The California Extension Service works with schools to develop energy education programs which will reduce school energy usage and costs by involving staff and students in energy management. This bibliography contains selected materials which present an accurate reporting of the facts, assume little teacher background, emphasize active learning in and out of the classroom, and emphasize energy conservation and quality of life. Listed here are 36 instructional resources for grades K-6. Resources are organized into five categories: (1) "Interdisciplinary Materials;" (2) "Science Activities;" (3) "Grade Level Materials (Developed by Energy Source);" (4) "Supplemental Activities;" and (5) "Resource Materials." For each set of materials, the grade levels, availability, cost, an abstract, and an example of the activities in the material are presented. (CW)
Please specify grade level when ordering our "Energy Tech'Knowledgy" (1st, 2nd, etc).
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Materials were prepared by local teachers unless noted by *, which indicates private development.
BUILDING STUDENT ENERGY LEADERS FOR CALIFORNIA’S FUTURE

Californians use twice as much energy per person as industrial nations with similar standards of living and consume more than 3% of the world’s oil even though statistics indicate we have cut our energy use substantially since the oil embargo. Clearly, the need for energy education remains if students are going to understand the finite nature of fossil fuels and make wise energy choices that will shape our destiny for years to come.

Teachers who recognized the importance of energy education had little support from traditional resources just after the oil embargo in the early 1970’s, and so many of you developed your own materials by taking some information from the media and utility bill stuffers, adding a pinch of films, resource people and field trips and mixing it all up with a cup or two of home-grown lessons and dittos. The Department of Energy (DOE) developed materials in partnership with the National Science Teachers Association and their national laboratories. The energy industries in California supported the development of materials by local companies such as Energex (now Educational Development Specialists), Enterprise for Education and Innovative Communications which are now recognized as some of the best materials nationwide. As the “crisis” appeared to abate, the funds to make materials available dwindled. The result is that some good materials, particularly from the Department of Energy, are no longer readily available. Luckily for Californians, some of those materials and most of the best commercially available kits are still available free through local utility companies.

When energy education is mentioned, there is a tendency to think—science. To be sure, as indicated in a 1984 statewide survey of teachers conducted by the California Energy Education Forum (CEEF), more energy concepts are taught by science teachers than other group.

Teachers in subjects other than science and social studies were less likely than others to teach energy. That is unfortunate because energy education is a good vehicle for stimulating intellectual growth and developing student abilities to:

1. collect, examine and criticize information,
2. think in a disciplined and logical manner,
3. communicate ideas and feelings through listening, speaking, reading and writing, and
4. expand schooling into their personal lives.

Ninety percent of teachers felt energy was important enough to accommodate a new unit in the curriculum, but adding another topic to an already full day is not likely to occur. Energy education, however, need not be a new unit, and perhaps is more effective infused into the curriculum so that students understand how pervasive energy is. Nearly 70% of teachers surveyed said they would consider replacing a unit with one on the same topic that included energy examples. Energy awareness can be increased by using energy examples to teach basic skills as in Energy Tech’Knowledgy and Conservation for Children. Many of the activities have students interpret graphs. (See How To Organize Energy Data, Project for an Energy Enriched Curriculum and meter reading activities.) Energy simulations or games can reinforce basic concepts. (See Growing Classroom or Best of Energy Book.) Students studying different periods in history can examine how our lives were different with different sources of fuel as in Power Switch. That type of inquiry takes students beyond the basics.

Both the Governor and Legislature have formally recognized the importance of energy education. In 1987 and 1988, the Governor declared the third Friday in March as Energy Education Day. Assembly Bill 1733, signed by the Governor in 1985, calls on the Superintendent of Public Instruction to “take any steps necessary to encourage school districts to provide some form of energy education instruction.”

Most of you, according to the CEEF survey, already make your own energy education materials rather than get them from other sources. It is the hope of the California Energy Extension Service that this Animated Bibliography will not only give you a source of materials and teaching ideas which you indicated you needed, but actual lessons that can be taught in the classroom tomorrow. Energy education should be, as an educator in Massachusetts noted, “a thread woven into the school’s
overall curricula. It is now time to move statements supporting energy education from letterhead pieties into action programs.

ENERGY CONCEPTS FOR DEVELOPING A LOCAL PROGRAM

Energy concepts are recognized in the recommendations contained in the State Frameworks and Addendums prepared for various subject areas by the State Board of Education. In particular, the State Science Framework emphasizes energy in the physical sciences and introduces it in discussions of photosynthesis, ecosystems, astronomy and geology. The section on "Energy: Sources & Transformations" is the most comprehensive.

To guide you in your selection of activities, a broad list of concepts that would comprise a comprehensive interdisciplinary program is noted below that was used in the CEEF survey in 1984. A third of the concepts were taught by both science and non-science teachers and most of the concepts were checked as essential by at least 40% of teachers. Four concepts in particular were taught by a majority of teachers at all grade levels:

1. Most energy on earth comes from the sun.
2. All human activities require energy.
3. Some energy sources are renewable.
4. Wise energy choices will conserve energy.

At the primary level, three additional concepts were taught by at least 51% of teachers:

- Energy cannot be created or destroyed, but may be changed from one form to another.
- Energy flows through a food chain beginning with greener plants.
- As fossil fuels become depleted, the cost of extracting them increases.

In addition to the seven concepts listed above, a majority of upper elementary teachers added three more:

- When energy is transformed, a portion is converted to heat.
- Our society is very dependent on petroleum.
- Energy supply and use is the major source of pollution.

North Carolina offers a similar, yet distinct way of approaching the selection of activities and that is through a set of learner-directed goals for energy education. Overall, learners should understand that:

1. There are many sources of energy.
2. Energy can be converted from one form to another.
4. There are many uses of energy.
5. There are wise and efficient management practices which can extend the useful life of the earth's energy resources.
6. Energy development and use create impacts on environmental and economic systems.
7. Our energy future may be different from that of the past or present.
Designing an energy efficient house

Procedure
1. Ask the class if they have ever sat in front of a window and felt the sun's heat energy strike them. Windows in a house are very good solar collectors. They allow the sun's energy in and trap it so that little escapes. All that is needed is a window facing the sun and a method of reducing heat loss at night, such as drapes.

2. Do following activity. Have students work in groups or independently.
   a) Cut and fold the model dwelling and assemble without taping. (Worksheet A)
   b) Place the folded model dwelling on the plot plan (Worksheet B) and decide on the setting. Make decisions about the room, windows and door orientations.
   c) Refold and tape the dwelling. Then tape the roof in place. Place the taped model dwelling on the plot plan. Cut out the model trees and shrubs and fold the bases. Use as many tree models as you desire to landscape the plot. (Remember, most deciduous trees lose their leaves in fall)
   d) Set the light source at the approximate angles for the winter and summer afternoon sky (low in winter, high in summer and always from the south). Check the effectiveness for winter heating and summer shading of your landscaped plot. Be sure to replace summer deciduous models with winter models and vice versa.

3. Ask the students the following questions:
   a) How do your houses compare to those of other students in window placement, door sizes and roof arrangement?
   b) What are the best ways to landscape homes? (Deciduous trees on south and west sides; Evergreens on north to protect against winter winds)
   c) What direction should the largest roof overhang face to take advantage of winter sun while shading the house from summer sun? (South)
   d) What direction should solar collectors or greenhouses face to work best? (South)

Have students walk through their neighborhood and observe how the houses are designed and oriented. Are they very good solar collectors? How could they be better?

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The title of the books is an accurate description—they are some of the “Best of “energy materials available around the country in the late 1970's and early 1980's. For a teacher who can't decide which materials to order, this sampler is an excellent place to begin. The books were developed as a joint effort between the Colorado Cooperative Extension and Denver Public Schools. The books have been designed and illustrated to be easy to reference and enjoyable to read. Virtually no page is without an illustration. Energy activities are designed to give students a fun, productive way to reinforce their basic skills. The books are organized according to subject matter (language arts, math, science and social studies). Each is keyed with graphic symbols to four [4] major messages: sun power, energy loss and gain, renewing our resources and individual energy responsibility. For each lesson, the time required and number of sessions recommended is noted. Background lesson information is provided for teachers. An added bonus is an annotated list of films.
PROJECT FOR AN ENERGY ENRICHED CURRICULUM

Energy unit/curriculum guide

Grades: 1 through 5 (Social Studies emphasis)

Available From:
California Energy Extension Service
1400 Tenth Street
Sacramento, California 95814, (916) 323-4388

Cost: No charge

These 3 books are from a series of 18 packets was produced in the late 1970's by the National Science Teachers Association for the Department of Energy to link energy, environment and economics issues. They are still classics from which you will see many other authors have drawn. Each packet is geared to a particular grade level and contains student materials as well as background information for teachers, lesson overviews, learning objectives and teaching strategies. The packets are about 75 pages. They are simply produced and thus the student section is easily reproducible.

The framework provided for exploring the topic is quite thorough and the informative charts and tables that frequent the packets can easily be updated as a research activity. The activities go beyond the more typical topics examined in other materials and often raise some controversial issues. Basic skills such as reading, listening and writing are reinforced.

The Energy We Use: Grades 1 and 2
Introduction to energy and common sources such as sun, wind, water and fossil fuels.

Community Workers and the Energy They Use: Grades 2 and 3
A look at jobs that are linked to energy such as oil deliverer, gas station attendant, meter reader, farmer and baker.

Energy and Transportation: Grades 3 through 5
Students learn about transportation in the neighborhood, community and nation through classification activities, picture studies, etc.
3. Energy is All Around

Overview
This lesson reinforces the nature of energy as producing heat, light, and motion. An energy tour illustrates that energy can be found in many places in and around the school building.

Objectives
Students should be able to:
1. Identify three forms of energy.
2. Explain some of the ways energy is used in the school.

Materials
Paper with one or two lines at the top and bottom and space for a drawing between Pencils Crayons

Background Information (Teacher use only)
Gas furnaces and gas ovens use chemical energy. When a fuel is burned, most of its energy is given off as heat.

Classroom lights use electrical energy. In incandescent lights, the filament of wire is made hot enough so it will radiate light as well as heat. Fluorescent lights give off more energy as light and less as heat.

The telephone system uses electrical energy to give motion to the clapper that strikes the bell which in turn vibrates, producing sound. Sound is one of the examples of motion as a form of energy.

The refrigerator and air conditioner use electrical energy to extract heat from inside the container and discharge it to the outside.

In previous lessons, children learned that heat and motion are forms of energy.

Teaching Strategies
Activity 1: Prepare your children for any of the trips you take around the building. These places may be visited in any order. Be sure the children know they are to look for places where energy is being used. What you see will depend on your particular school building. Have them watch for things that produce motion, heat, or light energy. You may choose to use one or more of the following trips:

Boiler Room -- Children should notice the furnace and the hot water heater, water pumps and air blowers. Energy forms are heat, motion, and light.

Cafeteria -- Children should notice the ovens (heat), refrigerators (heat/cool), dishwasher (heat, motion), mixer (heat, motion), slicer (heat, motion), etc.

Library -- movie projector (heat, motion, light).

Office -- electric typewriter (motion), bell system (sound, motion), florescent lamp (light).

Activity 2: Following the trip, ask the children to choose one thing they saw on the tour and to draw it. They might print at the bottom of the picture the form of energy being produced -- heat, light, or motion.

Summarizing the Lesson
Make up some riddles to recall some of the energy users seen on the tours:
1. In the office we saw something that was on a desk, moved and used electricity. It was a __________________________. (Typewriter.)
2. In the library we saw something that used a light, had two spools that moved and used electricity. It was a __________________________. (Projector.)
3. In one room we saw something that uses oil and gives off heat. It was a __________________________. (Furnace.)
4. We saw something that gives off heat energy, has a light in it and uses electrical energy. It was a __________________________. (Oven.)
5. We saw something that has a round base, that twirls around and uses electricity. It was a __________________________. (Floor polisher.)
6. We saw something that uses electricity and makes a noise. It was a __________________________. (Bell.)
7. We saw something that was rectangular, uses electricity and makes things cold. It was a __________________________. (Freezer.)
Dina the dinosaur and a variety of other cartoonish characters teach students about energy and conservation with activities geared toward math, science and language arts learning objectives. The materials were developed for the CEES by Marilyn Bodourian of the Cupertino Union School District, who many may know from her Conservation for Children materials. The materials are divided by grade level with approximately 10 activities each. For example, at the 3rd grade level, objectives such as reading comprehension, capitalization, homonyms, spelling, alphabetical order, charts, multiplication and 3-digit addition are covered. Any teacher who is dealing with one of these particular skills could easily integrate one of these activity sheets and teaches children about energy at the same time. Activity sheets are reproducible.
How Electricity Affects Our Lives

People began using electricity less than 100 years ago. Thomas Edison made the first practical electric light bulb in 1879. The electric motor was little used until the 1880s.

Today we have many electric appliances that help us around the house, entertain us, and make our lives easier. In 1900 very few homes had electricity. Those that did used it mainly for lighting. People cleaned their homes with brooms, mops, and dust cloths. They bought ice every few days to keep their food cold and fresh.

People in the United States today own many electric appliances, from big refrigerators and washing machines to small electric razors and can openers. Over 100,000,000 appliances a year are manufactured in the United States alone.

How does this affect our environment? Where do the materials come from to make the appliances? Where does the electricity to run the appliances come from?

DIRECTIONS: In the picture below, cross out the things that are wrong.
With either of these thick activity guides in hand, you are guaranteed to stimulate the creativity of any student as they delve into titles such as, "How Far Did Your Breakfast Travel?" or "Grandma Had No McDonalds". The 300-page guides, developed in 1979 and revised in 1985, provide an excellent source of information and activities dealing directly or indirectly with food production and related energy topics. The premise of the books is that a careful study of the food system should lead to an understanding of energy — what it is, why we need it and how we can conserve it. Activities are organized by eleven concepts, some of them familiar in energy curricula such as renewable and non-renewable sources of energy, hidden energy requirements and transformations, and other more related to the energy consumed in getting food to us and the nutritional value of food. Each guide is divided into three sections: Global Food and Resource Needs, Energy and the U.S. Food System and energy Efficient Nutrition. An additional section on the basic characteristics of energy is provided in the secondary guide.

Lessons can be infused, taught as a separate unit and/or used as independent study. The index makes infusion easy because it lists activities by subject area — social studies, language arts, health, math, art, music, science. The format for each activity includes the concept addressed, discipline, grade level, objectives, materials required, procedures, bibliography and a few even have teacher comments. Some lessons are oriented to the Northwest but can be easily adapted.

**ACTIVITY TITLE:** "Drawing" Attention to Energy Sources (game)

**CONCEPT:** Although the sun is the primary source, there are many sources of energy. Some energy sources are renewable and some are non-renewable.

**SUBJECT AREA:** Science, Art

**GRADE LEVEL:** Primary

**OBJECTIVE:** To understand that most of our energy comes from the sun.

**MATERIALS:** Crayons
4 large sheets of butcher paper

**ACTIVITY:**
1. Divide the class into group is given a number.
2. Each member of the small group is given a number.
3. Provide each group with crayons and 1 large sheet of butcher paper.
4. At a starting signal, number one from each group runs up to the teacher who whispers the same energy source to them.
5. They run back to their groups and draw that source, not talking, until someone whispers the correct identification.
6. Number two runs to the teacher, whispers the answer and if correct, receives the second item on the list to draw.
7. Progress through 10 items.
8. Remind students they must whisper the answer or another team will overhear.
9. Discuss team cooperation and consideration.

**Suggested terms:**
1. Food
2. Wind
3. Water Power
4. Sun
5. Ocean Currents
6. Oil
7. Gasoline
8. Garbage
9. Wood
10. Compost

**BIBLIOGRAPHY & RESOURCES:**
Energy and Conservation Education, activities for the classroom, grades 1-3, Energy & Man's Environment Inc (EME), Portland, Oregon, 97201
Oregon Department of Energy, The Family Energy Watch Calendar, Department of Energy, 528 Cottage Street, NE, Salem, Oregon, 97310, $1.50

A variation of the game "Pictionary".
The Adventures of Aunt Energina: An Energy Knowledge Development Program

**Aunt Energina’s Almanac and The Adventures of Aunt Energina**

Part of the Energina Program
Self-contained curriculum kit

**Grades:** 2 through 6

Available From:
Los Angeles Department of Water and Power
Pacific Gas and Electric
Sacramento Municipal Utility District
Southern California Edison
Many municipal utilities

For Further Information:
Innovative Communications
207 Coggins Drive
Pleasant Hills, California 94523
(415) 944-0923

**Cost:** Free from many utilities

The *Almanac* is a 16-page, colorfully illustrated "comic" activity book designed for the year’s best energy consumer to use at school and share at home. The *Adventures* is twice as long and includes activities in science, math, language arts and social studies. It develops student energy knowledge on energy forms, basic electricity, renewable and non-renewable resources, electrical safety and energy history. A special home energy audit focuses student and parent attention on what can be done to conserve energy at home. Both sets of materials have been rated by teachers as being "excellent" because they can be used without teacher preparation, while there are many helpful resources available in the teachers’ guide. The 40-page teacher’s guides provide teachers with basic energy information, curriculum extension ideas, thermofaxable student activity sheets and sources of further information. The activities can easily be incorporated into an existing curriculum in a 3, 5, or 10-day unit. The student workbooks are full of stories, puzzles and energy conservation information; also available in Spanish.

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**Agent 006%: Home Energy Investigation**

Here’s a chance to join the Energy Agent and help them conserve energy in your own home. Your job is to investigate your family’s appliances in search of clues for saving energy.

First, decide how each one is used in your home. Check the column marked "HEALTH/CLEANLINESS" if the appliance helps you breathe, clean or safe. If it makes you more comfortable or makes a job easier, check "COMFORT/CONVENIENCE." If you use the appliance just for fun, check the "ENTERTAINMENT" column.

Next, go through your home and see how many of the items on the list you can find. In the column headed "NUMBER OF HOME," write down how many of each appliance your family has.

Now, decide how much energy these appliances use in your family. If you think they can’t live without it, write number 1. But if you think "I CAN LIVE WITHOUT IT," then circle numbers 2, 3 or 4, depending on how important you think it is.

First, mark in the "ENERGY CONSERVATION" column the ones that you think you can use less or more efficiently to save energy.

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**Table: Home Energy Investigation**

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Grades: 2 through 6
Although the Life Lab Elementary Science Program that developed the books is not an energy education program per se, it contains units on energy and recycling. There are eight activities for the energy unit and seven for recycling. Activities include an energy report card, an exploration of the energy used for Big Mac, and values clarification. "Pretzel Hog," "Sin City" and "G: at Gearloose Creation" relate specifically to transportation. The original Life Lab site, a three acre garden classroom begun in 1979, includes a solar-assisted water heater, solar oven and crop dryer. Produce is used by the school cafeteria, sold by children at the Farmer's Market or made into snacks. Original project has spread to ten schools in five districts. One 6th grader says it's "better than recess!" It has received awards from NSTA, CSBA and the American Community Gardening Association.

To demonstrate that supplies of certain kinds of energy are finite:

Play an "Energy Trip Ticket Game." List several places the students go in school. Charge one energy ticket for the cost of using or going to the following:

- recess
- pencil sharpener
- special projects
- drinking fountain
- library
- office
- bathroom
- lunch

Ditto the energy tickets and give each student 30. Have the students put their names on each ticket (kids can cut out their own). Each time the student takes a trip, it costs one energy ticket. Place a box by the door and have students deposit tickets.

Keep a record of how many tickets the students have left at the end of the day. Which students are wasting energy? Which students are conserving energy? How are they doing it? Discuss energy saving ideas for trips in the school (e.g., at recess I could go to the restroom and get a drink all for one ticket rather than using three tickets). Stress the idea that in one trip we can accomplish several things.

At the point where student ticket supplies begin running low, discuss the idea of running out of tickets. There are no more energy tickets. How will we be able to finish the week without running out of tickets? What can we do to save? How will saving affect us? As the students begin to feel the pressure of conservation, relate this awareness to the actual use of energy in the "real world.

Have the students write a story: "The Day the Energy Ran Out."
MANURE, MEADOWS AND MILKSHAKES
Outdoor activities
Grades: K through 6.

Available From:
The Trust for Hidden Villa
26870 Moody Road
Los Altos Hills, California 94022
[415] 941-6119

Cost: $10.65 plus $1.50 postage and handling

The 1986 edition of this 130 page activity guide draws on concepts developed over the last 15 years by naturalists at the Hidden Villa Ranch. Their philosophy was inspired by John Muir and his notion that everything is hitched to everything else. Many of the activities provide experiences for children to understand that concept. The more than seventy activities are divided into seven sections—Who Am I?, Exploring and Expanding Our Perceptions, Fostering Care and Respect for the Environment, Checking Out Our Lives, Consumption and Disposal, Chains and Connections and Population. Ten to fifteen of the activities can be used for energy education, although only the inventory of energy consumption and role playing exercise "Dinosaurs all Around" relate directly to energy. The related activities may include energy as one item students are to examine, but present some interesting formats. For example, children are to establish totems in one activity, interview older people in another and give thanks to the water for providing energy. One exercise has children explore their feelings for smog. Each activity is divided into four parts: preparation, insight, action and follow-up. They are laid out nicely with "kid-like" illustrations. Eleven songs, poems and puppet shows are also included. They even have a tape and song sheet called, "Hug the Earth!" The final section of the book is quite interesting as it gives teachers creative options for opening and closing exercises, what to do when you have the blahs and tips on what activities are guaranteed to bore kids.
ENERGY ACTIVITIES FOR THE PRIMARY CLASSROOM
Classroom activities

Grades: K through 3

Available From:
California Energy Extension Service
1400 Tenth Street, Room 209
Sacramento, California 95814
[916] 323-4388

Cost: Free

This booklet of activities is a result of one primary teachers' search over the past twelve years. During that period, she has discovered or developed a number of energy activities that work well in the primary classroom. The packet includes an outline for energy education, sample activities, charts and readings. Compiled as a supplement for curriculum workshops in El Dorado County in California, a bibliography of activities "discovered" is included.

Sun jobs

What jobs does the sun do? Make a sun jobs chart or book with students.
Below is a sample of how the chart may look with three examples.

Sun makes a warm

Sun dries
dressed

Sun gives energy
WHAT MAKES EVERYTHING GO?
Classroom activities

Grades: K through 3

Available From:
Yosemite Association
Post Office Box 545
El Portal, California 95318
(209) 379-2646

Cost: $3.63 (includes postage)

What Makes Everything Go is a charming book which describes energy basics at a beginning reading level through delightful illustrations and a clear text. An alligator, surrounded by his insect and animal friends, dramatically shows a curious young boy and girl about how energy functions in our environment. The teacher's manual (available from the California Energy Extension Service) reinforces the concepts through classroom activities. For each activity, a concept, skill and lesson objective are presented. Many activities are action oriented and multidisciplinary. One failing is that many activities include discussion and teachers are not guided through the inquiry, but left on their own. The book covers what energy is, energy flow, energy transfer, energy resources and energy efficiency. Particular emphasis is on contrasting the orderliness of cycles powered by energy and with the progression of energy toward disorder.

IF

Kid heat

Concept: When energy is used, it changes to heat.
Skills: Observation, discussion
Lesson Objective: Students will be able to understand why their bodies produce heat.

Activity:
1. Read Chapter 3, "If".
2. Discuss the various foods people had for lunch. Discuss the source of your students body energy.
3. Close the doors, windows and blinds in the classroom.
4. Measure the temperature in the classroom.
5. Clear desks and other objects to the sides of the room.
6. Instruct your class to produce body heat by exercising vigorously.
7. After 15 minutes, measure the temperature of the room. Is it warmer?
8. Discuss the source of body heat.
9. Discuss the role of clothing as insulation.
### ANIMATED BIBLIOGRAPHY

**GET YOUR HANDS ON ENERGY**
Interdisciplinary materials on renewable energy

**Grades:** 4 through 6

**Available From:**
Alternative Energy Resources Organization
44 North Last Chance Gulch
Helena, Montana 59601
[406] 443-7272

**Cost:** $10.95 plus $2.50 postage and handling

This informal teaching guide suggests a sensory appreciation approach to renewable energy and conservation for the 4th through 6th grade classroom, so don’t be surprised to find poetry interlocked with science experiments. Each section highlights concepts around which creative and unusual activities were developed. The guide consists of fifteen [15] sections covering energy awareness, energy conversions, solar (basics, hot water, cooking and collectors), water, wind, energy conservation, energy flow, cooling, waste recycling and packaging. Most activities are half-page narratives that provide a jumping-off point for teachers. The illustrations are fanciful and imaginative. The guide was prepared in the late 1970’s by the The Alternative Energy Resources Organization in Helena, Montana.

### WIND POEMS

After watching the wind carry on and hearing its sounds, and after “being” the wind, write a poem about it! The “CINQUAIN” is a simple poetic form that allows this pattern:

- one object (in this case, the wind)
- two words describing the object
- three-word verb phrase
- four-word adjective phrase
- a synonym of the object or the object

Encourage the children to be descriptive and to think of exciting words and moods about the wind.

**Wind**
gentle and strong
dancing so lightly
whispering so softly
small sigh

**Wind**
strong and blustery
twisting tree tops
swooshing as it goes
the wind

### MEASURING THE WIND

Here is a simple wind gauge for use in breezes. It will indicate direction and relative speeds. Use the wind gauge to find out where the wind blows strongest. Compare gauge readings. Do obstacles affect wind speeds and directions?

Edmund Scientific has precision wind gauges of various types.

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**Diagram:**

- Use this pattern to cut a light cardboard gauge.
- Tie thread or string in hole, cut just short of cardboard edge. Thread is very sensitive, string takes a stronger breeze.
- Move gauge until thread is blowing parallel to bottom of gauge. This indicates wind direction.
- Where the thread points along the arc indicates a relative velocity.
ENERGY CONSERVATION EDUCATION FOR NEW YORK STATE
Interdisciplinary materials

Grades: 4 through 9

Available From:
New York State Energy Office
Two Rockefeller Plaza
Albany, New York 12223
(518) 473-4315

Cost: 1 free copy to teachers

These materials, developed in the late 1970's take a “concentric circle” approach—developing student awareness of their immediate classroom environment and then providing them with experiences in the ever widening spheres of the school building, home, neighborhood and city and at large. There is no conceptual sequence to the 18 lessons, although each of the four sections represents a “ring” in the concentric circle. The first section provides introductory experiments for classes beginning to study energy. In the second, the focus is on classroom electricity as students perform a lighting audit, keep a log of consumption and graph electricity savings. (This unit makes a good companion to the Energy Patrol activity described as another entry in this bibliography.) The final unit includes a good lesson as preparation for a visit to a power plant, a comparison between fluorescent and incandescent lights, energy careers and famous men in energy history. Instructions are provided for constructing a simple solar collector and wind generator to use in labs. Materials were designed by teachers. Individual pages can be removed for copying.

DATA SHEET A

Interior Observations

Directions: Go through the building room by room. Do not overlook any space. Keep a check-off list of rooms to be sure all spaces are examined. Give specific answers. Examples:

"Three of the six rooms have rugs."
"There was one faucet dripping."

1. Are the ceilings insulated? ______________________________
2. Do the rooms have acoustic tile or cork on the ceiling? ______________________________
3. Are the floors insulated? ______________________________
4. Do the rooms have rugs? ______________________________
5. Are the walls insulated? ______________________________
6. Is the furniture placed so it does not block the heating or cooling ducts? ______________________________
7. Are the thermostats located on inside walls? ______________________________
8. Are the walls and ceilings light in color so as to reflect available light? ______________________________
9. Are the ceilings no more than average height? (About 8 feet) ______________________________
10. Are there insulating drapes or other window coverings? ______________________________
11. Are these drapes or coverings closed at night? ______________________________
12. If there is a fireplace in the house, does it have a damper? ______________________________
13. Is the damper closed when the fireplace is not in use? ______________________________
14. Does the draft meter show windows and doors to be draft free? ______________________________
15. Does the draft meter show other openings to the outside to be draft free? ______________________________
16. Does the draft meter show that the openings in electrical outlets are draft free? ______________________________
17. Are faucets free from drips? ______________________________
18. Are flow restrictors installed on showers? ______________________________
19. Has a clock thermostat been installed for automatic set back at night? ______________________________
20. Are hot water pipes in the cellar area insulated? ______________________________
21. Are warm air ducts in the cellar area insulated? ______________________________
Grades: 5 through 12

The Project is co-sponsored by the State University of New York, the New York Department of Education and electric utilities. Four student activity guides, produced in 1985, are available including Energy Conservation, Renewable Energy, Fossil Fuels, and Nuclear. A fifth packet, "Energy Options", has a series of 21 one-page readings on energy and sources, each with a vocabulary list and questions. The presentation is even-handed and the activities are interesting. For example, one of the solar activities is on solar land use ordinances. The Conservation book contains six activities on conservation in buildings, transportation and appliances. The Renewables book contains seven activities on solar, wind and biomass, as well as values and attitudes. The Fossil Fuel book has 9 activities on the formation, conversion and use of fossil fuels; their role in U. S. history and environmental effects. The Nuclear book has 7 activities on the basics, technologies and economics. There are also two sets of diagrams and graphs for duplication: Energy Facts and Energy Sources and Technologies.

For each unit, there is a suggested teaching strategy for a 4-day to 6-week unit at various grade levels. Each activity is formatted to include objectives, skills and knowledge required, materials, vocabulary, procedure, questions, review and ideas for further exploration. A matrix highlights how materials can be used in Industrial Arts, Home Economics, Math, Economics and English classes. Although some activities could easily be infused, they are best used as complete units of study. According to one reviewer, "this is a well conceived learning unit."
ENERGY CURRICULUM FOR THE MIDDLE GRADES
Interdisciplinary energy unit

Grades: 4 through 6

Available From:
ERIC Documents Reproduction Service
3900 Wheeler Avenue
Alexandria, Virginia 22304
1 [800] 227-3742

Cost: Unit I: $19.40 [ED # 187-554]
Unit II: $13.58 [ED # 187-555]
[Please include ED number when ordering] Inquire for postage and handling charges

These two [2] middle school units investigate different but related aspects of energy: "Energy in World Cultures" and "Energy in American History". Accompanied by an introductory cartoon book, each unit contains imaginative lessons and activities concerning energy concepts, processes and policies. Unit I (229 pages) establishes energy basics, while Unit II (174 pages) involves more advanced ideas and skills; both units can be used independently. Mini-lessons encompassing several subjects can be taught by a collective group of teachers from different disciplines. Both student materials and teachers' guide are designed to recognize adolescent potential through positive energy roles.

Class-Based Activities

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.

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 book 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.

Person Power! Students in the class could devise a series of posters to be used around the school - 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.

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.

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.

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...
This 350-page interdisciplinary activity guide originally produced in 1981 with help from the resource agencies at the state level was significantly revised and field-tested in 1987 by the Alameda County Office of Education’s Environmental/Energy Education Program based on user feedback. While the original guide was organized by areas of concern with corresponding objectives and activities, the revised guide consists of eight instructional units and six action projects. Each unit is organized around a theme and is based on concepts from the California State Department of Education Frameworks. All units integrate content areas and consist of ten to fifteen sequential learning experiences that are activity-based.

The guide contains a unique section entitled, “Help for Beginning Teachers” which discusses how to manage groups outdoors or in a laboratory setting, learning style considerations and ways to plan your own instructional unit.

The 4-week energy unit is for the 5th or 6th grade. The seven activities include building a model home to explore passive solar, testing a home appliance and designing a personal conservation plan. One 30 to 45-minute period

**ARE YOU USING ENERGY?**

**SUMMARY OF ACTIVITY**

Students run to see what effects using energy has on their own bodies, search out other ways to determine when energy is being used, and explain in writing how they can tell whether energy is being used.

**Table:**

| Time:       | One 30- to 45-minute period |
| Setting:    | Classroom, outdoors        |
| Materials:  | - Butcher paper            |
|            | - Marking pens             |
|            | - Writing paper            |
| Subjects:   | Science, physical education, language arts |
| Key Words:  | Energy, heat, light, motion |

**RELATED CALIFORNIA FRAMEWORK CONCEPTS**

Energy takes many forms: e.g., heat, light, electricity, sound, and motion of objects. (Science Framework Addendum)

Every energy conversion involves some loss of useful energy to the surroundings, usually as heat. (Science Framework Addendum)

**OBJECTIVE**

Based on observations they make about their own bodies after running, students develop and write general statements about how to tell when energy is being used.

**BACKGROUND INFORMATION**

Solar energy probably is not a direct source of the energy your students use. In this activity students look at the ways they use energy every day, a focus that will continue throughout the remainder of the unit.

There are several things to look for when trying to determine if energy is being used. One way is to check to see if heat is being produced. Almost all common uses of energy give off some heat as a by-product. For example, a light bulb in use becomes too hot to touch, a refrigerator motor gives off heat, and a TV or radio gets warm if left on for a while. Many uses of energy also make something move or produce light. A washer spins, a TV lights up, and an alarm clock rings. (Other means of detecting when energy is being used, such as cooling and plant growth, are not covered in this activity)

**PREPARATION AND LEAD-UP**

Write the headings “Produces Heat,” “Produces Light,” “Produces Sound,” and “Causes Motion” separately on four pieces of butcher paper.

**PROCEDURE**

1. Ask, “What work did the sun do in the solar home experiments?” (It heated the air in the house.) Tell students that as part of their study of energy, you want them to use some of their body’s energy to run around the track (or another appropriate area). Take the class outside and have them run as fast as they can for about three minutes. Return to the classroom.

2. Ask, “How did you feel after you ran? What changes did you notice in your body?” Most likely students will mention that they got hot. Explain that one of the signs that energy is being used is that heat is produced. Introduce three other methods of determining that energy is being used—motion, production of light, and production of sound. Post the four labeled sheets of butcher paper. Ask, “Which of these happened when you used energy by running? Which apply to the solar home experiments you did?” Have students record each of these uses of energy on the appropriate piece of butcher paper (for example, running could be listed under “produces heat,” “produces sound,” and “causes motion”).

3. Give students writing paper and have them write complete sentences that begin “I can tell energy is being used when...” Volunteers can share their writing.

4. Tell students that they will expand their study of energy by investigating ways they use energy every day (see the home learning suggestion).
Students making discoveries on their own is the rationale behind this set of seven activity packets developed in the late 70's by Oak Ridge University under contract to the U.S. Department of Energy with assistance from teachers at Lawrence Hall of Science at UC Berkeley. Well designed and attractively presented, these packets are some of the most frequently "borrowed" energy activities and their signature is unmistakable. The front of each file folder has teacher instructions followed by pull-out sheets which contain from 11 to 16 activities or experiments. Each activity begins with a question and graphically directs the inquiry to its conclusion. The time required for each varies, but all foster open-ended exploration and are designed to be infused into general science courses. Activities need not be completed in sequence and rely on materials readily available like paper cups, water, salt, etc. Each sheet is easily reproducible or can be projected on a screen.

Some elementary physical science is needed to explain the "why" of the concepts. For some packets, process skills, objectives, background, precautions, strategies and results are outlined for the teacher. Packets are available for biomass (growth, energy storage and use of vegetation as fuel), solar (optics, heat transfer, photovoltaics), wind (measurement and machine design), conservation (temperature, heat and efficiency), chemical (storage, conversion, electricity and heat), electricity (electromagnetism, generation, fluorescent lighting, motors, meter reading), and storage (batteries, kinetic, pneumatic and hydraulics). The packets are guaranteed to add pizzazz to any science program and makes science relevant by asking questions like "will your bike coast twice as far if your tires have more pressure?"

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**Materials**
- Ceramic socket
- Lamp cord with attached plug
- 100, 60, and 25-Watt bulbs
- 2 Meters of #18 hookup wire (stranded and insulated)
- Electrical tape
- Photo light meter
- Metric ruler
- Dimmer switch
- 0-1 A.C. Ammeter

*available at camera stores, borrow one from a photographer, or make your own (see Conservation Activity 6)*

**Set Up And Conduct Your Experiment**

- Using the different bulbs, measure and record the light output in foot-candles at 30 cm and the current in amps at each dimmer setting.

**Summary Question**
Which method saves more energy for the same amount of light output: using lower wattage bulbs or dimming higher wattage bulbs?

**Note**
The room must be almost dark!
<table>
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<th>30 MINUTE TEMP</th>
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</tbody>
</table>
PROJECT AIMS
Hands-on activities

Grades: K through 9 (Interdisciplinary)

Available From:
AIMS Education Foundation
Post Office Box 7766
Fresno, California 93747
(209) 291-1766

Cost: $10.95 each (plus 6-1/2% sales tax and 10% shipping)

Project AIMS is a non-profit venture administered by Fresno Pacific College. The project began as a National Science Foundation grant to train teachers to integrate math and science, but has since developed to include language arts and other subjects. Since the mid-1980's, over 180 teachers have participated as writers and a matching number have field tested activities that are compiled into about 20 books. Each 50 to 100 page volume consists of a teacher manual with all the information about the investigation and how to prepare for it and a student manual with recording sheets and written or pictorial directions for each activity.

Not all of the energy activities are included in one book, but Popping with Power (3-4), Math + Science = A Solution (5-9) and Pieces and Patterns (5-9) have numerous energy activities interspersed with the 20 to 30 activities in each volume. Exploring for Fossil Fuels in a Bran Muffin, is one favorite. The Correlations with the Science Framework Addendum for grades K-3, 3-6 and 6-9, are a tremendous aid for teachers wanting activities for particular concepts such as Energy Takes Many Forms or Conversion of Energy From one Form to Another has Consequences for the Environment. This correlation makes it easy to use energy examples to teach basic concepts. Teachers may need to apply some of their own creativity to note more of the energy applications of the activities. For example, an activity on measuring shadows does not discuss the implications for siting homes to use passive solar energy.

CARTONS 'N COTTON

I. Topic Area
   Insulation—En. + Conservation

II. Introductory Statement
   Students will discover the effectiveness of insulation.

III. Math Skills
   a. Measuring
   b. Computing—Subtraction with regrouping

IV. Materials
   (per group)
   3 small jars with lids—all same size (large baby food jars work great)
   3 half-gallon milk cartons
   glue
   cotton balls (about 250-300)
   thermometer
   hot tap water
   worksheet

V. Key Question
   How do we use a blanket or covering to keep things warm?

VI. Background Information
   It is helpful for the teacher to know that the carton with the cotton on the inside will be noticeably warmer than the other 2 cartons.

VII. Management
   1. Three class periods of 45 minutes each. It is better to make the insulated milk cartons one day and do the experiment the next. The math paper was completed the third day.
   2. Groups of 4-6 are recommended. Size of groups should be determined by the number of thermometers and supplies available.
   3. Before passing milk cartons out to the students, the teacher needs to cut a door large enough for easy access to the jars.
   4. It is better to have three thermometers per group, but it can be done with just one.

VIII. Procedure
   Day One
   Assign groups. Pass out glue, cotton balls, and milk cartons. Students will glue cotton balls on the inside of one carton and on the outside of the second carton. Be sure students include all sides, top, and bottom. The third carton will remain untouched.
   Day Two
   Collect all necessary materials. Give each student a worksheet. Go through "What the Students Will Do" step by step. As the students are waiting during the first 15 minute timing period have them sequence the steps gone through so far. The teacher can write these on the board for the students to copy. This gives the student a set of directions to use at home. Don't forget to include the gluing of cotton balls from the previous day. Record temperatures after the second 15 minute period. Discuss what is happening.
   Day 3
   Do computation on worksheet. Discuss results.

IX. What the Students Will Do
   1. Students will insulate one carton by gluing cotton balls to the inside of the carton on all sides, top, and bottom.
   2. Students will insulate one carton by gluing cotton balls to the outside of the carton on all sides, top, and bottom.
   3. Students will leave the third carton untouched.
   4. Fill all three jars with the same amount of hot tap water.
   5. Put a thermometer in each jar and record temperature on worksheet. If group has only one thermometer work quickly but give the thermometer time to register in each jar.
   6. Remove thermometer and place lids on jars.
   7. Put each jar in a milk carton and close door.
   8. Wait 15 minutes.
   9. Remove jars and record temperatures one by one being careful not to mix the jars up.
   10. Replace lids and return jars to same milk cartons and close the doors.
   11. Wait 15 minutes.
   12. Remove jars and lids. Record temperatures.
   13. Discussion.
THOMAS ALVA EDISON EXPERIMENT BOOKLETS
Experiments

Grades: 4 through 9 (Science)

Available From:
Southern California Edison
Pacific Gas & Electric
Los Angeles Department of Water & Power

Cost: One copy free from utility

For Further Information:
Thomas Alva Edison Foundation
21000 West Ten Mile Road
Southfield, Michigan 48075

These small format, 32-page booklets, produced in the early 1970's by the Thomas Alva Edison Foundation contain easy, inexpensive experiments that illustrate scientific concepts for a variety of energy sources, including alternate energy sources such as tidal, geothermal, biomass, etc. Background information is presented to give the 5 to 10 experiments some context. One of the booklets focuses on Lewis Howard Latimer, a black inventor.

Topics of booklets include:
Magnetism and Electricity
Energy of the Future— How to investigate and reduce waste at home.
Alternative Energy— Sun, wind, geothermal, ocean, tidal, coal, garbage, chemicals.
Electrical and Chemical
Environmental Problems— Experiments related to the effects of pollution.
Lewis Howard Latimer: A Black Inventor— Parallel circuits, burglar alarms and others.
Thomas Alva Edison: Selected Experiments and Projects— Related to his 1,093 inventions including the phonograph, motion picture camera and light bulb.
Nuclear (for high school): Building a geiger-counter is featured.
Energy Conservation— How energy can be conserved immediately including storm windows, clothes dryers and refrigerators.
OFFALOT
Part of the Energy Source Program.
Self-contained curriculum kit

Grades: Kindergarten

Available From:
San Diego Gas & Electric
Southern California Gas
Modesto Irrigation District

Cost: Free from many utilities

For Further Information:
EDS
5505 East Carson, Suite 250
Lakewood, California 90713
[213] 420-6814

Offalot, a furry, animal-like puppet who turns things like lights and televisions “off a lot”, helps the teacher introduce Kindergarten children to the use of energy in the home and helps them develop an awareness of important energy conservation and safety practices. Students will be able to name home energy users, how they operate and when energy use costs money. The unit consists of ten [10] lessons, each about 15 to 20 minutes’ length. Materials include: teacher guide, student booklets, puppet, cassette tape, picture cards, story cards, poster of energy users in a home, home activity booklets and badges.

Offalot Settles an Argument
Eric and Sandra were having an argument. Offalot heard them arguing. “What's the problem?” asked Offalot.

“Eric says that using energy costs money, and I say it doesn’t,” Sandra said.


They went to the park. “Look around,” Offalot said. “There are many people here using energy that doesn’t cost money—like those people riding bikes and those people playing baseball. The energy doesn’t cost anything because they're using their own energy to pedal the bikes and to hit the ball. We don’t have to pay to use our own energy.”

“What about that person flying, and those people sailing boats on the lake?” Eric asked. “Are they using energy that costs money?”

“They're using energy from the wind to make their sailboats move and their kites fly,” Offalot answered. “It doesn't cost any money to use energy from the wind.”

“What about the sun?” Sandra asked. “We get energy from the sun, don't we?”

“Yes,” said Offalot. “We can stand in the sun and get warm without paying for it.”

“I think I'm beginning to understand,” Sandra said as they walked home. She pointed to the cars and trucks moving down the street. “Cars and trucks use energy that costs money. We have to pay for the gasoline that makes them run.”

“That's right,” Offalot said.

They were back at Eric's and Sandra's house. They went inside. “At home, we use lots of energy that costs money,” said Offalot.

“What kinds of energy?” Eric asked.

“Well, we pay for the natural gas that heats the house and runs the water heater, range (stove), and clothes dryer. And we pay for the electricity that runs many energy users in our homes,” Offalot explained.

“Like the refrigerator and the washing machine?” Eric asked.

“And the television and the toaster?” Sandra added.

“Right,” Offalot said. “You've learned a lot about energy today.”

“Thank you,” said Sandra and Eric.

Offalot smiled. “I'm always glad to help when it comes to energy. Goodbye for now.” As Offalot walked away, Eric and Sandra began to argue again. This time they were arguing about what television show to watch.

What are some ways we use energy that costs money?
(We drive cars; we heat our homes with heaters; we wash our clothes in washing machines; we keep our food cold in refrigerators; we cook our food on stoves; we watch television, etc.)

What are some ways we use energy that doesn't cost money?
(We ride bicycles; we sail; we fly kites; we read books; we play the piano; we open the drapes to let in the sun's light and warmth, etc.)

*Some pupils may mention that we pay for food, which supplies our bodies' energy. Point out that even though we pay for the food we turn the food into energy for free. We must pay energy companies to make oil into gasoline, or to make electricity. Also point out that all items cost money to buy, but some also cost money to use, while others do not.

California Energy Extension Service
Grades: Kindergarten
The King and Queen in a faraway land are trying to prepare for a winter festival, but do not have enough time or people. With an "alakazam" the Wizard brings energy to Brightland. The Brightland unit introduces children to basic energy concepts such as heat, light and motion, how energy gets to our homes, how appliances are powered and helps them develop habits of energy conservation. Each of the ten lessons takes about thirty minutes. The unit includes teacher guide, student booklets, filmstrips and cassette tape, energy user cards, story cards, two posters on how energy gets to us and energy sources, pre- and post-tests, home activity booklets and badges.
THE CAPTAIN POWER ENERGY EDUCATION PROGRAM
Part of the Energy Source Program
Self-contained curriculum kit

Grades: 1 through 3

Available From:
Southern California Gas
San Diego Gas & Electric
Modesto Irrigation District

Cost: Free from utilities within service area.

For further information:
E.D.S.
5505 East Carson, Suite 250
Lakewood, California 90713
(213) 420-6814

An introductory program of fifteen, thirty minute lessons for primary students. Captain Power zooms into action as she focuses on Willie Wasteful. She takes him on a flying trip over the oil and gas fields and electric generating plants, pointing out the important job energy does. Wasteful Willie becomes Watchful Willie as he becomes convinced of his part in conserving energy. Students will understand energy concepts and be able to identify the kinds of energy and related costs, learn what appliances use the most energy and how to distinguish between essential energy needs and luxuries. This activity oriented package can be plugged into any teachers' curriculum as is. Include are a teacher's guide, film strip and cassette, energy cards, posters on annual energy costs and how energy gets to us, puppets student materials and badges. The parent information leaflet is available in Spanish.

CAPTAIN POWER ENERGY EDUCATION PROGRAM

Understanding Energy

Energy Exercise 1.

For each question below, listen as it is read aloud. Then answer the question by drawing a circle around "Yes" or "No".

Example. When we talk about energy, do we usually mean electricity and natural gas for our homes, and gasoline for our cars?

1. By "fossil fuels," do we mean oil, natural gas and coal?
2. Do we use energy when we cook our food?
3. Do we use energy to keep the inside of our refrigerators cold?
4. Do we use gasoline in our home heaters?
5. Are electricity and water the main kinds of energy we use in our homes?
6. Is oil made from gasoline?
7. Is supplying energy only a small business in most cities?
8. Do lots of people work at water and power companies?
9. Do the water and power companies know how much water and energy we use in our homes?
10. Are electricity and natural gas free?
11. Are there electric and natural gas meters at many of our homes?
12. Do electricity and natural gas cost most families more than food does every month?
13. Do we pay for electricity according to how much we use?
14. Do we have enough oil, coal and natural gas to last forever?
15. Does burning coal or oil to turn water into steam help make electricity?
16. Do we use lots of energy?
Sheriff Crockett is proud of his town because they know all about energy and how to use it wisely. When rumor has it Dewey Dolittle and his Gang are on their way, the Sheriff rustles up a posse to meet them at the train station. The Fossil Fuel Junction unit introduces pupils to many facts about how we get and use fossil fuels, including their information, how they get to our homes and products. Students are encouraged to develop and follow personal conservation plans.

Learning Objectives for Fossil Fuels:
1. Economic, Technological and Environmental Aspects.
2. From the Ground to our Homes.
3. Everyday Products.

We use products made from fossil fuel chemicals every day. Read the story below. Products that are often made using fossil fuel chemicals are pictured.

A Rainy Day

The alarm clock rang in Clementine's ear. She opened her eyes and looked out the window. "Why does it always have to rain on Saturday?" she moaned. She wanted to try out her new tennis racket and tennis balls. Now she would have to change her plans. She pulled the blanket over her head and went back to sleep.

When the telephone rang, she jumped out of bed and pulled on her bathrobe.

Michael was calling. He asked Clementine to go shopping with him. She would have to hurry. Clementine went into the bathroom. The tile floor was cold so she stood on the rug. She put toothpaste on her toothbrush and brushed her teeth. Then she pulled open the shower curtain and turned on the water. In the shower she rubbed shampoo into her hair. After she got out of the shower, she picked up the comb and started to dry her hair with the hair dryer.

Clementine got dressed quickly. She put on a pair of jeans, a plaid shirt, red socks, a red sweater, and a pair of sneakers. She almost forgot to get her belt from her dresser drawer.

In the kitchen, Clementine poured some juice into a plastic glass and put some cereal into a bowl. She sat down at the kitchen table to eat. Soon Michael rang the doorbell.

Clementine put on her raincoat. As they walked to the bus stop, Michael shared his umbrella with her. The bus was crowded. Clementine and Michael were lucky to find two seats together.

At the shopping center, Clementine bought a new tire for her bike and a lipstick for her mother. Michael bought a stuffed toy for his little sister and some film for his camera. When Clementine got home, she was tired. She put some records on the stereo and sat down in a big chair. It was still raining outside. Clementine listened to the sound of the rain on the roof as she closed her eyes and went to sleep.
THE GREAT HOT-AIR BALLOON RACE
Part of the Energy Source Program
Self-contained curriculum kit

Grades: 4 and 5

Available From:
San Diego Gas & Electric
Southern California Gas
Modesto Irrigation District

Cost: Free from many utilities

For Further Information:
EDS
5505 East Carson, Suite 250
Lakewood, California 90713
[213] 420-6814

In The Great Hot Air Balloon Race, pupils are introduced to heat energy—where it comes from, how we measure it, how it escapes, and how we try to trap it, by the brother and sister team of Phineas and Annie. Learning is made more fun as the two characters must master a number of skills in order to beat Mean Maxwell and Terrible Tanya in a cross country race. Skills learned include how to choose clothing best suited to temperature and weather conditions, how to read Fahrenheit and Celsius scales, identify conductors and insulators.

EXERCISE 1: READING THERMOMETERS AND THERMOSTATS

PART A
Directions: Look at each thermometer and thermostat. In the spaces next to each one, write the temperature that is shown.

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PART B
Directions: Decide which of the following ranges best describes each temperature reading below. Then write the correct letter in the blank space.

a. hot  c. comfortable  e. cold
b. warm  d. cool  f. very cold

6 -4°F    7 98°F    8 72°F
9 40°F    10 57°F    11 85°F
The Power Switch unit introduces students to the history of our three major fuel eras and to the advantages and disadvantages of present and potential future energy sources. Coal, oil and natural gas are personified to help students learn about different energy eras through history. Solar, wind, geothermal, nuclear, etc., are introduced as future sources. An interesting chapter allows students to explore energy use around the world and compare lifestyles.

The unit consists of teacher guide, student booklets, filmstrip and cassette tape, poster of the energy timeline, pre and post-tests, interview forms, home activity booklets and stickers.

Learning Objectives:
1. Identify energy eras -- wood, coal and oil.
2. Name sources and pros and cons.
3. Identify future sources.

You can tell from the chart that there are many differences between the six countries that are shown. The people in the countries that have the most energy to use make more money, live longer, and have more goods than the people in energy-poor countries. In countries like the United States and Sweden, energy powers machines that do much of the work. It is also used for travel and for home entertainment. In poor countries, most of the hard work must be done by hand. And as you can see, there are few cars, radios, or television sets in these countries.

The chart shows that we use a lot of energy in the United States. In fact, we use the most energy of any country in the world. We use more oil, more natural gas, more nuclear power, and more hydropower than any other country. We use more coal than any country except Russia.

Where do we get all this energy? Well, we produce most of it right here in the United States. Our country is very rich in energy resources. We have more coal and more uranium than any other country. We also had great amounts of oil and natural gas in the past, but we have used up much of our supplies of these fuels that are easiest to get out of the ground. From energy resources within the United States, we produce all or nearly all of our energy that comes from natural gas, coal, nuclear power, and hydropower. Oil is the only energy source that we buy in large amounts from other countries.

Energy is very important to the future of other countries, just as it is to our own future. The poorer countries of the world, and even most of the richer ones, do not have the energy resources that we have in the United States. One of the ways a poor country becomes richer is by getting more energy and using it well. In the years ahead, countries around the world will be seeking ways to produce their own energy and, when necessary, to buy the energy they need from other countries.
THE POWER QUIZ ENERGY EDUCATION PROGRAM
Part of the Energy Source Program
Self-contained curriculum kit.

Grades: 5 through 6

Available From:
Southern California Gas
San Diego Gas & Electric
Modesto Irrigation District

Cost: Free from utilities within service areas.

For further information:
E.D.S.
5505 East Carson St, Suite 250
Lakewood, California 90713
(213) 420-6814

This “game show” is easy to use due to its flexible format.
Fifteen [15] lessons are included, requiring 20 to 30 minutes daily.
Students receive a colorfully illustrated “Practice Exercise Booklet”,
which gives them information on different energy sources, energy
costs, the need to conserve fossil fuels, and what they can do.
Sy Malone, energy sleuth, tracks down energy wasters. Many
teachers have found that this program provides a good foundation
of basic energy skills. After completion, classes can pursue additional
energy activities. Teachers receive a guide along with cards, two
filmstrips and a cassette tape, poster, badges and parent leaflets.
The parent information leaflet is available in Spanish.

Learning Objectives:
1. Understand energy concepts.
2. Determine needed energy users.
3. Identify energy costs.

LESSON 8: More Practice on Energy Costs

Materials:
- Pupil Practice Exercise Booklets
- Set of Energy User Picture Cards
- Three small pieces of colored paper for each pupil (blue, yellow, red)

Procedures:
A. Provide additional group practice on yearly energy costs
   - Prior to this lesson, cut three small pieces of colored paper for each pupil,
   one blue, one yellow, and one red to match the cost ranges on the Yearly
   Energy Costs Chart.
   - Give each pupil one piece of each color. Have pupils label each piece
   according to the cost ranges on the chart:
     - red: high (more than $50)
     - yellow: medium ($10-$50)
     - blue: low (less than $10)
   - Hold up the eleven energy user cards
     - refrigerator: high-red
     - electric toothbrush: low-blue
     - electric water heater: high-red
     - gas range & oven: medium-yellow
     - home lights: high-red
     - toaster: low-blue
     - electric clothes dryer: medium-yellow
     - sewing machine: low-blue
     - color television: medium-yellow
     - washing machine: medium-yellow
     - hair dryer: low-blue

   (red)
   (yellow)
   (blue)
Energy Placemats

GOAL: To create energy education placemats for distribution to area restaurants for use during NEED Week and/or on NEEDay.

Background

An effective way to create community awareness of NEED and energy is to custom design placemats for use in area restaurants on NEEDay and week. This activity achieves the goal of energy education as many community members as possible during the annual NEED celebration.

How to Organize

STEP 1. Before making a commitment to using your placemat, the restaurant manager will want to see a sample NEED placemat. Be prepared to have students go early (i.e., January) to the drawing board to develop the placemat design. In designing the placemat, keep in mind specifically what you want people to learn about energy from the placemat. A placemat might have six or more objectives. Develop a list of educational objectives before you even think about sketching the placemat design.

Here are some educational objectives to get you started. Further research of energy education materials will help you develop more.

Upon completion of reading and doing the exercises on the placemat the reader will be able to:

1. which energy sources are renewable and nonrenewable;
2. the five major sources used today to generate the nation's (or state's) electricity;
3. the major ways of saving energy on the road;
4. four historical facts about the use of energy.

To get the reader to learn this information in a variety of ways, you can use crossword puzzles, jumble words, energy trivia facts (Energy's President-in-chief), Find-a-riddle, or graphs. Examples of these can be found on the reverse side of this page. Two or more activities on the placemat might be directed toward the same educational objectives.

You can also use the NEED logo or the NEED story found on the reverse side of this page on the placemat. You should also leave space for the place where the sponsor(s) name will go or the name of the restaurant sponsor(s), e.g. Sponsored by McDonald's, Main Street Diner. You may want to use two or more colors when having the placemat printed to give a really professional appearance. Remember a t.l.c. - tending is a not going to put poorly designed mats in his restaurant.

STEP 2. Determine how to list sponsors on the placemat, Some businesses might not want their competitor's name on the placemat to be used in their establishments. In this case you can have the ads printed separately. The printer can easily "strip in" the different sponsor's names and print a personalized placemat. Make sure you speak with several printers before hand in order to get the best price and the cost for different printing options.

The price of the placemats should cover all printing costs, development and marketing supplies and all the little other expenses it takes to achieve your goal. You might even be able to get the printer to donate all or part of the printing costs by adding their name somewhere on the placemat. Take your profit an put it towards a NEED activity in the school that requires funds.

STEP 3. Approach the managers of several fast-food restaurants or other restaurants that use placemats at least six weeks before NEEDay. Explain to them the concept of NEED. Show them a copy of the placemat you have designed. Make sure it's the actual size and that paper stock, graphics and printing are in the colors similar to the actual ink to be used.

Ask them if they would like to purchase your custom-designed NEED placemat for use in their establishments on NEEDay or Week. You should also have the request in writing covering the same points from your verbal presentation. Be prepared to leave a sample of the placemat and to wait several weeks for a reply.

STEP 4. Set a deadline for sponsors to contact you. You may have to make a reminder call to some restaurant managers. When all the orders are finalized get everything ready for the printer. Make sure everything is marked correctly so there's no mistakes. A week or more in advance, if possible, deliver the placemats to the restaurant. It's safe to visit the establishment on NEEDay to photograph the placemats in actual use.

STEP 5. PRIZES = PRIZES = Enter your placemat design in the NEED Place contest by sending it to NEED Headquarters by April 1. The schools with winning placemats in each of three categories (elementary, junior high, and senior high) will be awarded for first place $75, second place $50, and third place $25.

Cost: $10 for schools and $25 for non-schools (Carnival is $7.95)
ENERGY PATROL PACKET
Supplemental classroom activity

Grades: 2 through 8

Available From:
California Energy Extension Service
1400 Tenth Street, Room 209
Sacramento, California 95814
(916) 323-4388

Cost: 1 free copy

The Energy Patrol is an example of a concentric circle approach to energy education in that it develops student awareness of their immediate classroom environment and then provides them with an experience in the ever-widening sphere of their school building and home. Simply stated, students on an Energy Patrol monitor classrooms to ensure that lights are turned off when rooms are vacant which can reduce school energy costs by 20% to 30%. In DeVargas Elementary School near San Jose, where the project originated, they saved $1,000 per month, which can be reprogrammed into other activities.

The Energy Patrol works well with classroom learning activities that focus on electricity conservation and encourages kids to keep logs and practice charting and graphing. Lighting audits and meter reading exercises are good background for students. (Such a set of lessons is outlined in Energy Conservation for New York State and Electric Gnu’s) However, the Patrol does not need to be integrated into the curriculum beforehand but can be implemented as a student leadership activity. If the kids at DeVargas are any indication, the experience will generate interest in classroom energy education!

The 6-page packet includes a description of the DeVargas patrol which has won a national award from the Department of Energy, samples of energy certificates, start-up procedures, checklists and specific information on how to start a Patrol.

DEVAROAS ENERGY PATROL PROCEDURES
1. Get jacket, clipboard, reminder notices and record sheet from the file room. Check for notices or Energy Patrol meetings.
2. Pick up key(s).
3. Inspect your area and record information neatly on the checklist. Re-lock rooms that you enter.
4. Return supplies to their proper area. If you run out of reminder notices, leave a note so more can be run-off on the ditto machine.

REQUIREMENTS:
• Use of the key is a big responsibility. It can be used by Energy Patrol members only.
• Only Energy Patrol members may enter locked areas. Do not bring your friends along or allow desperate students who need snacks, jackets, pencils, books, etc., to enter classrooms.
• Members must always wear their jackets and I.D.’s when on duty.
• Work quickly—also, quietly and politely in rooms where people are working.

ENERGY PATROL CHECKLIST
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KEY:
/ Area in Use
O Energy in use no people
X No energy in use
ANIMATED BIBLIOGRAPHY

CLASSROOM ENERGY POSTER PUZZLE
Classroom Activity

Grades: 2 through 4

Available From:
California Energy Extension Service
1400 Tenth Street
Sacramento, California 95814
(916) 323-4388

Cost: One free copy

This unique poster/puzzle activity was developed by the Energy Office in Alberta, Canada. The packet consists of instructions for the teacher on using the poster which depicts energy use and abuse in a classroom, discussion questions for each piece of the puzzle, and 21, 8-1/2 x 11 pages that assemble into a poster for a bulletin board.

The poster is ideal for a class activity during Public Schools week or Open House and can be used as a classroom decoration. But, it is most effective as a teaching center for instructing students about:

1. electricity use in a classroom
2. how heat is supplied and used in a classroom
3. how energy is wasted
4. how energy can be conserved and used more wisely

For example, a puzzle piece featuring a “window with a car” can be used to discuss how incandescent lights are not as efficient as fluorescent lights, that lights can be turned off on sunny days and daylight used, that cars consume gasoline which is a non-renewable resource and that sugar contains food energy that originally came from the sun.

A few items, such as the flag of Canada and the Alberta Energy Office insignia give away the fact that this is from Canada, but those items can easily be changed.
Part One

I. How to Motivate Staff to Save Energy

A. COMMUNICATING WITH STAFF

"I used to leave the lights on in my classroom and the radio playing when I wasn't there, but I don't any more. I have developed some good habits as a result of the (energy) program." (teacher in Newcastle School District)

Staff cooperation and support start with effective communication. Administrators, teachers or certified staff typically do not know how much it costs for energy to operate the school, and are astonished by utility costs. An obvious way to heighten staff awareness of energy waste is to regularly communicate energy costs. How these costs are communicated can make the difference between staff being only mildly interested in saving energy or highly motivated to take an active role in conservation. The impact of energy waste comes to life when energy costs are expressed in numbers of teaching positions or textbooks instead of just dollars. Following are suggestions for communicating energy use to staff in such a way that generates interest in changing wasteful habits.

1) DISCUSS ENERGY COSTS AND HOW TO REDUCE ENERGY WASTE AT STAFF MEETINGS

One high school had a staff meeting where home as well as school energy management was presented. Two teachers talked a local hardware store into giving teachers at the school a discount on energy conservation purchases (see flyer). The enthusiasm for saving money at home was carried over to saving energy and money at school.

2) DISPLAY LARGE CHARTS SHOWING ENERGY CONSUMPTION IN VISIBLE PLACES

Large charts showing gas and electrical savings can be displayed in conspicuous places such as the cafeteria or a hallway. A class or club can take responsibility for keeping the monthly them and kWh consumption up to date. In some schools, students read the electric and gas meters daily and graph these numbers. Student interest and questions motivate staff to stay on top of this information.

3) CONDUCT MONTHLY ENERGY CONTESTS ON SCHOOL ENERGY USE

A regular monthly contest to guess electricity and/or gas consumption for the previous month draws attention to school energy use while teaching basic energy facts (i.e., what is a kWh or therm?). Teachers need fun ways to learn information just as students do. In addition to staff competing against each other, their administration of the contest keeps them abreast of the information.

A guide to methods and techniques for classroom use that will involve students in school-wide energy management programs. The activities suggested in this guide are good companions to a more general energy education program because they transform the school site itself into a laboratory of sorts and enable the students to apply concepts they have learned. This publication describes the approaches successfully used by 21 school districts in California that received funding to operate model programs. Using these approaches, these districts saved $2.14 in energy costs for every State dollar invested. Two examples of student word contests are provided. A packet of supplemental quizzes and contests can be requested.

Available From:
California Energy Extension Service
1400 Tenth Street, Room 209
Sacramento, California 95814
(916) 323-4388

Cost: Free
HOW TO ORGANIZE AND COMMUNICATE
YOUR ENERGY DATA: A GUIDE TO ENERGY
ACCOUNTING
Supplemental materials

Grades: 4 through 12

Available From:
California Energy Extension Service
1400 Tenth Street, Room 209
Sacramento, California 95814
(916) 323-4388

Cost: Free

Once students understand the basic energy concepts, it makes sense for them to use their own school as a laboratory. Tracking the energy usage of the school is one way to do that. Although primarily a guide for administrators, energy managers and energy committees, examples are provided showing how students can be involved.

Case studies are included that document how students caught errors in utility bills and saved their districts a substantial amount of money. Actual worksheets provided may be used by business or math classes. This book also helps teachers who want to track the progress of Energy Patrols or supplement lessons in Electric Gnus and Energy Conservation for New York.

FIGURE 3: Avoided utility cost based on a reduction of 44% in energy usage over three years in Mt. Diablo USD.
CRAFTY IDEAS [How to Make Something from Nothing]
Classroom projects using recycled materials.

Grades: 1 through 6 (Art)

Available From:
Cupertino Union School District
Conservation for Children
6560 Hanover Drive
San Jose, California 95129
(408) 725-8376

Cost: $5.00 plus 10% of order on shipping and handling

Arts and crafts ideas which further recycling efforts in the elementary school are included in this booklet. The projects provide an alternative to throwing things away. More than 40 classroom projects, all made from recycled materials including styrofoam, paper, fabric and yarn, bottles and cans and miscellaneous materials, along with teacher background information about the collection, recycling and disposal of everyday products. Some of the crafts include making recycled paper, puppets, draft dodgers, lanterns, bird feeders and musical instruments.

Making Recycled Paper

Things you will need:
- Used paper (paper bags work well)
- A piece of screen about 6 inches square
- A flat pan that is a little larger than the screen
- Newspaper for blotting
- A bowl for mixing
- An egg beater or blender
- Rolling pin or wooden dowel

What to do:
1. Tear the used paper into little tiny pieces. Add about two cups of hot water. Beat the paper and water with the beater or blender to make pulp.
2. Pour the pulp into the flat pan. Slide the screen into the bottom of the pan and move it around until it is evenly covered with pulp. Lift the screen cut carefully. Hold it level and let it drain for a minute.
3. Put the screen, pulp side up, on the newspaper. Put more newspaper on top and use the rolling pin to squeeze out more water.
4. Carefully remove the top newspaper. Have the screen with the pulp to some dry newspaper to let dry. When the paper is almost dry, you can peel it off the screen. Let it dry thoroughly. You can save a piece of recycled paper. Use it for stationary, a picture, or a beautiful background for a leaf print.
ANIMATED BIBLIOGRAPHY

COMPUTER SOFTWARE
Computer Software Review

Grades: 1 through 6.

Available From:
Cupertino Union School District
Conservation for Children
6560 Hanover Drive
San Jose, California 95129
(408) 725-8376

Cost: $4.00 plus .60 postage and handling

A softcover supplement which lists and describes ten [10] computer software programs providing information and/or instruction in the area of conservation of natural resources. Topics include dinosaurs and fossil fuels, earth science, food chains, delivering energy to homes, finding household energy wasters and insulating homes. The review was developed as a companion for teachers using Conservation for Children from the San Mateo County Office of Education's software evaluation project. It is designed for teachers who wish to expand environmental education into the computer lab. Listings include subject area, grade level, equipment, price and a brief description. Student worksheets are also included which relate to or reinforce concepts contained in the software programs. They are intended as examples to assist other teachers in developing their own materials to further infuse conservation education into all areas of the elementary school curriculum.

Name _______________________

DIRECTIONS: Use the software program "INSULATION AND YOUR HOME" to complete the following questions.

1. When outside air passes through cracks or openings between windows and door frames of your home, it is called
   ————————-

2. The movement of heat through walls, windows, and other building materials that separate the inside of your house from the weather outside is called
   ————————-

True or False?
————

1. Insulation keeps your energy bills low in the summer and winter months. 
————

2. Insulation in a home prevents heat from escaping up the chimney flue. 
————

3. The R-value of insulation materials measures the ability of the materials to resist heat flow. 
————

4. It is important that insulation have a vapor barrier. 
————

5. Insulation is only effective if you live in a very cold climate. 
————

List the six types of insulation:
1. ————
2. ————
3. ————
4. ————
5. ————
6. ————

What insulation material has the highest R-value per inch of all loose fill materials?
————

What type of insulation and material received the highest rating for floors over unheated spaces? 
Type: ————
Material: ————

Write the names of two materials not recommended for a roof or cathedral ceiling.
————
————
ENERGY & EDUCATION Newsletter

Grades: Teachers at all levels

Available From:
National Science Teachers Association
5112 Berwyn Road
College Park, Maryland 20740
(301) 220-0870
Jane Ponton, Editor

Cost: $9.00

This bi-monthly newsletter is one of the best places to find evidence of the vitality and innovation in energy education. Each issue begins with a guest editorial which may be authored by the Under Secretary of the U.S. Department of Energy or a classroom teacher and always offers an interesting perspective. "Energy News" highlights what is going on in other states and the federal government. The "Facts Page" gives an update or statistical review of issues. Of primary interest to teachers are reviews/notices of new curricula and a calendar of events. The Spring supplement is always a Directory of Energy Education Materials. Readers find everything from lab kits to slideshows, computer software and complete teaching units. The listing, however, is not exhaustive, nor are the materials evaluated or reviewed. Materials are coded by type (curriculum, teaching unit, contest, game, etc.) and grade level.

TABLE 2 PART 2: Electricity Sales, Utility (10^6 Kwh)

<table>
<thead>
<tr>
<th>Consuming Sector</th>
<th>1985</th>
<th>1986</th>
<th>% Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>792.9</td>
<td>810.8</td>
<td>3.5</td>
</tr>
<tr>
<td>Commercial</td>
<td>605.9</td>
<td>630.3</td>
<td>3.8</td>
</tr>
<tr>
<td>Industrial</td>
<td>880.3</td>
<td>877.4</td>
<td>-0.3</td>
</tr>
<tr>
<td>Street &amp; Highway Lighting</td>
<td>14.6</td>
<td>14.9</td>
<td>2.1</td>
</tr>
<tr>
<td>Other Public Authorities</td>
<td>62.2</td>
<td>62.0</td>
<td>-0.3</td>
</tr>
<tr>
<td>Railroads &amp; Railways</td>
<td>4.7</td>
<td>4.7</td>
<td>0.0</td>
</tr>
<tr>
<td>Interdepartmental</td>
<td>5.3</td>
<td>5.2</td>
<td>-1.9</td>
</tr>
<tr>
<td>Total Consumer sales</td>
<td>2,306.9</td>
<td>2,355.3</td>
<td>2.1</td>
</tr>
</tbody>
</table>

We have also provided some international comparisons (see Table 3), of both the total electrical energy consumed and the per capita consumption. It is interesting to note that the U.S. is not the most electrified nation. Canada with its enormous hydroelectric resources has that distinction. Sweden, not shown in the table, has second place with a per capita consumption of 16,386 Kwh per person.

In total generating capacity, however, the U.S. is far ahead of the others, and now after 10 years of relative stagnation, the utilities are beginning to look forward to a new spurt of growth. The nature and amount of that growth will have an important role in shaping the energy and economic future of this country.

TABLE 3: International Comparisons

<table>
<thead>
<tr>
<th>Countries</th>
<th>Generating Capacity (Mw)</th>
<th>Total Consumption (10^6 Kwh)</th>
<th>Per Capita (Kwh/Person)</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S.</td>
<td>708,795</td>
<td>2,255.2</td>
<td>10,577</td>
</tr>
<tr>
<td>U.S.S.R.</td>
<td>319,393</td>
<td>1,584.0</td>
<td>5,564</td>
</tr>
<tr>
<td>Japan</td>
<td>169,328</td>
<td>679.4</td>
<td>3,979</td>
</tr>
<tr>
<td>Canada</td>
<td>99,384</td>
<td>460.4</td>
<td>18,127</td>
</tr>
<tr>
<td>West Germany</td>
<td>92,704</td>
<td>404.7</td>
<td>6,673</td>
</tr>
<tr>
<td>France</td>
<td>88,800</td>
<td>336.4</td>
<td>5,327</td>
</tr>
<tr>
<td>China</td>
<td>82,000</td>
<td>410.7</td>
<td>3,946</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>67,601</td>
<td>394.7</td>
<td>5,233</td>
</tr>
<tr>
<td>Italy</td>
<td>54,576</td>
<td>182.2</td>
<td>3,169</td>
</tr>
<tr>
<td>India</td>
<td>51,180</td>
<td>188.5</td>
<td>2,444</td>
</tr>
</tbody>
</table>

* Other Sources include cogeneration, etc.
** Does not include Other Sources.
*** Other includes geothermal, wood waste, wind and solar produced electricity generated by utilities.

The American Nuclear Society presents classroom project in their newsletter Reactions. The November issue lists a classroom project, which calls for a debate over the disposal of nuclear waste. Students will prepare to debate whether or not the disposal of nuclear waste can be disposed of properly. Some points made should include the different types of nuclear waste and their hazards, the variety of uses of the atom in everyday life, proposed and existing methods of disposal and their potential effects on society, the environmental costs, and why people are concerned. All students can be involved in research for the debate. The American Nuclear Society speakers kit "An Introduction to Nuclear Waste and Disposal: Low-Level and High-Level" contains appropriate materials for this activity. It can be borrowed from the Society's free-loan audiovisual library. ANS also offers a free copy of a "Bibliography of Quotations on Peaceful Uses of the Atom and Radioactive Substances." Contact ANS Public Communications Department, 555 N. Kensington Ave., LaCange Park, IL 60025, or call 600-323-3044.
Major gas and electric utilities in California have Educational Services Departments or Divisions that provide curriculum materials, teacher training and field trips. Many of the materials listed in this Animated Bibliography are available free to teachers in their respective utility service territories. For example, PG&E offers over 100 items including energy education materials, videos, filmstrips, speakers and classroom material. On the other hand, Southern California Gas only distributes Energy Source materials. SMUD and Los Angeles Department of Water and Power have programs geared especially for their communities. Southern California Edison has a mobile classroom, The Science Connection, aimed at the 5th and 6th grade level and equipped with state-of-the-art equipment.

Los Angeles Department of Water & Power Educational Services
Public Affairs Division, Room 1217
Post Office Box 111
Los Angeles, California 90051
(213) 481-6338 or 4085
The LADWP has a cooperative arrangement with Los Angeles Unified School District to provide materials through the Regional Science Centers (K-8); Environmental Programs Center (K-8); or Science Materials Center (7-12).

Pacific Gas & Electric
Attention: Ms. Sylvia Hardy
Educational Services, F-2825
77 Beale Street
San Francisco, California 94106
(415) 972-3882
Also: Newsletter

Sacramento Municipal Utility District
Consumer Education
Post Office Box 15830, Mail Stop 10
Sacramento, California 95852-1830
(916) 732-5130
Also: Newsletter and EC hotline

San Diego Gas & Electric
Ernest Roberson
Post Office Box 1831
San Diego, California 92112
(619) 696-4298

Southern California Edison
Educational Services
Post Office Box 800
Rosemead, California 91770
(818) 302-9134
Contact Educational Services Representatives in your local division.

Southern California Gas
Market Services, ML 202N
Attention: Linda Milano
Box 3249 Terminal Annex
Los Angeles, California 90051
(213) 689-3023

Local Municipal Utilities such as Imperial Irrigation District, Modesto Irrigation District, Palo Alto, etc., often provide materials as well.
RENEWABLE ENERGY MATERIALS

Up-to-date information on renewable energy sources can be difficult to find. In response to a growing number of requests, the United States Department of Energy (DOE) has put together some materials for teachers and students. The most immediate source of information is the DOE CARIERS toll-free-hotline, which provides basic information on the full spectrum of renewable technologies and energy conservation. For those who require detailed assistance, staff will provide referrals. Call them at (800) 523-2929. Another hotline, NATAS has some specific lists that may be useful to teachers including solar energy education projects, audio-visual material, for appropriate technology and catalogs of energy education kits and equipment.

As California utilities begin to have renewable resource installations such as Solar One in Southern California and the Geysers in Sonoma, their curriculum materials also highlight renewables. Pacific Gas & Electric, Los Angeles Department of Water and Power, San Diego Gas & Electric and Southern California Edison, have films and booklets relating to solar, wind, geothermal, hydro and alternatives in general. A number of these are small 15 to 20 page booklets developed by Channing Bete. (Channing Bete has an office in San Francisco at 834 38th Street, 94121, if you would like to contact them directly.) Trade associations are also a good place to look for materials.

A number of the materials presented in the Bibliography have particular activities related to specific renewable technologies and are listed along with each description. For the elementary grades, Get Your Hands On Energy and Connections are good places to begin. For 7th through 9th graders, Innovative Communications has a series of volumes called Electricity Choices, distributed by the electric utilities in California. The New York Energy Education Project is excellent for grades through 12. There is one specifically for solar, another on power management and a third on wind and water. At the high school level, or for background information, the Electric Power Research Institute's Energy Researcher and Reporter series addresses those technologies which generate electricity. The T. A. Edison Foundation has a set of experiments on most renewables, even Ocean Thermal (OTEC)!

out-of-date.

BIOMASS: A number of materials exist that deal with solid waste problems, although they are not tied specifically to energy. The California Department of Education has interdisciplinary curriculum kits for the 3rd and 6th grades. Both the Wizard of Waste (3rd) and the Trash Monster (6th) are ten activity units that use comical figures to explore the problems of the "throw-away ethic" and teach students to "reduce, re-use and recycle". Contact the Publications Department at Post Office Box 271, Sacramento, California, 95820-0271 or call (916) 445-1260.


GEOTHERMAL: The California Department of Water Resources has a film library with a geothermal listing for the junior high level up. The best film is called Geothermal: The Roaring Resource and is about the Geysers area. Excellent instructional design. Utilities with geothermal plants have materials, too, as does Union Oil. Contact UnoCal, Corporate Communications, Post Office Box 7600, Los Angeles, California, 90031.

For Some, Its Potential Is Hot Stuff

By Walter Smith

Recently, everyone realized that the world's people are energy hungry and that some energy is tied to no country. The world's energy needs are being met by the human's will to survive. Some of the most economical are hydro, geothermal, wind and other types. They are the least damaging to the environment. But several million tons of waste are generated each year, and some governments are encouraging the burning of the waste, which can be said to be "renewable." But, in order to do this, there must be a means of generating a power source to do the work. The world's energy needs are being met by the human's will to survive. Some of the most economical are hydro, geothermal, wind and other types. They are the least damaging to the environment. But, several million tons of waste are generated each year, and some governments are encouraging the burning of the waste, which can be said to be "renewable." But, in order to do this, there must be a means of generating a power source to do the work. The world's energy needs are being met by the human's will to survive. Some of the most economical are hydro, geothermal, wind and other types. They are the least damaging to the environment. But, several million tons of waste are generated each year, and some governments are encouraging the burning of the waste, which can be said to be "renewable." But, in order to do this, there must be a means of generating a power source to do the work. The world's energy needs are being met by the human's will to survive. Some of the most economical are hydro, geothermal, wind and other types. They are the least damaging to the environment. But, several million tons of waste are generated each year, and some governments are encouraging the burning of the waste, which can be said to be "renewable." But, in order to do this, there must be a means of generating a power source to do the work. The world's energy needs are being met by the human's will to survive. Some of the most economical are hydro, geothermal, wind and other types. They are the least damaging to the environment. But, several million tons of waste are generated each year, and some governments are encouraging the burning of the waste, which can be said to be "renewable." But, in order to do this, there must be a means of generating a power source to do the work. The world's energy needs are being met by the human's will to survive. Some of the most economical are hydro, geothermal, wind and other types. They are the least damaging to the environment. But, several million tons of waste are generated each year, and some governments are encouraging the burning of the waste, which can be said to be "renewable." But, in order to do this, there must be a means of generating a power source to do the work. The world's energy needs are being met by the human's will to survive. Some of the most economical are hydro, geothermal, wind and other types. They are the least damaging to the environment. But, several million tons of waste are generated each year, and some governments are encouraging the burning of the waste, which can be said to be "renewable." But, in order to do this, there must be a means of generating a power source to do the work. The world's energy needs are being met by the human's will to survive. Some of the most economical are hydro, geothermal, wind and other types. They are the least damaging to the environment. But, several million tons of waste are generated each year, and some governments are encouraging the burning of the waste, which can be said to be "renewable." But, in order to do this, there must be a means of generating a power source to do the work.

California Energy Extension Service
HYDRO: The California Department of Water Resources coordinates a number of water education programs. They put together a 50-page compendium of curricula in a format similar to this bibliography. For the most part, the materials do not emphasize the links between water and energy, but a reference to the Science Framework Addendum at the beginning identifies those that do emphasize the links between water and energy. Several films are also available from their film library on the State Water Project, Oroville Dam and other facilities. Contact Carolyn Tucker at (916) 445-9371, or write DWR, Post Office Box 942836, Sacramento, California, 94236-0001.

SOLAR: The Solar Energy Research Institute (SERI) is responsible for basic research in solar (which technically includes biomass, wind and ocean energy as well as more traditional solar collectors and photovoltaics). They have an excellent set of seven loose-leaf binders, Solar Tech-Books, relating to particular technologies. The binders are not designed for teachers, but targeted for a wide cross-section of the scientific and technical community. They are continually updated and include stand alone documents related to the technologies, bibliographies, research directories and research reports. Binders include wind, ocean/tidal, biomass, photovoltaics, active heating and cooling, passive heating and cooling, solar thermal. Much of the material can be accessed through the CARIERS hotline. SERI's Technical Information Branch is at 1617 Cole Boulevard, Golden, Colorado, 80401. Their telephone number is (303) 231-7303.

The Photovoltaic Information Education Association was set up by members of industry, government and education in 1986 to provide relevant information on this emerging technology. One of its main functions is to act as a clearinghouse for close to 1,000 PV modules donated by government and industry. Contact them at 1600 Stout Street, Suite 1100, Denver, Colorado, 80202.

WIND: The California Energy Commission sponsors a wind information center that has technical reports and general publications on siting small turbines, cost and feasibility for systems and directories of manufacturers and contractors. Contact them at (916) 324-3490 or write Development Division, 1516 Ninth Street, Sacramento, California, 95814.

Department of Energy information includes a list of wind equipment manufacturers, research and development in progress, summaries of experimental wind research funded by the DOE, technical and general reading lists of wind energy publications and a "general background" paper. The background piece is probably the most useful for the layperson and students. Call CARIERS or write directly to Wind/Ocean Technology Division, Department of Energy, CE-351, 1000 Independence Avenue, SW, Washington, DC, 20585.

ANIMATED BIBLIOGRAPHY

Compute the daily per capita water consumption for a pioneer family of six if its use totalled as follows:

Cooking/dishwashing: 16 l/day
Drinking: 4 l/day
Handwashing: 11 l/day
Clothes washing: 77 l/week
Bathing: 54 l/week

16 + 4 + 11 + (77 + 7) + (54 + 7) = 54
54 ÷ 6 = 9 l/day per capita

(54 X 7) ÷ 40 = 0.85 = 10 trips/week

TOILET COMPOUND

ZINGER: Given the conditions of the setting, design a water conservation program for this log cabin family and reduce their consumption by 40%.

ZINGER: This would be an appropriate lesson to use in conjunction with a study of interest in general as it relates to banks, stores, oil companies, etc. Note the recent requirements for companies to advise their customers of the interest rates charged on accounts. You could have the students calculate the annual interest rates, using both simple and compound interest of 9% per month.

If the bill was not paid for a year and the family was charged 9% compound interest per month, what would the total bill be?
$15.12 X 1.09 = $16.65
$16.45 X 1.09 = $17.87
$17.87 X 1.09 = $19.26
$18.26 X 1.09 = $19.76
$19.76 X 1.09 = $21.36
$21.36 X 1.09 = $23.25
$23.25 X 1.09 = $25.35

How much more interest would the pioneers pay in a year if they were charged 9% compound interest rather than 9% simple interest monthly?
$42.51 - $31.44 = $11.07

The bill was not paid for 3 years and the family was charged 9% compound interest per month. What would the total bill be?
$11.07 X 1.09 = $12.07
$12.07 X 1.09 = $13.29
$13.29 X 1.09 = $14.64
$14.64 X 1.09 = $16.16
$16.16 X 1.09 = $17.81
$17.81 X 1.09 = $19.59
$19.59 X 1.09 = $21.52
$21.52 X 1.09 = $23.66

87

41

California Energy Extension Service
NON-RENEWABLE ENERGY MATERIALS

For the most part, each of the "fossil fuels" is represented by a well-established trade association that assumes a corporate responsibility to provide instructional aids on energy-related topics. The topics are so specific and the offerings so numerous that they are not reviewed here. For virtually all of the fossil fuels, utilities have educational materials available and are a good first stop. Many have been prepared for the utilities and associations by the same curriculum developers that prepared the materials reviewed earlier, e.g., Innovative Communications, Channling L. Bete.

COAL: This is a minor source for California, but big in some of the states back east. The American Coal Foundation gears a number of their materials to teachers. Most are for grades 4 and up.

918 16th Street, NW, Suite 404
Washington, DC 20006, (202) 466-8630

GAS: The American Gas Association (AGA), founded in 1918, represents approximately 300 companies involved in the production, distribution and transportation of natural gas. Their teacher advisory panel includes two representatives from California. A catalog of materials including booklets, films, videos, comic books, software and posters for all grade levels is available. Many of the items are available free of charge from gas utilities. Of all the associations, their materials seem most "teacher-friendly".

Educational Programs
1515 Wilson Boulevard
Arlington, Virginia 22209, (703) 841-8676

NUCLEAR: The American Nuclear Society was founded in 1954 and members include scientists, engineers and educators working in government, industry and academia. The Society prepares materials for educators interested in teaching about the various peaceful uses of nuclear science and careers in the field. Besides providing a variety of materials and a speakers bureau, they also publish a 4-page newsletter five times a year called RE-ACTIONS. A typical issue would include short reports of on-going research, conference dates, free items available, reviews of curriculum, etc. Two of the most interesting features are the "classroom projects" and "notes and quotes". The project is printed in a format like a 3 x 5 card which can be clipped out for a card file. The quotes include trivia items of interest such as, "If the diameter of an atom were the size of a football field, the nucleus would be the size of a pea." The newsletter is printed in brown on white so that teachers may reproduce a portion of it for classroom use.

Re-Actions Editor
555 North Kensington Avenue
La Grange Park, Illinois 60425
(800) 323-3044

Public Information Chair: Lynn Wallis, (408) 925-1149

ANIMATED BIBLIOGRAPHY

American Nuclear Society
Classroom project 11 - Half-life
(using M&M candies)

Bob Morgan, of Western Central High School in Reading, PA, sends this activity suggestion for demonstration of half life. "My students were doing the student or replacement game of 253-Half Life, handed in the exercise book that accompanied the Chemistry Module from the Physical Science textbook. We were making the graphs, but I could not see the actual trail of the paper trail, so I asked the chemists on my staff for help. One lady said, 'I wonder that would work with M&Ms?' I wrote down that idea and tried it out. We have had these activities the past two years and the students have really enjoyed it. We have had great feedback on it."

The following activity represents the radioactive decay of potassium-40.

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass (gram)</td>
<td>150</td>
<td>108.3</td>
<td>78.5</td>
<td>57.6</td>
<td>37.8</td>
<td>28.0</td>
<td>18.2</td>
<td>11.4</td>
<td>6.7</td>
</tr>
</tbody>
</table>

For the most part, each of the "fossil fuels" is represented by a well-established trade association that assumes a corporate responsibility to provide instructional aids on energy-related topics. The topics are so specific and the offerings so numerous that they are not reviewed here. For virtually all of the fossil fuels, utilities have educational materials available and are a good first stop. Many have been prepared for the utilities and associations by the same curriculum developers that prepared the materials reviewed earlier, e.g., Innovative Communications, Channling L. Bete.
The Atomic Industrial Forum is an international association of nearly 500 groups from 25 countries involved in the development and utilization of nuclear energy. This is the group to contact for statistics on nuclear power plants or if you want to visit one of the four information centers in California. They also distribute educational materials.

7101 Wisconsin Avenue
Bethesda, Maryland 20814-4891, (301) 654-9260

For those interested in using microcomputers to teach about nuclear energy, give Ron Saltinsky a call at the Monterey County Office of Education, (408) 424-0554.

The Union of Concerned Scientists publishes materials that have a somewhat different perspective. They have background materials on radioactive waste, alternatives to nuclear, nuclear power plants in the United States and Three Mile Island. They also have a junior high curriculum on conflict and nuclear war.

Department NSTA
26 Church Street
Cambridge, Massachusetts 02238, (617) 547-5552

OIL: The American Petroleum Institute was established in 1919 as the first group to encompass all aspects of the petroleum industry. Publications are handled through their public relations department, although their extensive catalog is composed primarily of technical materials, not classroom aids.

1220 L Street, NW
Washington, DC 20005
(202) 682-8118

Many oil companies are based in California and are often a better source of materials, films and speakers. Chevron has an education division and can provide materials on careers, off-shore oil and environmental considerations along with basic information about oil. Their Land Department has been helpful identifying speakers for off-shore oil issues, (415) 842-3128.

Carrie Murphy
Public Affairs, Youth and Education
575 Market Street, Room 864
Post Office Box 7753
San Francisco, California 94120-7753
(415) 894-5193

Union Oil of California has a poster tracing the history of oil. Contact them at:

Corporate Communications
461 South Boylston Street
Los Angeles, California 90017
(213) 977-7702

For different points of view on offshore oil, you might contact the Governor's Office of Offshore Development, c/o Office of Environmental Affairs, 1102 Q Street, Sacramento, California, 95814, (916) 324-3706 and the Natural Resources Defense Council, (415) 421-6561.

Exploration
The first challenge is to locate new deposits of petroleum.

Geological Formations are studied through:

- Surface Methods
  Sound waves, magnetic and gravity readings help locate promising formations under the earth. Radar is used to examine areas covered by forests or clouds.

- Bore Holes
  Deep holes are drilled so samples from underground layers can be studied.

Exploration becomes more difficult and costly all the time, because the most accessible reserves have already been found.