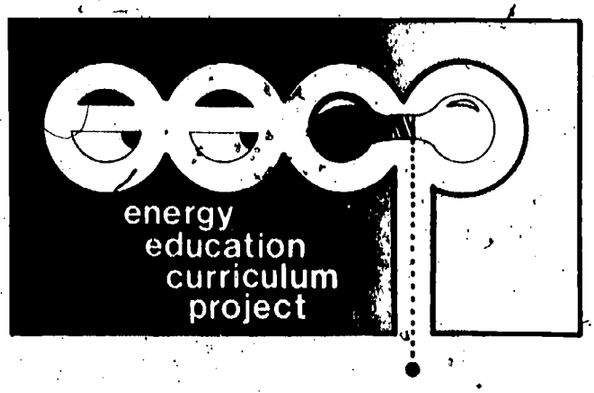
In addition to driving less, there are other things you and your family can do as a joint project to conserve gasoline. Some of these are as follows: maintain the 55 miles per hour as posted for highway driving; keep the proper air pressure in the tires; allow the engine to warm up while driving at slower speeds rather than sitting for a long period of time; use car pooling; and finally, use alternative modes of transportation. The use of any or all of these conservation strategies can certainly lessen our energy demands. We must all use the automobile and other modes of transportation wisely as well as give careful consideration when purchasing a car.

ACTIVITY # 4

Imagine for a moment that you have either been given the responsibility to choose the next family car or that you are old enough to buy one for yourself. Make a survey of the prices and information about cars in your area. After you have completed your survey rank the cars in the order in which you would buy a car for you or your family. Number (1) is the car you would buy first and number (10) is the car you would buy last.

Answer the following questions on your survey sheet.

1. What factors did you consider in choosing a particular car?
2. What was the most important factor?
3. What was the least important?
4. Compare your answers with your classmates.
5. Did you consider such things as the size of your family and where you live?
6. What do you think the results of this survey would look like in 1985? Compare your answers with others.



Energy and the Post War Period

TEACHER'S GUIDE

LESSON ONE: THE POST WAR ENERGY PROBLEM

Introduction:

This is the first of four lessons in the chapter on energy in the post war period. They fit logically into a discussion of the post war era in most American history textbooks. This lesson focuses on the idea of imagination. We want students to be able to create their own ideas about energy in the post war era so that we can build from them. Hopefully this technique will not only teach students some important ideas such as the idea of "increase" and the idea of "consumer," but will get students to see and feel these ideas and make them a part of their own everyday lives. In this way we hope to increase not only their intellectual but their affective potential, motivating them to change their own habits of energy consumption. There are no prerequisite skills for this lesson.

Objectives:

1. Students will know how energy use has increased since World War II.

2. Students will identify how increases in consumption and production result in decreases in the availability of energy resources and products.

3. Students will identify how increases in energy use result in increases in prices.

4. Students will analyze the role energy consumers play in the energy problem.

Time: One to two class periods.

Instructional Strategies:

1. Ask students to read the material on the idea of "increase." They should study the pictures in this lesson and develop their own image of something that is increasing. They should share their images with the class and talk about different ways in which increases occur in their everyday lives. They should take a survey on their feelings about increases and share those also.

   There are no definite answers to the question. The idea is for students to explore the concept of "increase." They should be subject to a wide ranging discussion where many people have different ideas and where they get different images about what the idea "increase" means.

2. The same strategy should be carried out with the word "decrease." Students should read the text material and study the pictures and then have a very wide ranging discussion about the idea of decrease. They should also re-do the survey with their feelings about decreasing as a result of increases in something or in the use of something. The whole idea for students here is to see that increases result in decreases and the two are tied together.

3. Now have students study the material on acting as a consumer by working on Activity #3. You might want them to write their own story about how they might change their habits in order to save basic energy resources. If students have trouble with this idea, you could ask them to make a collage of pictures of different ways people consume energy and go through their collages with them.

4. Now have students read the section on U.S. consumption after World War II. You might want students to work in groups with the chart in Activity #4 in order to determine how energy was used and what results it had for the supply of energy resources. When students have completed their use of the tables and charts, lead a class discussion using the questions in the Activity.

5. When students read the section on energy production after World War II, they should be able to see that both consumption and production increases produce decreases in the available energy supply. Ask students to compare their tests in Activity #5. Then lead a class discussion around problems in consumption and production which students have identified. You may want students to find more examples from the section of the American History text you are using.

6. After you have completed this lesson you may want to begin working with science, language arts, or practical arts teachers on some of the adaptations that are possible in other classrooms. These adaptations are presented at the end of the teacher's guide for this chapter. The more extensively you use the adaptations, the more students will have help from a variety of perspectives in seeing the energy situation and developing sound energy habits.

Student Assessment: Correct answers for assessment instrument for "The Post War Energy Problem" are:
1. D, 2. D, 3. D, 4. A, 5. A

STUDENT ASSESSMENT

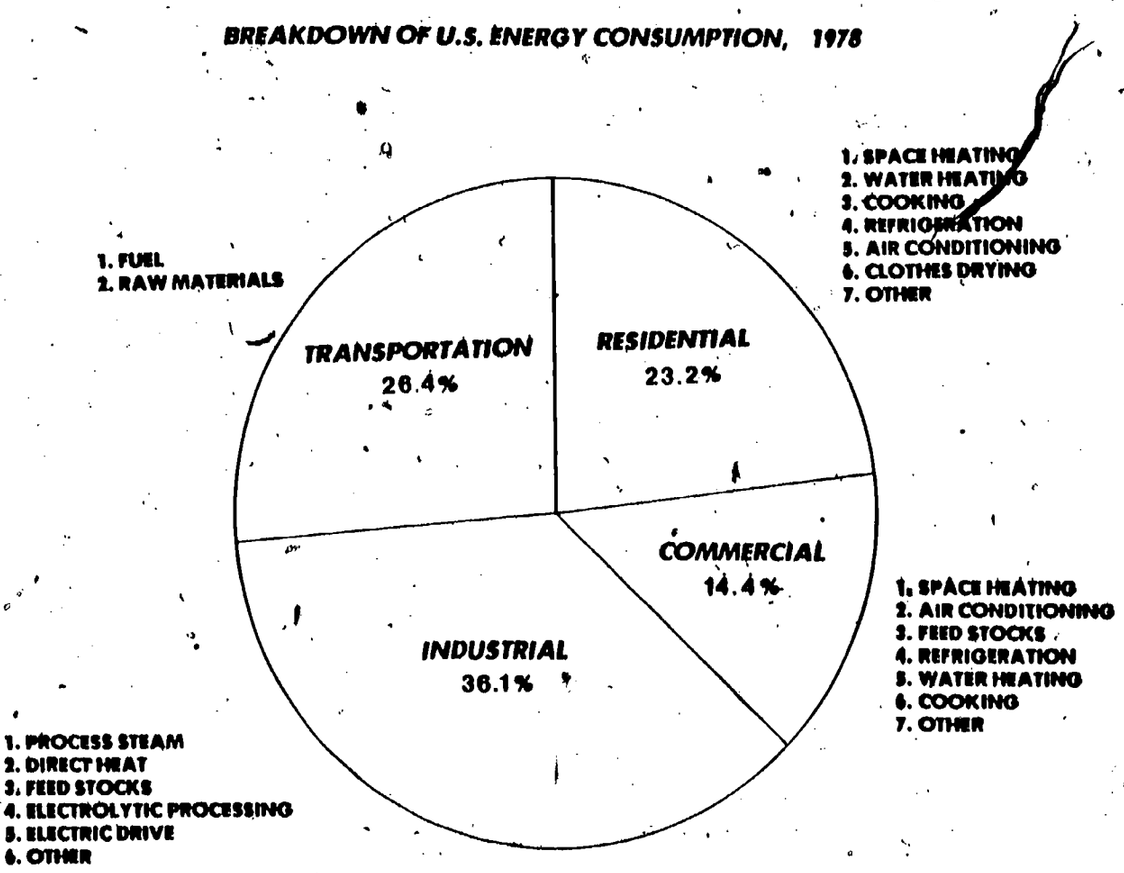
POST WAR PERIOD

Lesson One: The Post War Energy Problem

1. What trend was noticed after World War II related to energy?

A. Fewer automobiles were used.
B. More people moved to the central city.
C. Fewer homes were built.
D. More people used airplanes.

Use the chart below to answer questions 2 and 3.



2. Residential energy consumption is

A. the largest part of energy use.
B. less than commercial use.
C. greater than transportation use.
D. less than industrial use.

3. Which activity consumes over one-third of the energy supply?

A. residential
B. commercial
C. transportation
D. industrial

STUDENT ASSESSMENT

POST WAR PERIOD

Lesson One: The Post War Energy Problem (con't)

4. After World War II, energy consumption increased as

   A. the economy grew.
   B. oil production decreased.
   C. dependence on coal increased.
   D. auto travel decreased.

5. Use of energy products such as automobiles, dishwashers, and applicances can

   A. reduce the available energy supply.
   B. increase the available energy supply.
   C. increase renewable resources.
   D. reduce energy consumption.

LESSON TWO: TAKING LEADERSHIP ROLES IN CONSERVING ENERGY

Introduction:

This lesson focuses on introducing students to three leadership models as a way of attempting to change habits and to take leadership in energy conservation. You may want the students to carry out some in-class conservation strategies before they move out of the class to practice their leadership skills.

Objectives:

1. Students will examine their own energy consumption habits.
2. Students will learn basic leadership models of individuals and groups in energy issues.

Time: One to two class periods.

Instructional Strategies:

1. Students should keep a diary of their activities for one day noting their energy consumption habits.
2. Encourage students to share their energy habits and changes they could make to conserve energy.
3. Now have students read the section on leadership models. Discuss with students about each of the leadership models independently, using the pictures which accompany each model. Students should give examples of how they have taken such a leadership role, or how they might take a leadership role in a non-energy related situation. They should then indicate what they have done or could do in the future in terms of the energy problem and their own leadership role. This should be a wide-ranging discussion and students should be able to see a whole variety of ways in which they might take each of the leadership models and utilize them in their own everyday lives.

   If students have problems understanding the models, you may want to reinforce these ideas by having students do a short biography of someone they know (not necessarily involved in the energy area) and discuss how they were leadership models. More advanced students may wish to do a detailed biography of a particular leader in the energy area.

4. Now ask students as a class to develop one energy conservation strategy in their classroom. They might decide to turn off lights for a week and rearrange desks in order to use natural lighting. They might decide to turn down the thermostat in their classroom. Decide with students a time limit for carrying out their conservation plan (an hour, a day, a week). This should give them one in-class experience which you can observe in carrying out leadership roles in a conservation strategy.

5. When they have completed this in-class activity, have them plan an out-of-class activity where they can use one of the leadership models. The point here is for them to practice the leadership models, not to solve the world's problems, although it is hoped that this will help to change their own energy habits. You may want to wait until after the next lesson for students to carry out their conservation plan when they have learned more about conservation strategies.

6. You may want to use some of the adaptations at the end of this chapter and work with the science teacher, practical arts teacher, or language arts teacher in reinforcing and amplifying the material given here.

Student Assessment: Correct answers for the assessment instrument for "Taking Leadership Roles in Conserving Energy" are:
1. B, 2. A, 3. B, 4. B, 5. B

STUDENT ASSESSMENT

POST WAR PERIOD

Lesson Two: Taking Leadership Roles in Conserving Energy

1. Linda decides to walk to school rather than have her parents drive her. She is acting as a leader in energy conservation by

   A. setting rules.
   B. individual example.
   C. convincing others.
   D. group example.

2. Mr. Gonzalez suggested that the students in his class turn the classroom lights off as they leave. All members of the class decided that it would be a good idea to turn the lights off when no one was in the room. This class has taken a leadership role in energy conservation by

   A. setting rules.
   B. bargaining.
   C. rewarding others.
   D. individual example.

3. One way of conserving energy is

   A. driving to school.
   B. turning down the heat.
   C. watching color TV.
   D. using bigger electrical appliances.

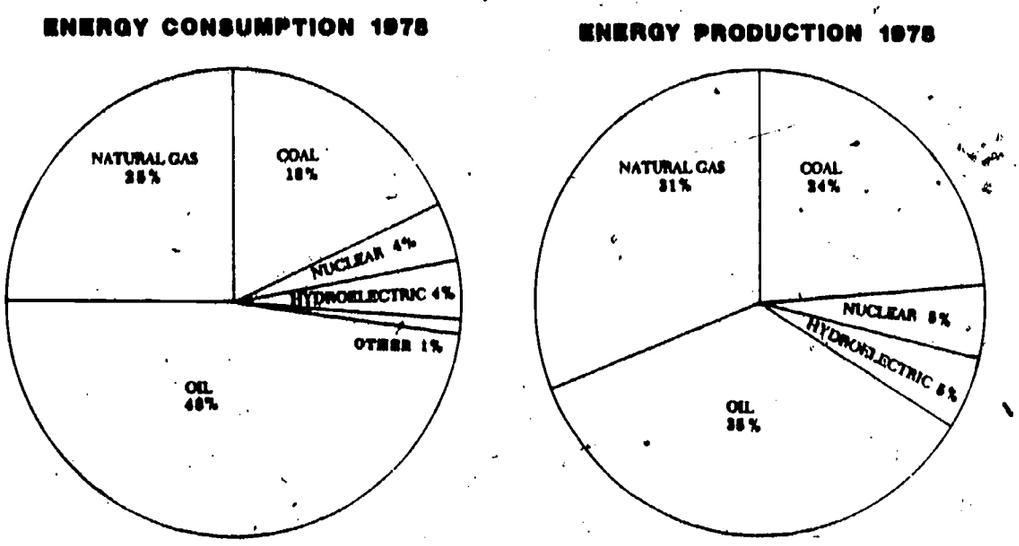
4. "Shifty Williams," a famous race car driver, speaks to a high school group across the country urging them to drive safely and efficiently. He is acting as a leader in energy conservation by

   A. bargaining.
   B. convincing others.
   C. punishing others.
   D. individual example.

STUDENT ASSESSMENT

POST WAR PERIOD

Lesson Two: Taking Leadership Roles in Conserving Energy (con't)



5. According to the chart above, where is the greatest potential for decreasing energy consumption?

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

LESSON THREE: AMERICAN LEADERSHIP AND ENERGY CONSERVATION

Introduction:

In this lesson students will learn some basic ways in which they can conserve energy. They will learn some strategies that they can carry out to make a difference in the energy situation. They will then study possible future solutions to energy problems. Finally, they will plan activities outside of class through which they can make decisions about energy conservation. Prerequisite skills for this lesson include an understanding of the concept of conservation and an ability to read a simple table.

Objectives:

1. Students will identify basic conservation strategies that can be used to conserve energy.
2. Students will recognize the interdependence of the U.S. with the rest of the world in taking leadership and in carrying out conservation strategies.
3. Students will explore energy futures based on what they know about the post war period.
4. Students will develop conservation strategies for the future.
5. Students will carry out a conservation plan in their homes, school or community.

Time: One to two class periods.

Instructional Strategies:

1. Ask students to do Activity #1 and discuss their findings in class.
2. Ask students to read the section of the materials on energy conservation strategies. Pursue with them the idea that the U.S. during the post World War period did not see the need to conserve. Discuss with them examples of energy conservation from their text reading. Then ask them whether or not they see examples of high energy consumption. Then turn to their everyday lives and discuss with them whether or not they have attempted such strategies in their own everyday lives and whether or not they think they could attempt them. Ask students to highlight the discussion with a wide variety of true and potential cases through which they might carry out conservation strategies.

3. Now focus on the section of the materials on interdependence. Students should understand what interdependence means and the ways in which the U.S. is interdependent with other countries. They should see that our actions in relation to gasoline usage, for example, make a difference in the number of imports we must have and our dependency upon other nations. Discuss with students ways in which they are interdependent in their school, in their home, or in their community. Talk about how that interdependence leads toward the necessity for group decision-making rather than individuals acting alone.

   The collection of pictures and articles may be a particularly useful way of teaching conservation and interdependence to lower ability students. The suggested wall collage can be used as a springboard or reinforcement for those students. Higher ability students might want to pursue their findings more extensively by talking with public officials or corporate personnel about their interests in a particular conservation strategy.

4. Conduct a class discussion of students' views on the future of the energy problem. It should be a wide ranging discussion that gets students to explore alternative futures.

   You can pair lower and higher ability students in their study of new technologies. In this way, the convincing of others can produce shared information and skills. You may also want students to write a short essay or organize their information in some way so that you are sure students understand at least one new technology. Some students may actually want to construct a model of the new technology to reinforce or extend their understanding.

5. Discuss each of the new technologies with students and use the pictures to explore possible applications.

6. Ask students to list a series of things they can do about the energy problem and make plans for their own behavior in the future. Talk with students either as groups or as individuals. Have the students report either as individuals or as groups about their energy conservation plan. In addition to developing a plan, students should develop a way of assessing their impact on the energy problem.

7. Be sure to continue to ask students about how they are implementing their energy conservation plan as you do lessons later on in the course.

8. You may want to consider utilizing some of the adaptations found at the end of the chapter guide in conjunction with other teachers to extend students' knowledge and awareness of the energy problem.

Student Assessment: Correct answers for the assessment instrument for "American Leadership and Energy Conservation" are:
1. A, 2. A, 3. D, 4. A, 5. C.

STUDENT ASSESSMENT

POST WAR PERIOD

Lesson Three: American Leadership and Energy Conservation

1. The highest levels of energy consumption have occurred during

   A. the 1970's.
   B. Colonial times.
   C. the 1950's.
   D. the Industrial Revolution.

2. In recent years, Americans have become more dependent on

   A. oil imports.
   B. oil exports.
   C. coal exports.
   D. coal imports.

3. If future energy consumption increases in the United States, we would be

   A. changing habits by conserving.
   B. paying lower prices for energy.
   C. becoming less dependent on energy.
   D. continuing trends of the last decade.

4. An example of the "use less" conservation strategy is

   A. driving at slower speeds.
   B. using waste heat for other purposes.
   C. using a renewable energy source.
   D. switching to another energy source.

5. In the early 1970's, the United States began to worry about its energy future because of

   A. increased conservation efforts.
   B. a decline in economic growth.
   C. a temporary shut-off of oil imports.
   D. a decrease in prices.

ENERGY IN THE POST WAR PERIOD
ADAPTATION LESSONS FOR SCIENCE, LANGUAGE ARTS AND PRACTICAL ARTS

The purpose of these adaptations is to extend instruction about energy outside of the social studies classroom. It is hoped that social studies, science, language arts, and practical arts teachers will work together to influence students in multiple ways to learn about the energy problem, to inquire into its many dimensions and to take action in energy conservation.

The first adaptation focuses on increasing consumption patterns in the United States. Here students take one or more energy products and determine how their own consumption patterns of that product have increased. The second lesson focuses on energy resources. Here the lesson is concerned about what resources are a part of students' everyday lives, and how basic resources become transformed into energy products. The final lesson is on leadership roles. Here students are asked to take leadership roles in a classroom conservation plan.

ADAPTATION LESSON: PATTERNS OF ENERGY CONSUMPTION

Idea. The idea here is for students to trace their own consumption patterns of some energy product. They should work with others in identifying an energy product or several products. What students need to do is to understand the idea of increasing consumption and what it means in terms of energy resources.

Objectives:

1. Students will know the idea of "increase" by tracing patterns of energy consumption in their home or school.
2. Students will develop a plan for cutting consumption of a particular energy product they choose.

Science Classes. This lesson will focus on natural resources such as fossil fuels. Students could see where energy comes from and do a survey of their room at home, or a particular room at school, and its use of energy products which are made from or use those particular resources. They could talk with parents or teachers about the amount of the energy resource that was used a long time ago, and compare it with the use now. You could then hold a class discussion pooling students' ideas of what energy resources are being consumed more now than before. They would then develop a class or small group conservation plan for how they might cut consumption of energy products which come from these natural resources.

Language Arts. Students can read a novel, poem, or story which involves someone using energy in the 1940's and 1950's. They could compare it to their current use of energy products and write an essay on increases in consumption, and show how they might conserve on the use of this particular energy product.

Practical Arts. Here students can study a particular energy product, such as an automobile, electrical appliances in the kitchen, food products or clothing, and show the increase in energy consumption over the years. They can talk with their parents and trace their own patterns of consumption. Students might do a collage on the different ways that appliances in the kitchen, for example, consume energy. They would see that energy consumption is increasing, and plan ways that they might conserve on energy consumption in their homes or in their school.

ADAPTATION LESSON: ENERGY RESOURCES

Idea. This lesson focuses on energy resources and how they are transformed into energy products. Students will see how energy is used not only in consuming products, but actually in making them. They will also discover some new types of products that they have probably not thought were energy intensive. Students tend to think that gasoline is an important petroleum product. They do not realize, for example, that plastic in plastic containers and pens that they use everyday are also energy intensive.

Objectives:

1. Students will know basic energy resources.
2. Students will know how resources are transformed into energy products.
3. Students will know basic energy products and where they come from.

Science Classes. First, students should see what basic energy resources are, such as fossil fuels, and speculate on products that come from them. They should go on a scavenger hunt to find a specific product. They should then study what energy resources are involved in making that product and in using that product. Through this lesson, students should recognize that energy is used in the making of a product, not just in its consumption.

Language Arts. A debate should be organized. Students are organized into groups to study a particular energy product and its use. They should know the resources which made the product, and the resources which are consumed in using the product. This should be done for several products in the class. When the groups have finished their study, they write a short report on their product and its use. Groups should be arranged in order to debate the best use of the product; whether it should be conserved, or whether it can be used freely.

Practical Arts. Students should take a specific product and see what energy was used to make it and to use it. An electrical appliance, for example, can be used. Students should study what resources go into making it, what kinds of electricity it uses, how much energy it uses, and what general consumption patterns are. They should be able to do an estimate of the energy that is used in making and consuming the product. When students have completed their study of a single product, they should then discuss what happens when literally millions of people begin to use the product everyday.

ADAPTATION LESSON: LEADERSHIP ROLES IN ENERGY PROBLEMS

Idea. The idea here is for students to see the various roles they can take to conserve energy. Students can take a leadership role. Most of them will not even have thought about this possibility. Here we will try to make them aware of roles they can take and have them take action in important ways with their peers.

Objectives:

1. Students will be aware of the variety of leadership roles they can take in energy conservation.
2. Students will act in some way to take leadership in energy conservation.

Science. Have students study several profiles of scientists and discuss how these people were leaders in their field. Choose scientists who not only are leaders in terms of scientific inventions, but were societal leaders in terms of social and political problems. Ask the students to project what they think these scientists might do in terms of some energy problems, and then discuss how students might do something. Have the class or small groups make exhibits which illustrate ways in which students can take roles in leadership conservation, modeling the roles of famous scientists to which they have been exposed.

Language Arts. Ask students to develop skits regarding the roles that people can take on an energy problem. Have them demonstrate ways that various people can take leadership in energy conservation in important areas. Students act out their skits in front of the class. After each skit, the leadership roles that were taken should be discussed as well as how they might take these roles in their everyday lives.

Practical Arts. Ask students to design a more efficient energy system. They might want to choose an automobile engine, or a home appliance, or construct clothing that is more versatile. Students should be able to see that they have ideas about more energy efficient products or appliances. Have them either draw or build something based on their ideas. Post students' drawings of their systems around the classroom and refer to them in subsequent discussions.

ENERGY AND THE POST WAR PERIOD

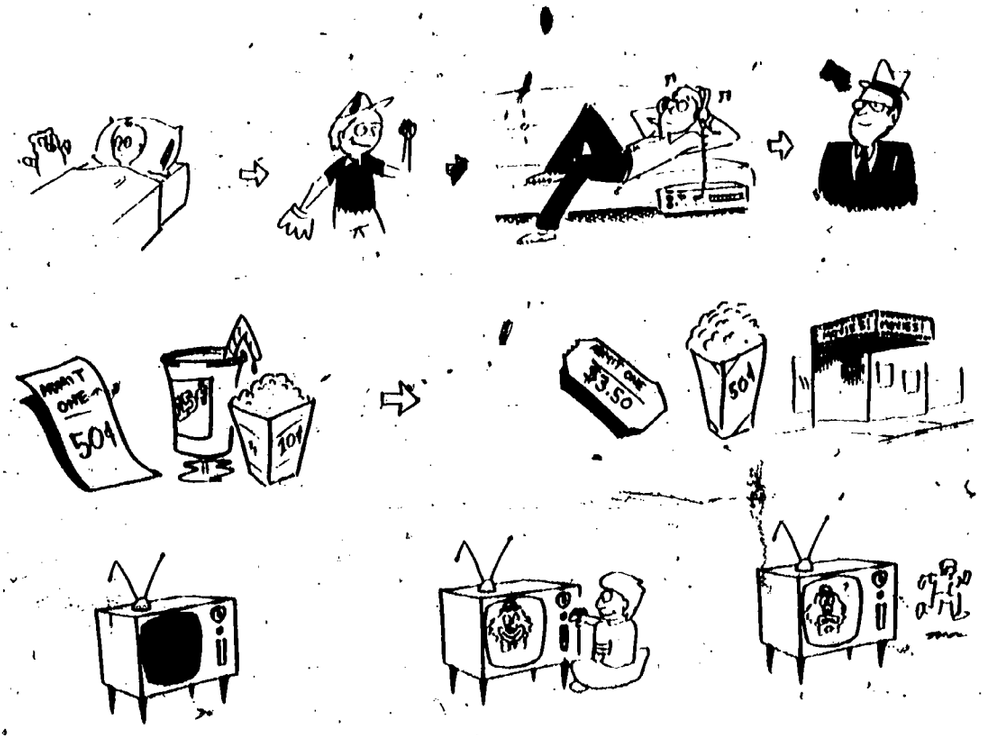
LESSON ONE: THE POST WAR ENERGY PROBLEM

Lesson Objectives

- To know how our energy use has increased since World War II
- To identify how increases in consumption and production result in decreases in the availability of energy resources and products
- To identify how increases in energy use result in increases in prices
- To analyze the role energy consumers play in the energy problem

ACTIVITY #1

Think for a minute about things that INCREASE. Study the pictures below. What three increases can you find?



There are a variety of kinds of increases which are important here. People increase. There are more people. People grow taller. People gain weight. In many ways, people experience increases. Think about the ways that you have experienced an increase from this morning, yesterday, last week or years ago.

Things also increase. Money increases if you get a job and can pay for the things that you do. Houses increase when people make new additions. Schools increase when they add new buildings, or more teachers, or students. Movie costs increase when you pay more for getting in or for popcorn. Things can increase in many of the same ways that people do.

In addition, the way people use things can increase. People can watch more television, and therefore use the television more. People can ride bikes more often, and therefore use a bicycle more. The use of things is as important an increase as the actual increase in people or the things themselves.

Now think about the opposite of increases. Along with almost every increase comes a decrease. If you increase the amount of food you eat, you decrease the food supply. If you eat an apple and a banana, you decrease the number of available apples and bananas for others to eat. This decrease comes about because there is a limited supply of these food resources and too many people. There are only so many apples that can be eaten in your home, your school, your community, or the world, at any given time. Because there is this limit, if you increase what you do, then there is less for everyone else who likes to eat apples or bananas. This idea of increases causing decreases is often summed up in the word "scarcity."

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ACTIVITY #2

We have been talking about increasing food that is eaten, and as a result decreasing the available food supply. A lot of other things decrease when certain things increase. Look again at the pictures of increases. In the space below, indicate what decreases are a result of the increases in people, things, or use, that are involved in these pictures. For example, as people increase in size, they decrease the world's food supply. As there are increases in price, there are decreases in the amount of things that you can purchase for that price. Make a list similar to the one below on a separate sheet of paper and give your own answers.

	INCREASES	DECREASES
1.	_____	_____
2.	_____	_____
3.	_____	_____

INCREASES AND DECREASES BY ENERGY CONSUMERS

The ideas of increases and decreases apply to energy in many ways. We have limited energy resources. When we increase our use of these resources, their availability decreases. Our uses of energy products such as automobiles, dishwashers, home heating, can make the available energy supply less. Increasing the use of energy also makes prices rise. As a result, fewer people can afford to use energy.

ACTIVITY #3

All of us are energy consumers. An energy consumer is a person who uses energy products. If we increase our use, then the availability of energy decreases and prices rise. Read the following story and think about how Susan is an energy consumer. Pay careful attention to the increases in Susan's energy use and the decreases in the availability of energy resources and products that occur.

A DAY IN THE LIFE OF SUSAN SMITH

Susan used to live in a city. She used to walk to school. She spent most of her time with her friends in their apartments. When Susan was with her parents, they were talking or reading together.

Susan's father was in an industry that made automobiles. After World War II, Susan's father was promoted in the company. The family moved to the suburbs. Susan's father now drives to work. Susan lives a long way from the school she attends.

During Susan's average day, her father drives her to school before he drives himself to work in the city. At school, Susan studies science, mathematics, English and social studies. Often she is uncomfortable because of the building. The building is overheated. She must shed her sweaters and coats in order to keep from being too hot. Susan uses a great deal of paper as she does lessons. Susan wonders whether or not the school owns a paper factory because of the paper that is used and then thrown away.

Susan eats lunch in the school. She buys food such as sandwiches in a plastic wrapper. As she throws the wrappers away, she notices the large amount of paper waste in the school cafeteria.

After school, Susan often rides home with friends and goes to her friends' houses. There they eat and watch TV. TV's in people's

homes use a lot of electricity.

When Susan calls her father to pick her up, she goes home and has dinner with her family. Instead of doing the dishes, she now uses the dishwasher. It takes a lot less time. She does her homework and uses even more paper. Because she is tired, she leaves her light on all night and awakens in the morning to find it is still burning.

1. What energy resources and products is Susan consuming?

2. Which of the resources she uses are renewable? Which are not?

3. How has her use of energy products increased since before the war?

4. What energy resources are decreasing in their availability due to Susan's consumption?

5. How might energy prices increase because of Susan's actions?

ENERGY CONSUMPTION AFTER WORLD WAR II

As Susan's consumption increases, the availability of some resources decreases. As she used more electricity, the supplies of coal, water, and other sources of electricity were being depleted. As she ate pre-packaged food, the supply of food and oil that goes into plastic wrappers was decreased. As she consumed large amounts of paper, available wood resources were decreased. Efforts at renewing this resource would need to increase. If you multiply Susan's average day by the millions of middle or junior high students who go to school each day, you can see how these numbers begin to increase dramatically. The decreases cause the availability of energy resources to go down, and prices increase.

One of the easiest ways to learn about consumption patterns for energy is to study a set of facts about the Post World War II period. They can be listed as follows:

The automobile boom occurred after World War II.

By 1970 more people lived in suburbs than in cities and used their cars more for work and other necessities.

TV's became popular after World War II. In 1947 there were only 14,000 TV's in homes in the United States. By 1953 there were over 20 million.

In 1959 the first commercial jet was flown coast to coast by American Airlines. This started the boom for jet traffic business and pleasure.

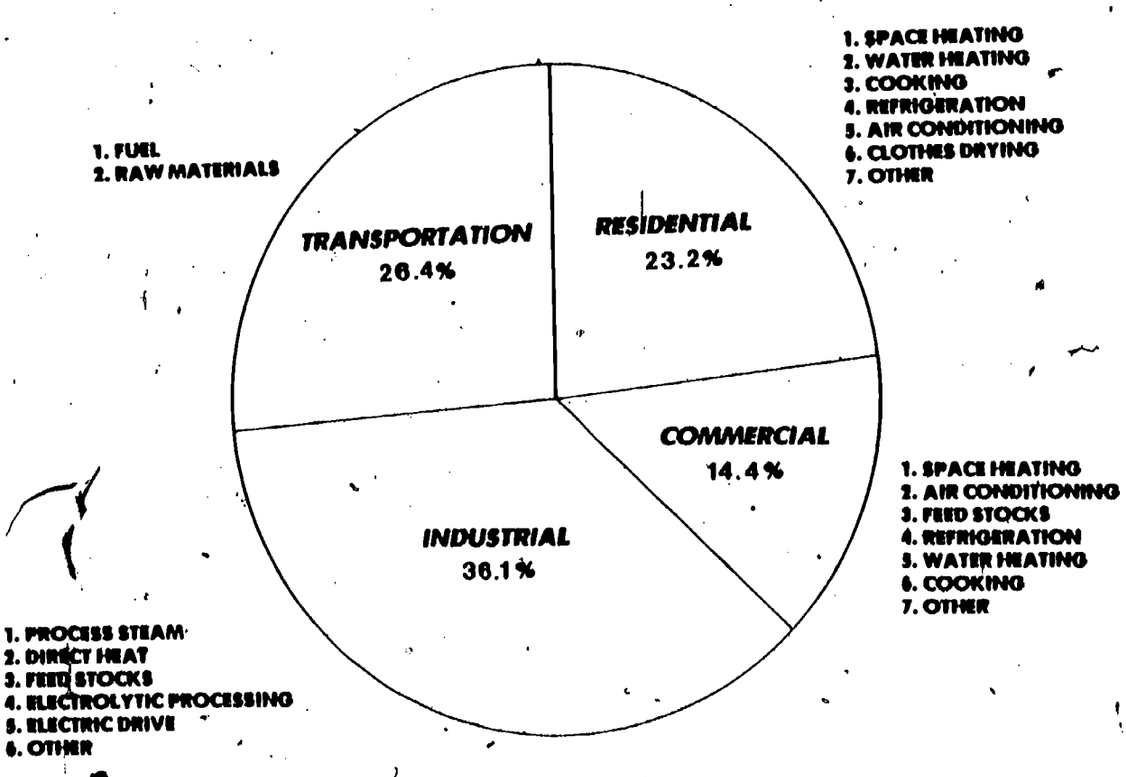
In all of these ways, Americans became greater consumers of energy. By moving to the suburbs, they produced a housing boom. This housing boom produced new needs for home heating and for people to commute from the suburb to the city. By introducing TV's into the home, millions of people began to buy them and to use them on a regular basis. Today most homes have more than one television.

ACTIVITY #4

The chart below indicates how people use the basic energy supply that we have. The chart gives a basic idea of what kinds of consumption patterns Americans have. Use the chart in answering the following questions:

1. In what area is the most energy consumed?
2. What are the main things we use energy to do?
3. What are the main uses you make of energy at home or at school?
4. What are the results of using too much energy for you? For other people?

BREAKDOWN OF U.S. ENERGY CONSUMPTION, 1978



ENERGY PRODUCTION AFTER WORLD WAR II

It is not only consumption increases which cause decreases in the availability of energy resources. Also it takes a lot of energy to produce something. The car that Susan's father drives takes a great deal of human and physical energy to produce. The steel mills in which the steel for the cars is made are generally run by coal. Huge furnaces burn coal to make the steel which eventually goes into automobiles. This is just one example of how production in available energy resources decreases. In this case, the increase in the production of cars causes decreases in the available coal supply.

In the post World War II period, the United States began to develop a serious energy problem caused from production and consumption after the war. On the other hand, the United States was becoming a world leader. The Marshall Plan was helping to rebuild Europe. People and materials were being sent from the United States to help West Germany and Japan rebuild. For example, oil production increased at a very high rate. The oil production curve rose dramatically between 1940 and 1960. During these years, oil was the major source for industry as well as for homes and its use in production of the materials which made the United States a world leader.

At the same time, we began to consume more energy. As we became a nation of suburbs and a nation of conveniences, such as automobiles, television, appliances, and other products, we began to consume energy at an ever-increasing rate. With the growing economy came energy consumption. Again, the consumption would cause problems in available energy supply in all areas.

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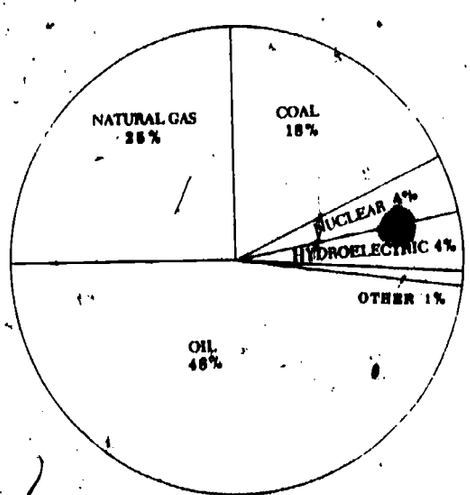
Using oil as an example, what happened was that our consumption of petroleum increased faster than our production of petroleum and the problem that this generated was a dependence on oil. During the early 1940's we were oil exporters. This situation changed from 1940 to 1960 and the U.S. became dependent upon other countries for the oil necessary for commercial and residential use.

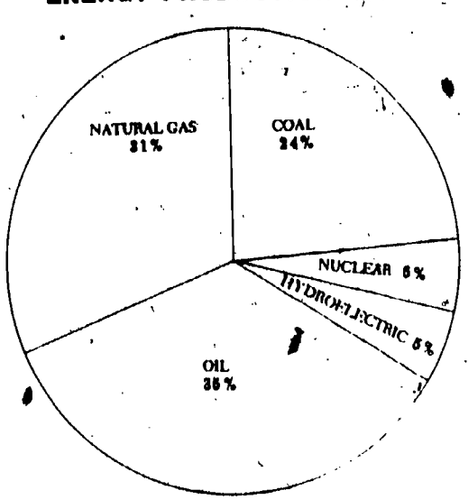
ACTIVITY #5

The charts below show how problems of consumption and production of energy still existed in the United States in 1978. You can easily see how we consumed more oil than we produced. At the same time, we produced more coal than we consumed. Study the charts and make a list on a separate sheet of paper of the energy resources that show greater consumption than the amount produced. Then list the resources that were produced in greater quantity than they were consumed.

ENERGY CONSUMPTION 1978



ENERGY PRODUCTION 1978



Source: Energy and Education, May 1979, p. 6. (Published by the National Science Teacher's Association.)

Compare the list with one other student's list. See if you can see at least three problems in our use of energy since World War II.

ENERGY AND THE POST WAR PERIOD

LESSON TWO: TAKING LEADERSHIP ROLES IN CONSERVING ENERGY

Lesson Objectives

- To practice different ways students can take leadership roles
- To examine energy consumption habits

ACTIVITY # 1

One way to learn about energy consumption is to look at the individual habits people have. A habit is something you do regularly. It is a part of your everyday life-style. You do it without thinking. It is as natural as getting up in the morning, or having dinner, or for that matter, going to school.

Think about the energy habits you have. Keep a diary of your activities for one day. List the ways in which you might change your habits in order to consume less energy. Share your ideas with other students in your class.

THREE LEADERSHIP ROLES

One way you can help to conserve, or consume less energy, is to act as a leader for others. There are at least three ways you can act as a leader in energy conservation. They are: 1) Individual example, 2) Convincing others, and 3) Setting rules.

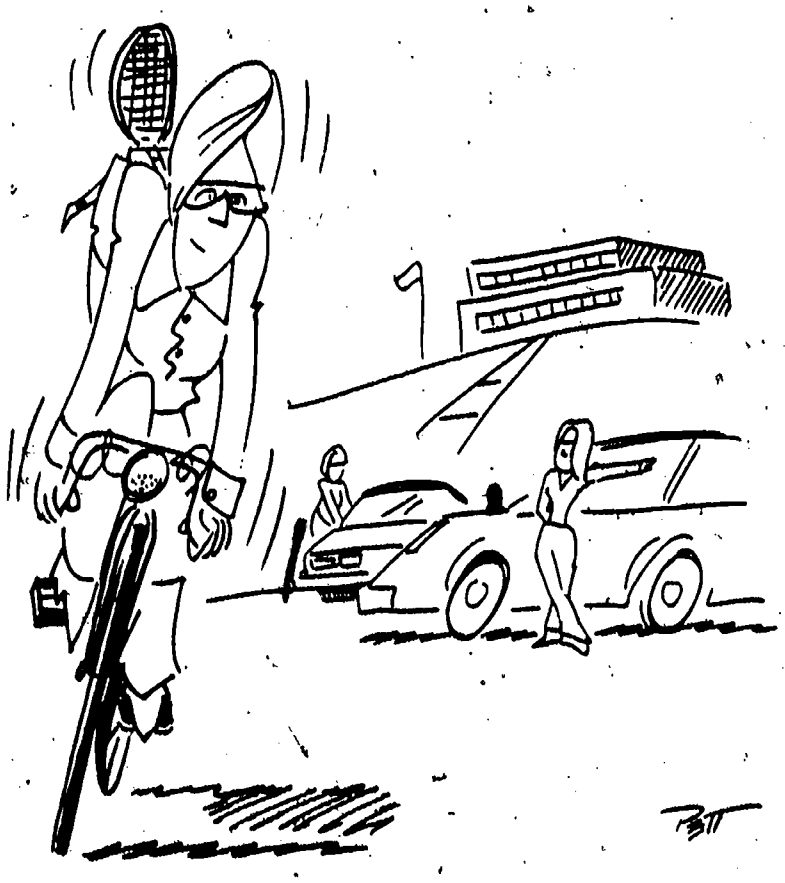
Individual Example. You yourself can be an example, or model, for energy conservation. If you want to change some of your habits of energy consumption you can ride your bike to school instead of having your parents drive you. You can wear warm clothes in the winter so your home and school

will not have to use so much heat. You can watch less TV. In this way, you would set an example for other people. You would not need to say anything. You would merely act in ways that would conserve energy. If others were watching you or were aware of your activities, then you would set an example for them.

There are some important criteria, or rules, for anyone who tries to take leadership by setting an example, or model, for the behavior they want others to follow. They can be listed as follows:

1. Modeling is a silent activity. You should act out a role without talking about it.

2. Modeling requires clear signals. You should make sure that actions are obvious so that they can be viewed or seen by others as an example.



INDIVIDUAL EXAMPLE

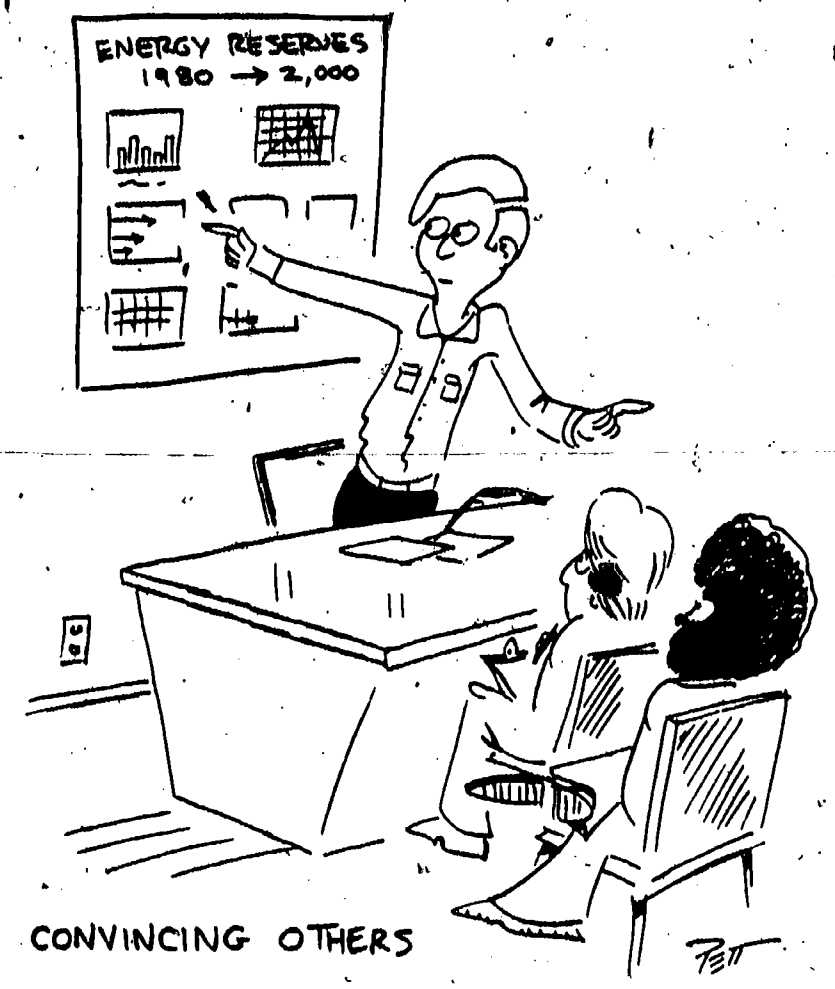
If you follow these criteria, you can model effective energy conservation by turning out lights at home or at school, by walking or riding a bike instead of having parents drive you places. You can put on a sweater and try to dial down the thermostat. You can save food energy by making sure that your calorie consumption is only what you need to be strong and to grow.

ACTIVITY #2

Think of one activity you can carry out for energy conservation. Model that behavior for one week. Write a short report on what you think was the impact of your individual example.

Convincing Others. Convincing someone involves a great many things. You have to be persuasive and know what you are talking about, but you also have to know about another person. If you try to convince your parents not to drive their car as much, you must come up with convincing arguments about the price of gasoline, the family budget, the need to preserve oil energy resources or other such ideas. Basically, there are some criteria for successful attempts to convince other people. They can be listed as follows:

1. Know the interests and concerns of the people you are trying to convince.
2. Have a series of clear arguments developed in favor of what you desire the other person to do.
3. Give that person a great deal of support by helping the person to change his or her habits and by encouraging the person when those habits are changed.
4. Be prepared for a counter argument and treat the other's point of view as a valid point of view.
5. Solicit the other person's support for your position quietly and logically.



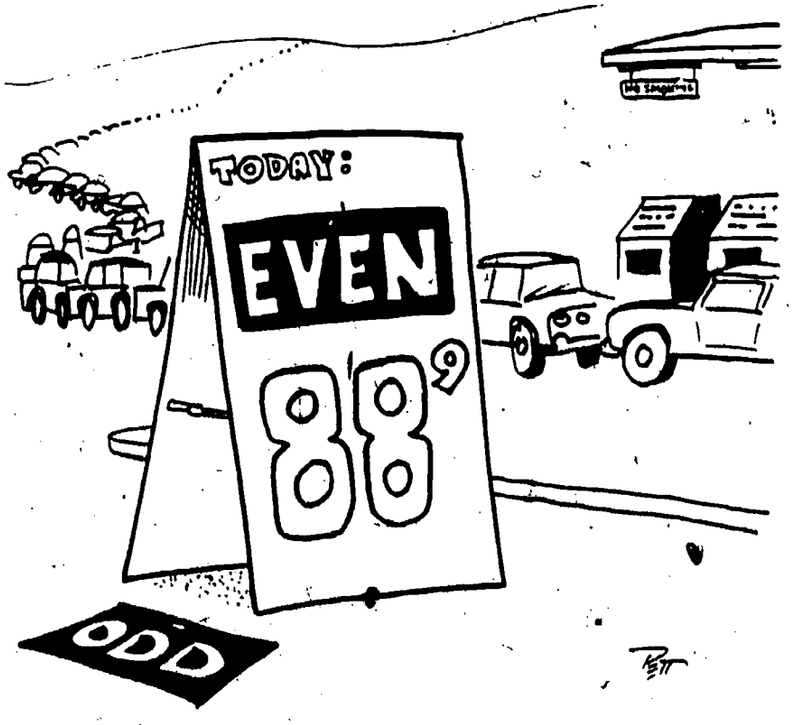
CONVINCING OTHERS

ACTIVITY # 3

Decide on one way to conserve energy that is important to you. Pick one person in your class and try to convince that person to join you in your energy conservation plan. Be sure to follow the criteria you have learned for convincing others. Share your successes (and failures) with others in your class.

Setting Rules. Another way that people take leadership roles in energy conservation is by setting rules. States have set rules about using gasoline. You can also set rules in your home or school which will help to conserve energy. You can work with others to set rules about turning off lights, setting thermostats or opening windows in the winter.

Normally, setting rules involves working with other people in a group. When you work in a group, people often have different opinions about what to do. In order to set a rule, you need to bargain with them. You need to give them something in order to gain their support.



SETTING RULES

Trading, or bargaining, is one of the more difficult leadership models to follow. It involves being sensitive to other people and being sure you can give them something they want and which you in turn can produce. In many cases people have a hard time finding things to trade. Time, friendship, activities and work are often common things that people trade when they believe in something.

In bargaining you ought to follow these criteria:

1. Know the person you are bargaining with; know what that person's interests are and the kinds of things he or she would accept as a trade for conserving energy.

2. Know your own strengths. Know what you can give them in turn for their compliance with your wishes.

3. Always give the other person support in efforts to support your wishes.

4. Always be true to your bargain and live up to your end or the other person will not change habits.

ACTIVITY # 4

Work with a group in your class to decide on one energy conservation rule you would like to set in your classroom. Be prepared to bargain with other members of your class in order to support the rule. Present your case to your classmates and follow the criteria for good bargaining. Try to get them to accept your rule. After everyone has finished you will discuss your successes (and failures). Then you will try to work under these rules which have been set.

ACTIVITY #5

You have seen how you can take leadership in a situation which involves energy conservation. Take some time to think about an energy situation in your own home, school or community. Pick one situation in which you have an interest. Make a decision about what you can do to save energy and which leadership model you could use. Then work with others in your class and your teacher in order to develop a plan about how you would practice your leadership role in a group that is important to you. Be sure to identify clearly what you want to do, who is involved in the group, when the group will meet, and outline in a step-by-step way your plan for carrying out your leadership role. Write your plan on a separate piece of paper.

ENERGY AND THE POST WAR PERIOD

LESSON THREE: AMERICAN LEADERSHIP AND ENERGY CONSERVATION

Lesson Objectives

- To learn about three ways to conserve energy
- To explore energy futures
- To develop conservation strategies for the future
- To carry out some aspect of an energy conservation plan

ACTIVITY #1

Conservation means taking care of things so that they will last longer, or the wise use of something. Choose one person in your school -- a teacher, student or staff member. Talk with that person about how he or she conserves energy. Use the following questions.

1. What do you do to conserve energy?
2. What could you do to conserve energy that you don't do now?
3. How can students help to conserve energy?

Write down your answers and bring them to class.

THREE CONSERVATION STRATEGIES

As the record shows, the post war period was a time of U.S. leadership in foreign affairs and home production. It was also a period of high energy consumption. The United States did not take leadership during this period in conserving energy resources. Resources were being used because of the rise in production and consumption patterns. It was not until the early 1970's that the U.S. really began to worry about its energy future. It

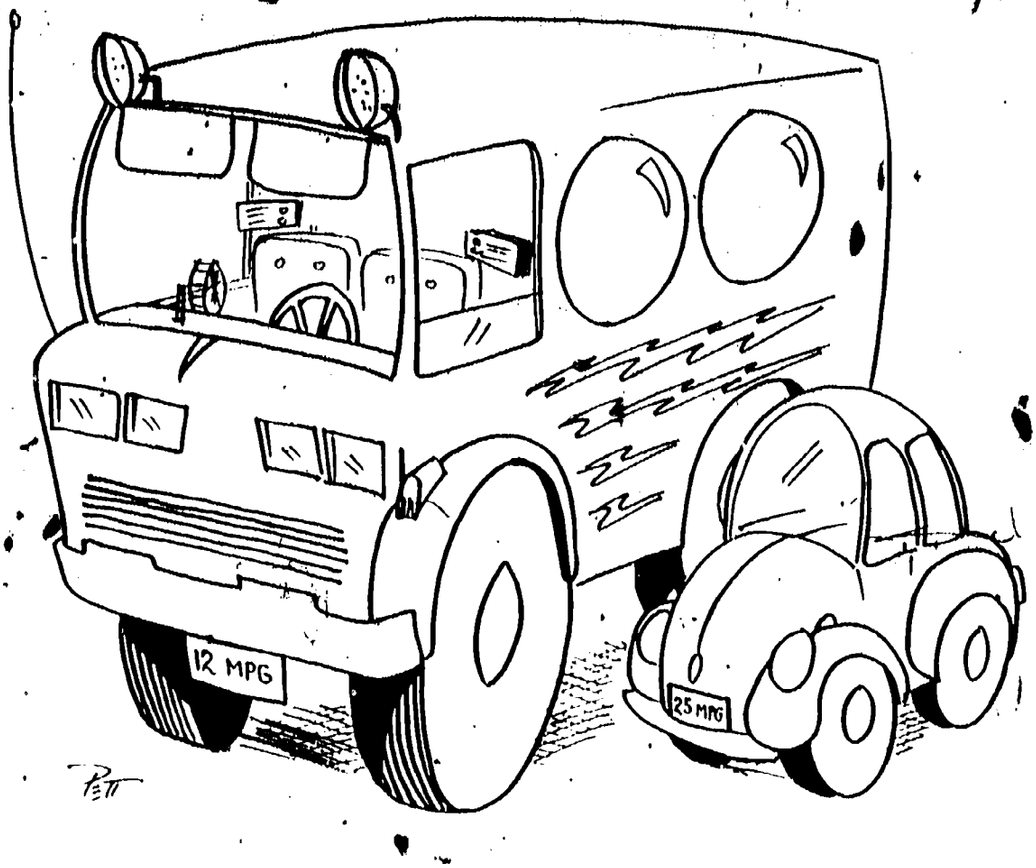
did so because of the oil crisis in the Middle East. This crisis caused a temporary shutoff of oil imports (oil coming into the U.S.) and permanent price increases.

Although the U.S. has not taken strong leadership in the conservation area, there have been efforts at energy conservation, many dating back to the post World War II period. Three typical energy conservation strategies can be summarized as follows:

1. USE LESS ENERGY
2. USE SOME OTHER TYPE OF ENERGY
3. USE ENERGY MORE EFFICIENTLY

Using less energy. This is a strategy that has been tried for many years, both by the government and by private individuals and businesses. What this strategy often involves is making a law, such as the 55 mile per hour speed limit. This means that people will drive more slowly and use less gasoline, and deplete the oil supply less rapidly. Reduction of lighting is the same kind of strategy. If people can turn out lights and reduce the number of needless lights they have on in their homes or businesses, they will use less electrical energy. We would save on coal, hydropower, or other resources. This is a voluntary action, and not one that requires making a law. Another voluntary action involves buying smaller cars which use less gasoline.

Basically, the "use less" idea was not popular in the 1940's through the 1960's. People were interested in high consumption as a mark of success. Using less energy was difficult. Using more was the usual pattern.



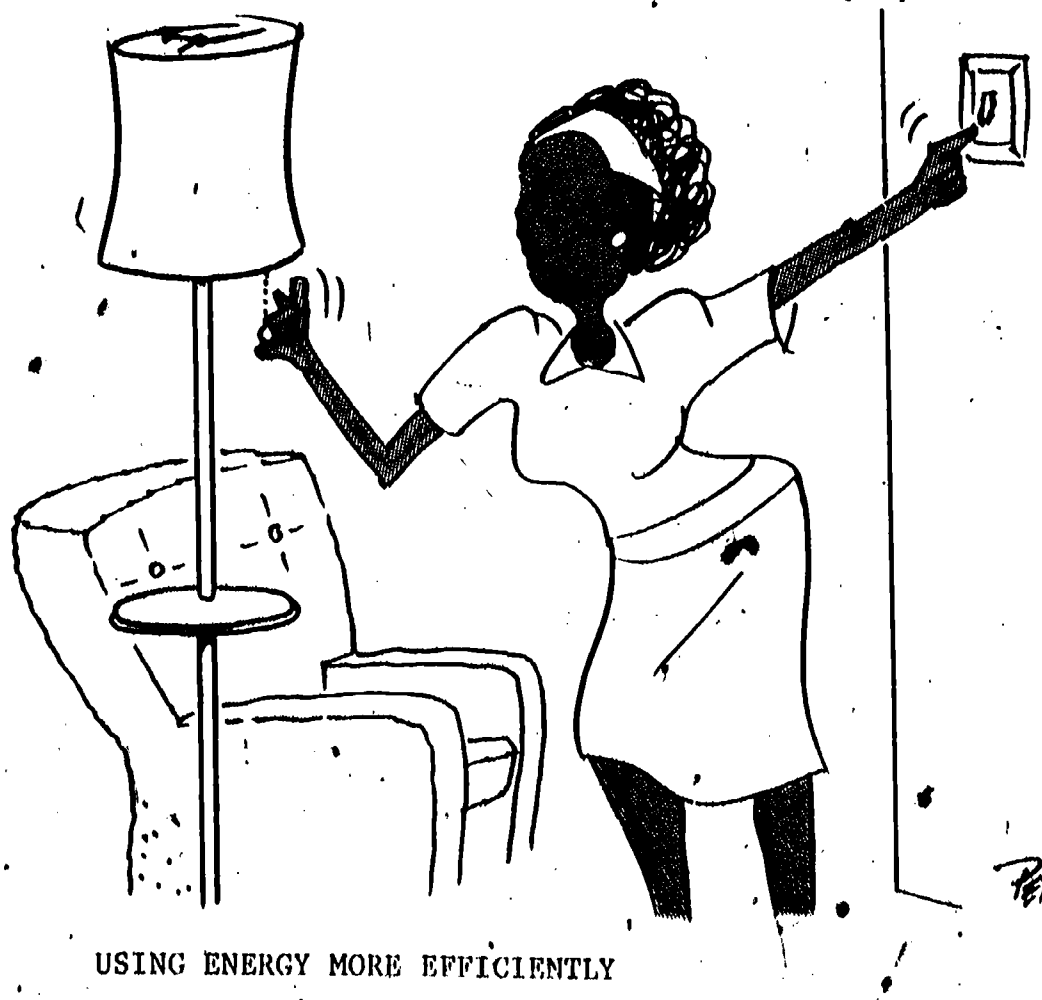
USING LESS ENERGY

Using some other type of energy. This is also a viable strategy. Here one uses coal instead of oil for firing furnaces. Nuclear power becomes a real alternative to oil imports. Solar energy becomes a useful alternative. In this way, if we are concerned about oil reserves, we can find other sources which are more efficient for energy conservation. However, few people have switched to alternative energy sources, either on the private level or on the public level.

One of the easiest ways to use another type of energy is to use human energy instead of other forms. In the picture on the next page the boy is using a hand mower to cut the grass. Normally, lawn mowers use both gasoline and oil. Since human energy is renewable, or can be restored and used again, he is conserving energy by using less gas and oil and using human energy instead.

USING SOME OTHER TYPE OF ENERGY

Using energy more efficiently. This strategy is also one that has been sought through public and private agencies. Some people have decided to turn off some lights and use lower wattage bulbs in others. Other people have decided to keep their car in good repair to improve mileage. Still other people have decided to insulate their homes to improve heating and cooling efficiency. All of these types of decisions help to conserve energy.



USING ENERGY MORE EFFICIENTLY

ACTIVITY # 2

Make a survey of your classroom. Decide which energy or energy products you can use less of, substitute or you can use more efficiently. Share your ideas with other students in your class. Develop a classroom energy conservation plan on which everyone can agree, using one or more of the conservation strategies. Carry out your plan for the remainder of the class.

ENERGY DEPENDENCE AND INTERDEPENDENCE

All of these alternatives had little support during the period of high consumption in the 1940's through the 1960's. They have now been revived and promoted due to depletion of available energy resources in the 1970's. There is another problem with energy conservation which makes these alternatives even more viable today. Beginning in the 1960's and early 1970's, the U.S. became dependent on imports of oil and other energy products. The percent of U.S. imports of oil is one of the crucial areas of the energy problem. For example, we are dependent on the Middle East for over 19% of our imports and this amount is increasing on a year-to-year basis. In the oil crisis in 1973, there was first a cutoff and then a price increase. This emphasized the dependency of the United States as an energy-consuming nation. More important, we are dependent on other areas of the world, including Africa, Canada and South America, for energy support. The chart on the following page shows our increasing dependence on oil imports.

U.S. OIL SUPPLY AND DEMAND (in billions of barrels)				
YEAR	DOMESTIC PRODUCTION	CONSUMPTION	IMPORTS	IMPORTS AS PERCENTAGE OF CONSUMPTION
1965	3.3	4.2	0.9	21%
1967	3.7	4.6	0.9	20
1969	4.0	5.2	1.2	23
1971	4.1	5.5	1.4	24
1973	4.0	6.3	2.3	36
1975 (projected)	3.7	6.8	3.1	46

Source: Energy-Environment Mini-Unit Guide. Washington, D.C.: National Science Teachers Association. 1975.

This dependence has created a situation for which the term "interdependence" is most often used. This means that nations around the world share dependencies on scarce energy resources. While we are dependent on oil, we have the opportunity to export coal to nations who need it. Therefore, there is a dependency of nations on each other for their survival in the energy area. This interdependence has brought the energy question into foreign policy and the relations between nations.

Conservation and leadership is a complex question. It depends upon the government, multi-national oil corporations, and public utilities. It also depends upon citizens. It depends upon the interdependence of the community and nations and individuals within it for its true solutions. Therefore, energy conservation depends a great deal upon group activity.

ACTIVITY # 3

Use the pictures on types of conservation strategies and the information on interdependence to answer the following questions.

1. In what ways could you take a leadership role by using less energy? By using alternative energy sources and/or products? By not using energy?

2. How would you be interdependent with other people in carrying out your leadership role?

Find some examples of energy conservation in your local community newspapers or magazines. Make a display of the articles and pictures on a wall in your classroom. Discuss the conservation strategies you have found with other members of your class. How are these strategies different from those people used in the 1940's and 1950's? You may want to talk with senior citizens in your town about these differences.

ENERGY FUTURES

We have seen what the energy picture looked like during the 1940's through the 1960's. Current conditions in the late 1970's are an exaggeration of the curve which began in the 1940's and 1950's. The 1970's have been characterized by some of the highest levels of energy consumption. People across the country are now beginning to think of what they can do to preserve energy and cut back on consumption. The future depends on conservation strategies that are used now.

Continuing Present Trends. Continuing present trends would mean that energy consumption would continue to increase at a fast rate. In effect, we would continue to do exactly what we have been doing with major consump-

tion of oil and other energy sources and products. We would exhaust available natural energy supplies in the long run and prices would increase. The consequences of this prediction are considerable. Electrical consumption has been doubling every ten to fifteen years. At this rate our basic electrical usage would outrun the ways we have for getting electricity. What all of this means is that without important kinds of measures to cut back on consumption, things we take for granted - lighting, fuel oil, transportation, heating, and other "necessities" - will be cut back dramatically. Clearly, something has to "give" in the consumption pattern.

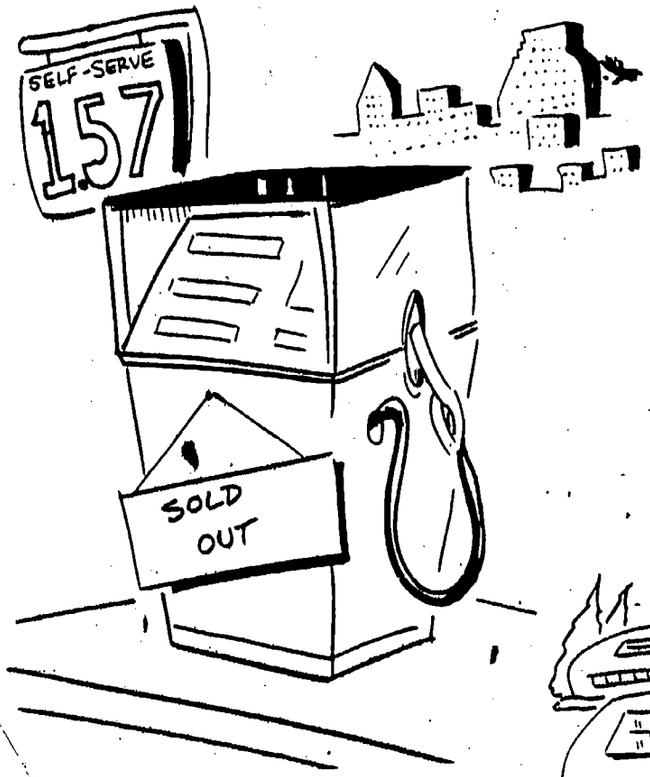
Developing New Technologies. Another outlook depends on the development of new technologies. At least three are now being given major consideration.

Solar energy is beginning to be used chiefly in residences in various parts of the country. In the late 1970's it is expensive and useful only where there is adequate sun and workable home heating plans. The technical difficulties have yet to be worked out, and it is still too expensive for most people. However, within the next ten to twenty years, such difficulties may be overcome..

Nuclear energy is also being developed in plants across the country. These plants create nuclear reactions which provide for electrical energy. Nuclear energy, like solar energy, is expensive. It is also potentially dangerous. If problems develop in the nuclear plant, dangers from radiation leakage from the plant, or waste disposal, could cause damage to populations which live in or around nuclear facilities. Again, like solar energy, this new technology has yet to be fully developed.

Wind energy is the third alternative which is just beginning to be

CHANGING HABITS: CONSERVATION



CONTINUING PRESENT TRENDS

DEVELOPING NEW TECHNOLOGIES

explored. Wind mills can be used to help produce electricity for homes and businesses. Again, setting up a system which uses wind energy is expensive. It cannot be used for all purposes in all areas of the country. It could, however, replace much of our use of nonrenewable energy resources and help us to use less oil, coal and other nonrenewable fuels.

Changing Habits: Conservation. A third possibility for the future is that people can change their habits of energy consumption in order to alter the rapid growth of the consumption of energy and energy products. This will involve a wide variety of measures including dialing down thermostats, driving cars less, watching food consumption, and other measures.

Imagine, for example, if everyone in every community across the United States drove cars half as much. The doubling of gasoline usage would then stop. The entire consumption curve could be changed. Of course, everyone will not necessarily do this voluntarily. If a sizable number of people across the country could decide on important conservation strategies, then the total effect would be to change the consumption curve.

ACTIVITY # 4

Now think about your own future plans for energy conservation. You should think about the conservation strategies and the new technologies you have studied in this lesson. Make a list of things that you might do on an everyday basis to change your own consumption habits and conserve energy. Now think about how you might get this done, how you might start tomorrow morning to work on this list. Present your plan to other students in the class and then try to do something in your own life about the energy problem. You may decide to trade ideas.