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ABSTRACT

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)

ANIMATED BIBLIOGRAPHY

California Energy Extension Service
Governor's Office of Planning and Research
1400 Tenth Street, Room 209
Sacramento, California 95814
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Bonnie J. Cornwall,
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This is by no means a complete listing of available materials. Those selected are fairly accurate in their reporting of energy facts, attractive in format, assume little teacher background in most cases, emphasize active learning in and out of the classroom and emphasize energy conservation and quality of life. Above all, most are free or readily accessible. If you have materials you think should be included, please contact our office.

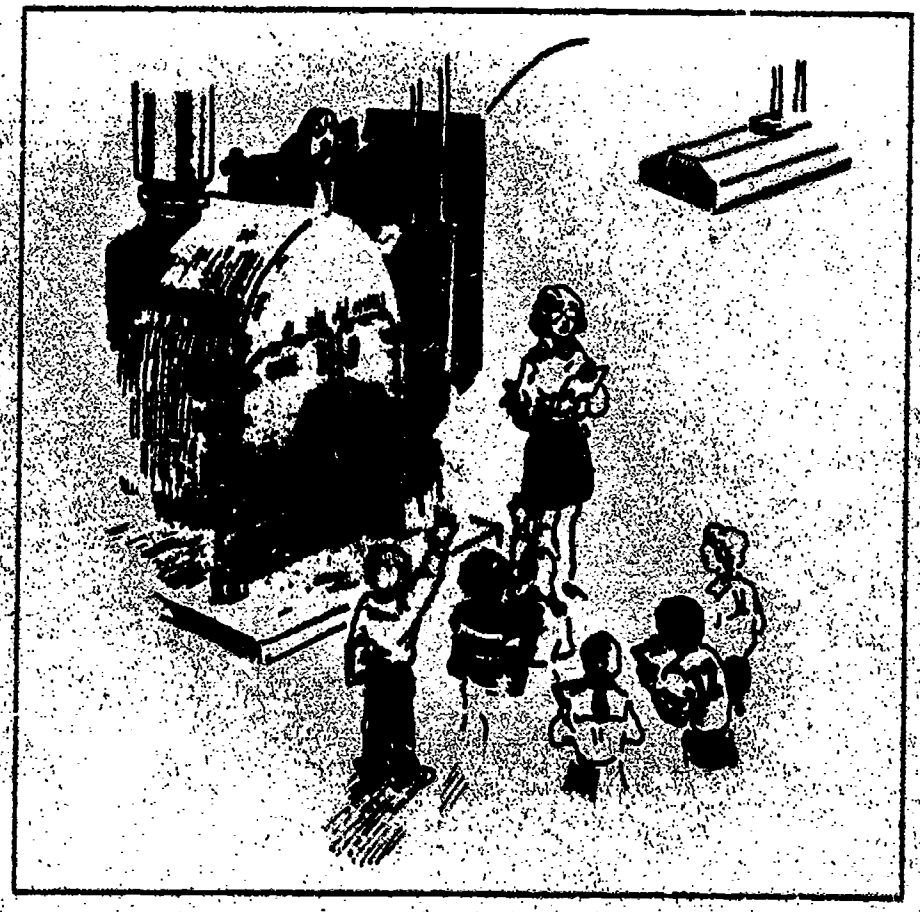
This 1988 revision of the Animated Bibliography was managed by Bonnie Cornwall and Kim Ortiz. The original version was developed in 1982 by Dana Stokes, with the help of Dickson Schwarzbach, Jan Philbin and Charlene Mathews. A 1985 revision was conducted by Marilyn Bodourian of Cupertino Union School District.

Many thanks to the producers of curriculum materials who provided the California Energy Extension Service with complimentary review copies.

The California Energy Extension Service works with schools in the State of California through seven regional centers to develop energy education programs which reduce school energy usage and costs by involving the school staff and students in energy management. Energy management needs to be practiced by everyone, not just the custodian. Energy education in the classroom helps teachers and students to become partners in reducing school energy costs. If you are not aware of the regional center in your area, please contact the California Energy Extension Service.

INSERT October 1989

Please specify grade level when ordering our "Energy Tech'Knowledgy" (1st, 2nd, etc).



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ANNOTATED BIBLIOGRAPHY

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:

- collect, examine and criticize information,
- think in a disciplined and logical manner,
- communicate ideas and feelings through listening, speaking, reading and writing, and
- 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 green 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.
3. Energy resources and their availability for human activity vary.
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.

THE BEST BOOK OF ENERGY [2 books]
Interdisciplinary activities

Grades: 1 through 6

Available From:
Modern Curriculum Press
13900 Prospect Road
Cleveland, Ohio 44136
1 (800) 321-3106

Cost: $11.46 each or $20.67 for set
[UPS, 10% of order, Parcel Post, 7% of order]

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 (one for 1st - 3rd grades and a second for 4th - 6th grades) 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.

social studies

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.

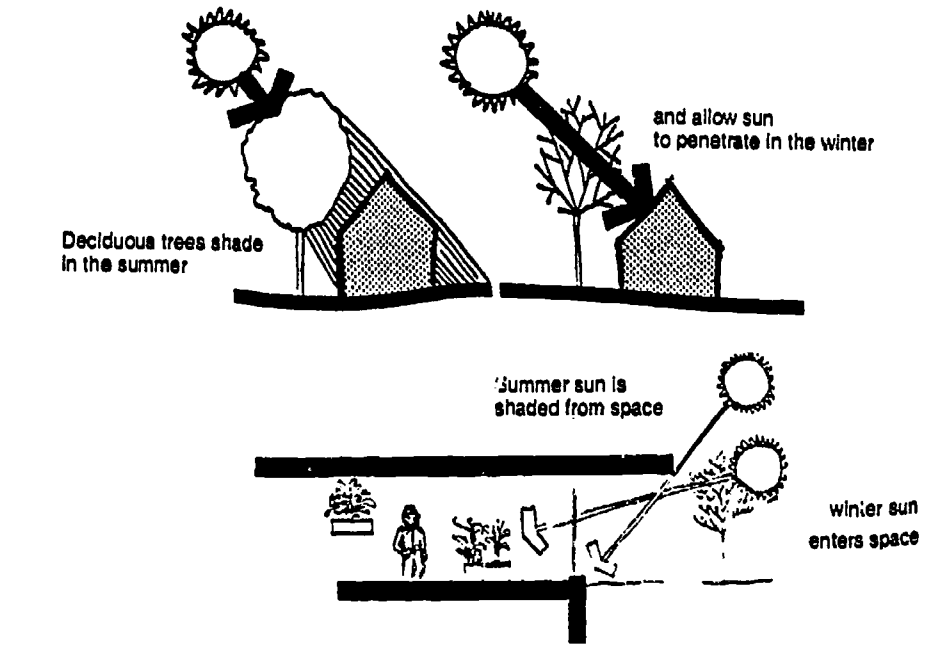
Explain that they will be designing and placing homes in an imaginary community that will take advantage of the sun for heating and cooling. Discuss the meaning of "passive" solar heating. Include discussion of site placement, landscaping, seasonal sun angle and wind patterns as described in Background.

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. Unfold the dwelling and draw in the windows and doors.
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 plots by taping the models in place. (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 visa 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 overhand 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).

4 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?



LARGE DECIDUOUS
-WINTER-
(FOLD UNDER)

SMALL DECIDUOUS
-SUMMER-
(FOLD UNDER)

CUT: Roof Dimension
House #1: 2" x 3"
House #2: 3-3/4" x 2"

House #2

SHRUB
(FOLD UNDER)

House #1

EVERGREEN
(FOLD UNDER)

SMALL DECIDUOUS
WINTER.
(FOLD UNDER)

LARGE DECIDUOUS
-SUMMER-
(FOLD UNDER)

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.

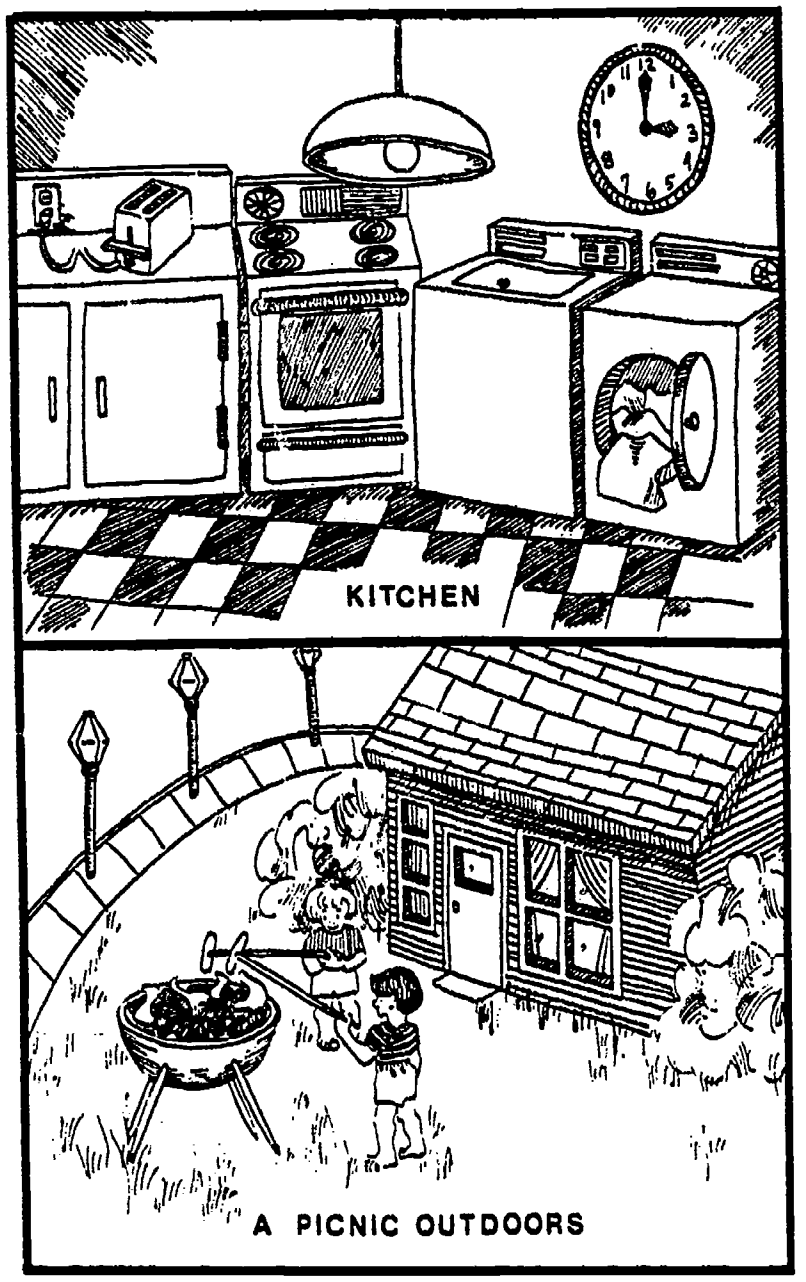
The framework provided for exploring the topic is quite thorough and the informative charts and tables that frequent the packets can easily be updated as a research activity. The activities go beyond the more typical topics examined in other materials and often raise some controversial issues. Basic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

Which give off heat or light?
Color them orange.



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

Note:
In advance of the day's lesson, arrange with the school custodian for a suitable time to visit the boiler room. Plan with the cafeteria staff for an appropriate time to visit the kitchen. You may wish to arrange for a class visit to the school office and school library.

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 or wire is made hot enough so it will radiate light as well as heat. Flourescent 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.)*

ENERGY TECH'KNOWLEDGY
Interdisciplinary activities

Grades: K through 6

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

Or:
Pacific Gas & Electric in their service territory

Cost: Free

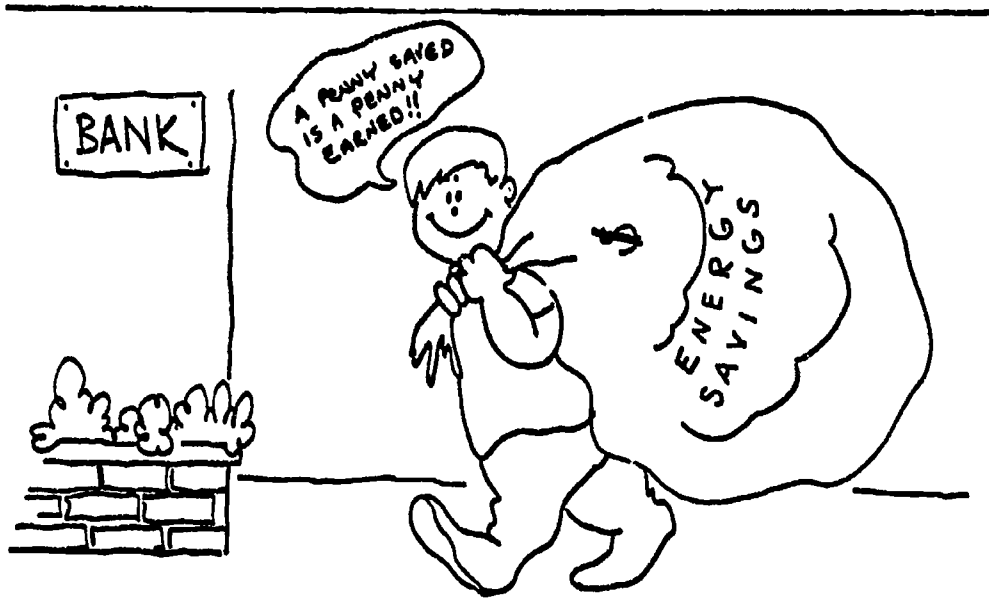
Dina the dinosaur and a variety of other cartoonish characters teach students about energy and conservation with activities geared toward math, science and language arts learning objectives. The materials were developed for the CEES by Marilyn Bodourian of the Cupertino Union School District, who many 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.

Math: Addition/Subtraction

NAME _____

DIRECTIONS: DO THE PROBLEMS. WATCH THE SIGNS.

9 - 5 = ____ = S	3 + 5 = ____ = G	6 - 3 = ____ = I
7 + 2 = ____ = R	9 - 4 = ____ = V	7 - 6 = ____ = E
3 + 4 = ____ = A	9 - 7 = ____ = N	5 + 6 = ____ = O
3 - 3 = ____ = M	5 + 1 = ____ = Y	5 + 5 = ____ = T



WRITE THE LETTERS ON THE SPACES THAT MATCH YOUR ANSWERS.

4	7	5	3	2	8		1	2	1	9	8	6
4	7	5	1	4		0	11	2	1	6		10	11	11

1-8

CONSERVATION FOR CHILDREN
Activity Guide

Grades: 1 through 6

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

Cost: $25.00 per guide; $165.00 [set of 7 guides].
10% of order for shipping and handling

The program was designed by teachers with teachers in mind to provide them with materials to teach students about conservation without requiring additional time, money or equipment. The materials present sequenced activities by grade level guide Each activity guide contains 90 student worksheets [40 Language Arts, 20 Math, 20 Social Studies and Science, 10 related activities] with grade level concepts, criterion referenced tests, correlation tables, student worksheets and, last, but not least, wonderful illustrations. The worksheets are intended for duplication by the teacher and can be used as a primary resource for teaching basic skills, supplementary materials to a core program, enrichment activities, skill review or as independent units of study. Activities are included in the supplement for arts and crafts, music and growing plants in the classroom as well. The program is very popular all over the state and across the country. Ms. Bodourian is available to conduct workshops as this program is approved by the U. S. Department of Education's Joint Demonstration Review Panel [JDRP] and funded by the National Diffusion Network.

Name _____

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.

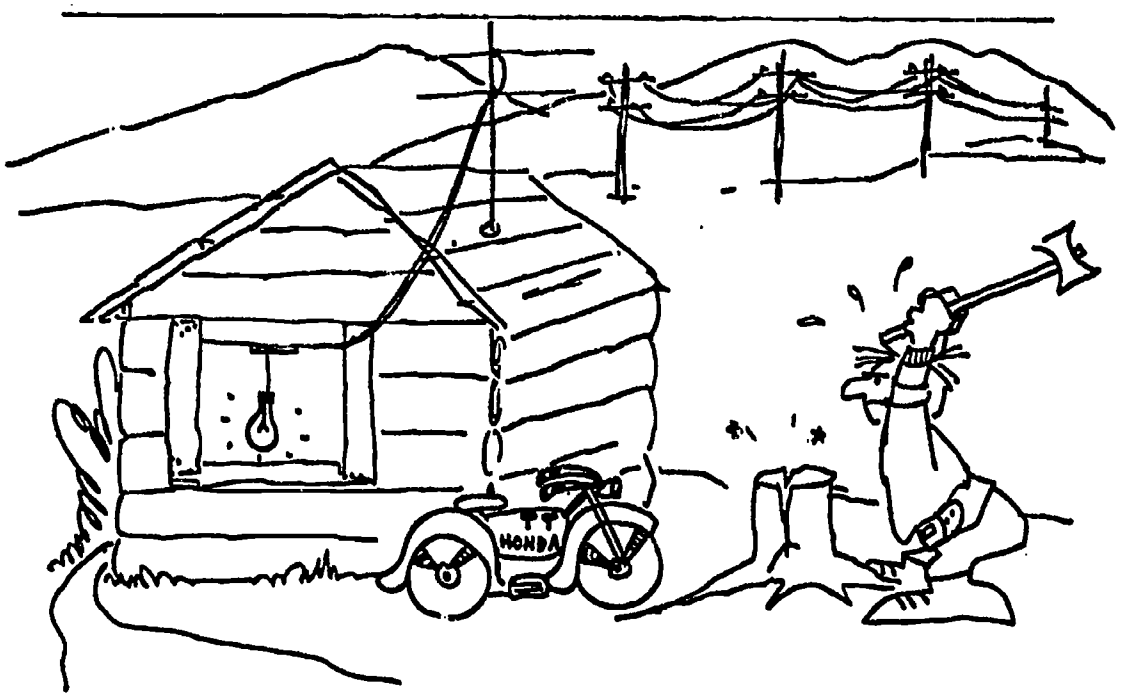
Today we have many electric appliances that help us around the house, entertain us, and make our lives easier. In 1900 very few homes had electricity. Those that did used it mainly for lighting. People cleaned their homes with brooms, mops, and dust cloths. They bought ice every few days to keep their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

A PIONEER CABIN IN 1850



ENERGY, FOOD & YOU
Interdisciplinary curriculum guide

Grades: K through 8; 9 through 12

Available From:
Washington State Office of Environmental Education
17011 Meridian North
Seattle, Washington 98133
(206) 542-7671

Cost: $7.00 per volume with $1.50 postage and handling

With either of these thick activity guides in hand, you are guaranteed to stimulate the creati.. mind 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	6. Oil
2. Wind	7. Gasoline
3. Water Power	8. Garbage
4. Sun	9. Wood
5. Ocean Currents	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".

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 youngest 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 work books are full of stories, puzzles and energy conservation information; also available in Spanish.

AGENT 006⅔.. HOME ENERGY INVESTIGATION

Here's a chance to join the Energy Agents 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 keeps you healthy, 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 IN HOME," write down how many of each appliance your family has.

Now, decide how important these appliances are to your family. If you really "CAN'T LIVE WITHOUT IT," circle number 1. But if you think "WHO NEEDS IT?", then circle number 5. If it is somewhere in between, circle 2, 3 or 4, depending on how important you think it is.

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

ELECTRIC OR GAS APPLIANCE	USE: HEALTH/CLEANLINESS	USE: COMFORT/CONVENIENCE	USE: ENTERTAINMENT	NUMBER IN HOME	IMPORTANCE: CAN'T LIVE WITHOUT IT	IMPORTANCE: WHO NEEDS IT?	ENERGY CONSERVATION
AIR CONDITIONER					1 2 3 4 5		
BLANKET					1 2 3 4 5		
BLENDER					1 2 3 4 5		
CAN OPENER					1 2 3 4 5		
CARVING KNIFE					1 2 3 4 5		
CLOCK					1 2 3 4 5		
CLOTHES DRYER					1 2 3 4 5		
CLOTHES WASHER					1 2 3 4 5		
COFFEE POT					1 2 3 4 5		
CORN POPPER					1 2 3 4 5		
DEHUMIDIFIER					1 2 3 4 5		
DISHWASHER					1 2 3 4 5		
DRILL					1 2 3 4 5		
FAN					1 2 3 4 5		
FLOOR POLISHER					1 2 3 4 5		
FOOD FREEZER					1 2 3 4 5		
FOOD MIXER					1 2 3 4 5		
FOOD PROCESSOR					1 2 3 4 5		
FRYING PAN					1 2 3 4 5		
GARAGE DOOR OPENER					1 2 3 4 5		
GARBAGE DISPOSER					1 2 3 4 5		
HAIR CURLERS					1 2 3 4 5		
HAIR DRYER					1 2 3 4 5		
HOME HEATING					1 2 3 4 5		
ICE CREAM FREEZER					1 2 3 4 5		
IRON					1 2 3 4 5		
JUICE EXTRACTOR					1 2 3 4 5		

ELECTRIC OR GAS APPLIANCE	USE: HEALTH/CLEANLINESS	USE: COMFORT/CONVENIENCE	USE: ENTERTAINMENT	NUMBER IN HOME	IMPORTANCE: CAN'T LIVE WITHOUT IT	IMPORTANCE: WHO NEEDS IT?	ENERGY CONSERVATION
KNIFE SHARPENER					1 2 3 4 5		
MICROWAVE OVEN					1 2 3 4 5		
MOVIE PROJECTOR					1 2 3 4 5		
PENCIL SHARPENER					1 2 3 4 5		
RADIO					1 2 3 4 5		
SAUCE					1 2 3 4 5		
REFRIGERATOR/ FREEZER					1 2 3 4 5		
SANDWICH GRILL					1 2 3 4 5		
SEWING MACHINE					1 2 3 4 5		
SHAVER					1 2 3 4 5		
STEREO					1 2 3 4 5		
SWIMMING POOL FILTER PUMP					1 2 3 4 5		
SWIMMING POOL HEATER					1 2 3 4 5		
TELEVISION					1 2 3 4 5		
TOASTER					1 2 3 4 5		
TOOTHBRUSH					1 2 3 4 5		
TOYS					1 2 3 4 5		
TRASH COMPACTOR					1 2 3 4 5		
TYPEWRITER					1 2 3 4 5		
VACUUM CLEANER					1 2 3 4 5		
WAFFLE IRON					1 2 3 4 5		
WATER HEATER					1 2 3 4 5		
OTHER: 30					1 2 3 4 5		
31					1 2 3 4 5		

AGENT NAME _____

DATE OF INVESTIGATION _____

THE GROWING CLASSROOM
Curriculum guide

Grades: 2 through 6 (Science and Nutrition)

Available From:
Life Lab Science Program
809 Bay Avenue
Capitola, California 95010
[408] 476-7140 Ext. 223

Cost: $40.00 plus $4.00 postage and handling [per set]

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[8] activities for the energy unit and seven[7] 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 "Great Gearloose Creation" relate specifically to transportation. The original Life Lab site, a three acre garden classroom begun in 1979, includes a solar-assisted waterheater, 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.

Sin City

purpose

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

Materials: energy tickets (prepare a ditto)

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:

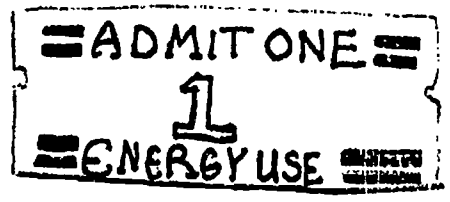
recess	pencil sharpener
special projects	drinking fountain
library	bathroom
office	lunch

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.

SAMPLE INTERVIEW

Photo by Liz Dana

1. When and where were you born?
2. Describe your family, home and community as it was when you were a young child.
   a. Family, including pets
   b. Type of home (brick, wood, 1-2-3 stories, near road, stream, trees, etc.)
   c. Was it a farm, town, or city home?
   d. Where did your grandparents grow up and live?
3. Describe:
   a. How large was your grammar school? (number of rooms, teachers and students)
   b. How did you get to school?
   c. What was one of your favorite books?
   d. What were your chores?
   e. What did you do with your free time? (hobbies, etc.)
   f. What games did you play?
4. Housing:
   a. How was your home heated?
   b. How was your home lighted?
   c. Where did your water come from?
   d. What was your bathroom like?
5. Food:
   a. What was your kitchen like? What fuel ran your stove? Heated your home?
   b. How was your food preserved? Where did your ice come from?
   c. Where did you get your food? (home garden, corner store, delivery truck, etc.?)
   d. Can you remember how your food was packaged? Type of containers?
   e. What were some of your favorite foods as a child?
   f. Can you name any special foods you used to prevent or cure illness?
   g. What foods were special holiday treats in your family?
6. Changes:
   a. What modern convenience that you did not have as a child do you most appreciate now?
   b. What do you dislike most in our modern environment?
   c. Do you think people were happier then or today?

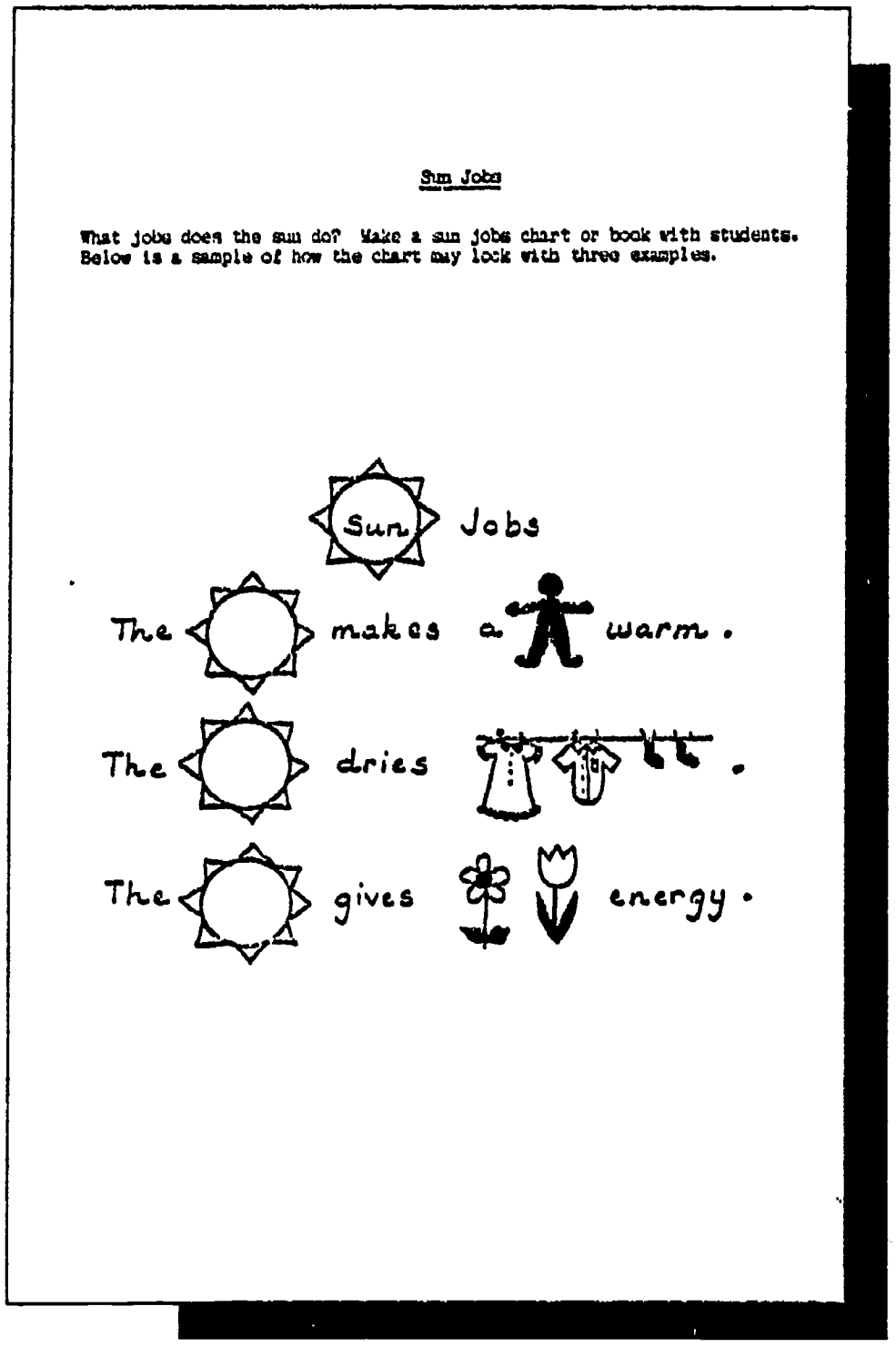
ENERGY ACTIVITIES FOR THE PRIMARY CLASSROOM
Classroom activities

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.



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)

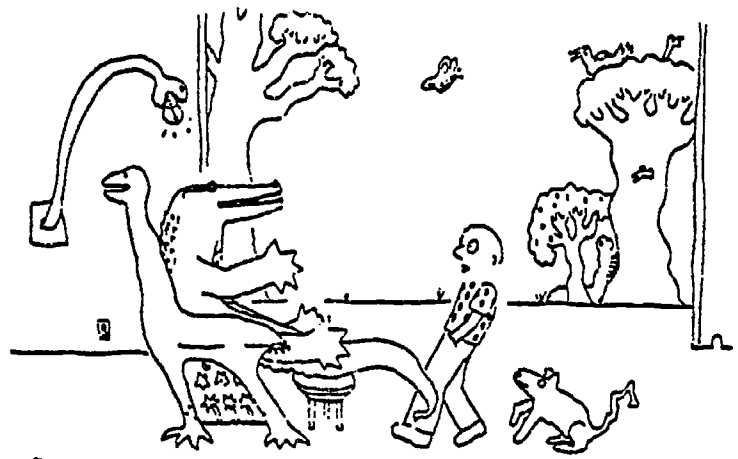
What Makes Everything Go is a charming book which describes energy basics at a beginning reading level through delightful illustrations and a clear text. An alligator, surrounded by his insect and animal friends, dramatically shows a curious young boy and girl about how energy functions in our environment. 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.



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

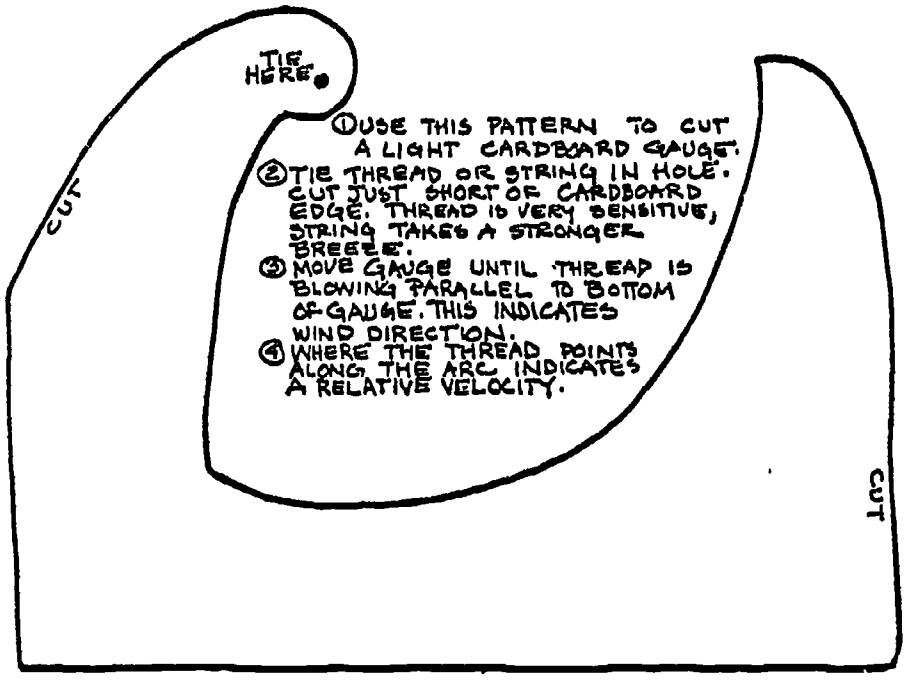
Encourage the children to be descriptive and to think of exciting words and moods about the wind.

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.



ENERGY CONSERVATION EDUCATION FOR NEW YORK STATE
Interdisciplinary materials

Grades: 4 through 9

Available From:
New York State Energy Office
Two Rockerfeller 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? _____

NEW YORK ENERGY EDUCATION PROJECT
ACTIVITY GUIDES
Interdisciplinary unit

Grades: 5 through 12

Available From:
Energy Education Project SUNY - Albany
1400 Washington Avenue
Box 22100
Albany, New York 12222, (518) 381-2243

Cost: $4.00 (teacher's guide is $1.60)

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."

The Nuclear Power Plant Game
On-Line: On Time and On Budget

Background

Any large construction project is expensive, complicated, and time-consuming. This is especially true for building a nuclear power plant. Why?

First, there are many people involved:

- the federal Nuclear Regulatory Commission (NRC)
- the state government
- the state's Public Service Commission (PSC)
- the local government
- citizens
- the utility company
- utility stockholders
- bankers
- power plant architects and engineers
- construction contractors and managers
- suppliers of construction materials and machinery
- construction workers
- electricity consumers

Second, there are many changing conditions:

- demand for electricity
- public attitudes about nuclear energy
- NRC regulations
- inflation
- interest rates for loans
- costs of other sources of energy
- quality of construction materials and components
- weather during construction

With so many people involved and so many changing conditions, it is not surprising that it takes a long time to complete a nuclear power plant.

In this game you will follow the steps for building a nuclear plant, from the first planning stages to getting the plant "on-line." When the plant is on-line, it is producing electricity for customers. At that point, it can start earning money to pay for the construction. Until then, as you will see, it just costs money.

Materials

- playing tokens (different colored buttons or coins)
- one die
- On-Line game board
- play money (one sheet per player)
- scissors

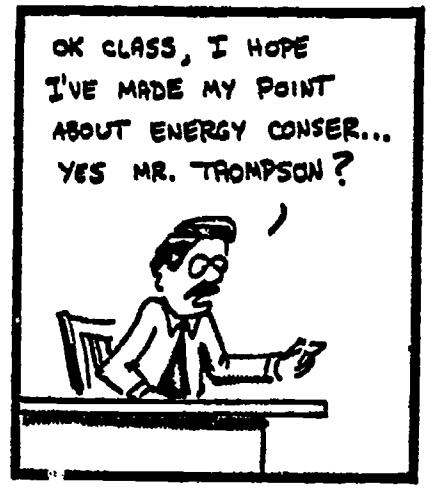
ENERGY CURRICULUM FOR THE MIDDLE GRADES
Interdisciplinary energy unit

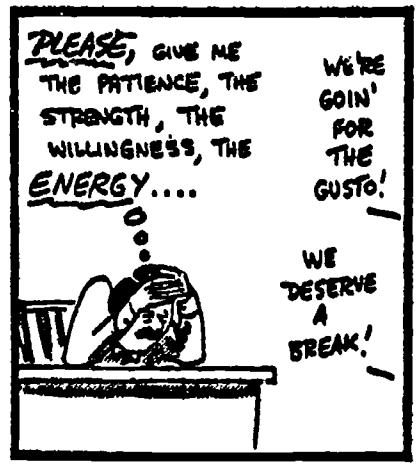
Grades: 4 through 6

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 or 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 booklet of these ideas. They could share the booklet with their parents and come up with class results in energy conservation that were chosen by families within the class.

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

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

CALIFORNIA STATE ENVIRONMENTAL EDUCATION GUIDE
Interdisciplinary activities

Grades: K through 6

Available From:
Alameda County Office of Education
Media Sales
313 West Winton Avenue
Hayward, California 94544-1198
[415] 887-0152

Cost: $17.95 (Available on April 10, 1988.)

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 you own insturctional 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 hypothesis on solar energy, running to see when energy is being used, researching energy sources, drawing murals on energy facts, surveying home appliances and designing a personal conservation plan. Other units are Diversity of Life (K-1st), Homes and Habitats (1st-2nd), Earth Supports Life (2nd-3rd), Caring for the Environment (K-3rd), Communities and Culture (3rd-4th), Adaptation and Variation (4th-5th) and Fostering a Healthy Environment (3rd-6th). A unit on toxics is being written.

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.

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 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 pieces 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).

SCIENCE ACTIVITIES IN ENERGY
Energy experiments

Grades: 4 through 6 (Science)

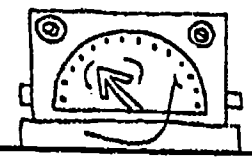
Available From:
Pacific Gas & Electric

Cost: Free

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?"

How much energy is saved when a dimmer switch is used with a 100-watt bulb?



CONSER-VATION 8

Materials

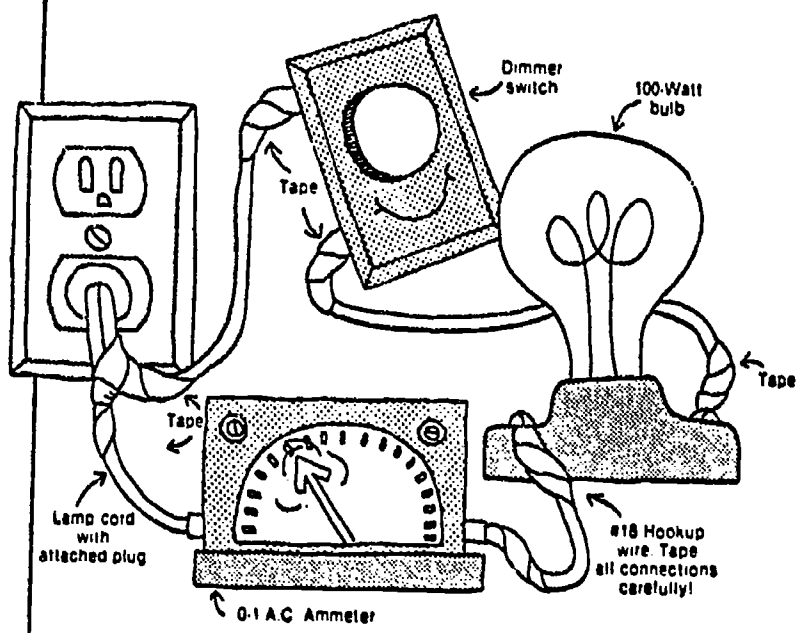
- Ceramic socket
- Lamp cord with attached plug
- 100-, 60-, and 25-Watt bulbs
- 2 Meters of #18 hookup wire (stranded and insulated)
- Electrical tape
- Photo light meter*
- Metric ruler
- Dimmer switch
- 0-1 A.C. Ammeter

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

Note

The room must be almost dark!

Set Up And Conduct Your Experiment



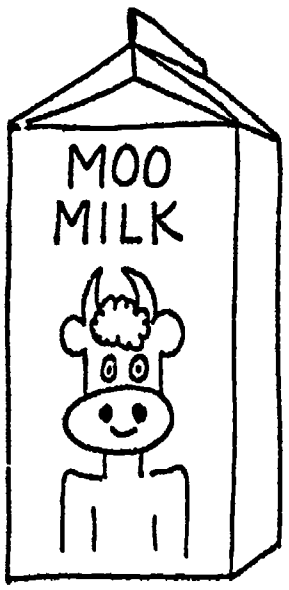
Using the different bulbs, measure and record the light output in foot-candles at 30 cm and the current in amps at each dimmer setting.

Bulb size		Amps	Light output in foot-candles
100-Watt	No dimmer		
	½ Output		
	¼ Output		
60-Watt	No dimmer		
	½ Output		
	¼ Output		
25-Watt	No dimmer		
	½ Output		
	¼ Output		

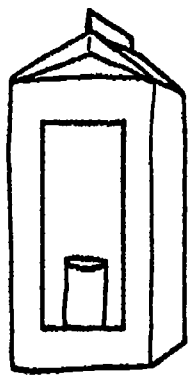
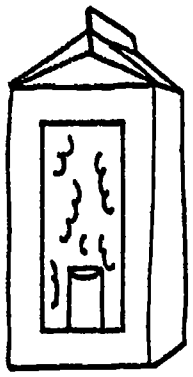
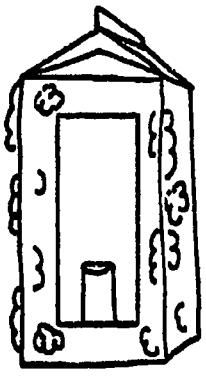
Summary Question

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

NAME _____



CARTONS 'N COTTON

	BEGINNING TEMP.	15 MINUTE TEMP.	30 MINUTE TEMP.
			
			
			

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—Energy Conservation

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

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

Science Processes
a. Gathering and recording data
b. Observing and classifying
c. Predicting and hypothesizing
d. Interpreting data

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.
14. Do computation on worksheet. 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 lightbulb.
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.

with pencil and paper in hand — and see how well the lights in your home stack up. Tell your parents about your findings.

• Are bulbs and lampshades free of dust and dirt that block light transmission? Dirty bulbs and shades waste the light produced inside the bulbs. As a result you may turn on two lights when only one is really necessary.

• Are lampshades *translucent* (so light can pass through them) rather than solid? It doesn't make sense to use energy to produce light, and then block the light with a solid lampshade.

• Are ceilings and walls light-colored? Light colors reflect more light than dark colors, and so fewer lamps (or lower-wattage bulbs) can be used to light the room.

• Are "non critical" lighting levels in your home kept as low as possible? As a rule of thumb, one watt of lighting per square foot of floor area is adequate for general room and hallway lighting. Use your yardstick or tape measure to make measurements. Of course, "critical" tasks (such as reading, sewing, building model airplanes, and doing your homework) require more light.

• Does every member of your family turn off lights after he or she leaves a room? Not doing this is just an out-and-out waste of valuable energy!

By the way, you may hear some people say that they *purposely* leave lights on. These people mistakenly believe that the sudden surge of electricity that flows through a light bulb when it is turned on represents a lot of energy. They think that keeping the bulb lit — and thereby avoiding starting surges — somehow saves energy.

They are wrong! A light bulb consumes less energy during its starting surge than during a *single second* of normal operation.

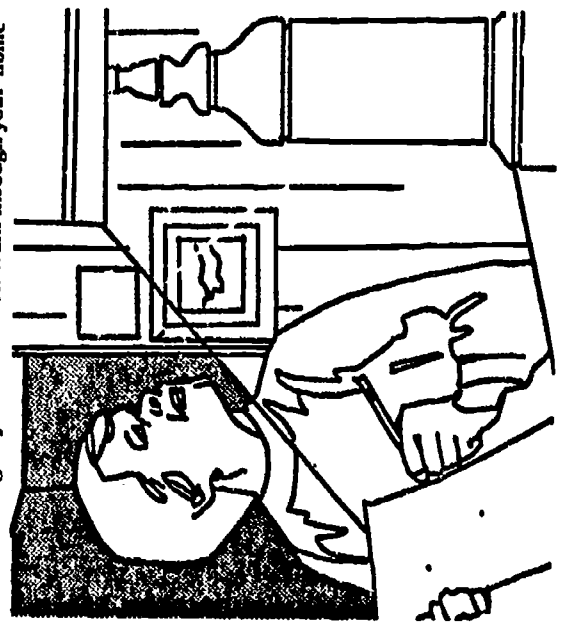
Always turn lights off when they are unnecessary, even for a few seconds.

EXPERIMENT 10:
CHECKLIST FOR ENERGY—
EFFICIENT LIGHTING

THINGS YOU NEED: A yardstick or tape measure.
Pencil and paper.

How much energy is used to light your home? Probably, about 2000 kilowatt-hours of electrical energy each year. Your local electric power plant burns about 150 gallons of oil (or over ¾ ton of coal) to generate the electricity.

With this much energy "going up in light," it makes good sense to learn to use lighting efficiently. This simple lighting checklist will give you a head start. Walk through your home –



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:
E D S
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 in 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.

"That's an easy argument to settle." Offalot said. "You're both right. Sometimes it costs money to use energy, and sometimes it doesn't." Eric and Sandra looked confused. "Come on," Offalot said. "Let's take a walk. I'll show you what I mean."

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 a kite 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 skate; 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 eat, our bodies 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 although all items cost money to buy, but some also cost money to use, while others do not.

BRIGHTLAND
Part of the Energy Source Program
Self-contained curriculum kit

Grades: 1 or 2

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

Cost: Free from many utilities

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

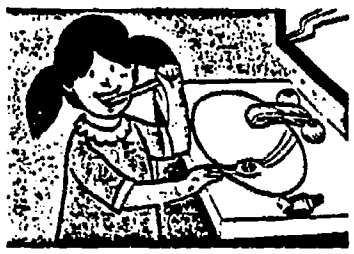
The King and Queen in a faraway land are trying to prepare for a winter festival, but do not have enough time or people. With an "alakazam" the Wizard brings energy to Brightland. The Brightland unit introduces children to basic energy concepts such as heat, light and motion, how energy gets to our homes, how appliances are powered and helps them develop habits of energy conservation. Each of the ten [10] 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.

Energy Saver Checklist

Directions: Listen as each sentence below is read aloud. Then mark the box [X] beside the answer that is true for you. Remember to be honest.

1. When I take a bath, I fill the tub only half full.

☐ Always ☐ Sometimes ☐ Never

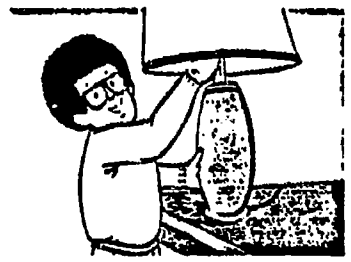


2. I turn the water off while I brush my teeth.

☐ Always ☐ Sometimes ☐ Never

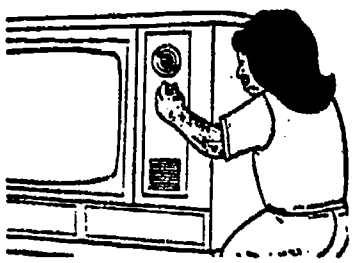
3. When I leave my room, I turn off the light.

☐ Always ☐ Sometimes ☐ Never



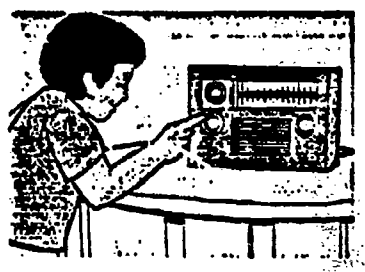
4. I turn the lights off in the house when they are not being used.

☐ Always ☐ Sometimes ☐ Never



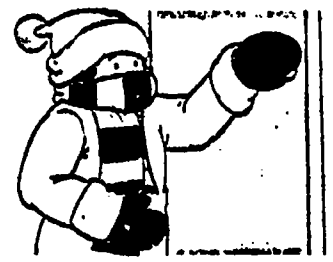
5. I turn off the TV when no one is watching it.

☐ Always ☐ Sometimes ☐ Never



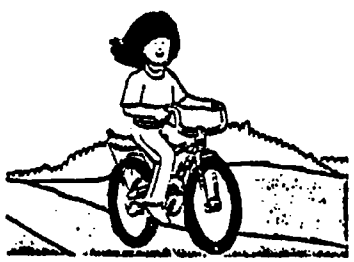
6. I turn off the radio when I'm through listening to it.

☐ Always ☐ Sometimes ☐ Never



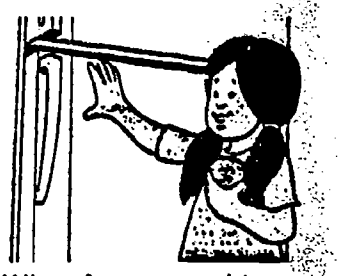
7. When the furnace or air conditioner is on, I close the door when I come into the house.

☐ Always ☐ Sometimes ☐ Never



8. If I can, I walk or ride my bike instead of asking for a ride in the car.

☐ Always ☐ Sometimes ☐ Never



9. When I get something out of the refrigerator, I do it quickly.

☐ Always ☐ Sometimes ☐ Never

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

Name _____

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? (Yes) No

1	By "fossil fuels," do we mean oil, natural gas and coal?	Yes	No
2	Do we use energy when we cook our food?	Yes	No
3.	Do we use energy to keep the inside of our refrigerators cold?	Yes	No
4.	Do we use gasoline in our home heaters?	Yes	No
5.	Are electricity and water the main kinds of energy we use in our homes?	Yes	No
6.	Is oil made from gasoline?	Yes	No
7.	Is supplying energy only a small business in most cities?	Yes	No
8.	Do lots of people work at water and power companies?	Yes	No
9.	Do the water and power companies know how much water and energy we use in our homes?	Yes	No
10.	Are electricity and natural gas free?	Yes	No
11.	Are there electric and natural gas meters at many of our homes?	Yes	No
12.	Do electricity and natural gas cost most families more than food does every month?	Yes	No
13.	Do we pay for electricity according to how much we use?	Yes	No
14.	Do we have enough oil, coal and natural gas to last forever?	Yes	No
15.	Does burning coal or oil to turn water into steam help make electricity?	Yes	No
16.	Do we use lots of energy?	Yes	No

FOSSIL FUEL JUNCTION
Part of the Energy Source Program
Self-contained curriculum kit

Grades: 3 through 4

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

Cost: Free from many utilities

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

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 The ten lesson unit consists of teacher guide, student booklets, filmstrips and cassette tape, poster on how we get and use fossil fuels, pre- and post-tests, home activity booklets and stickers.

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

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

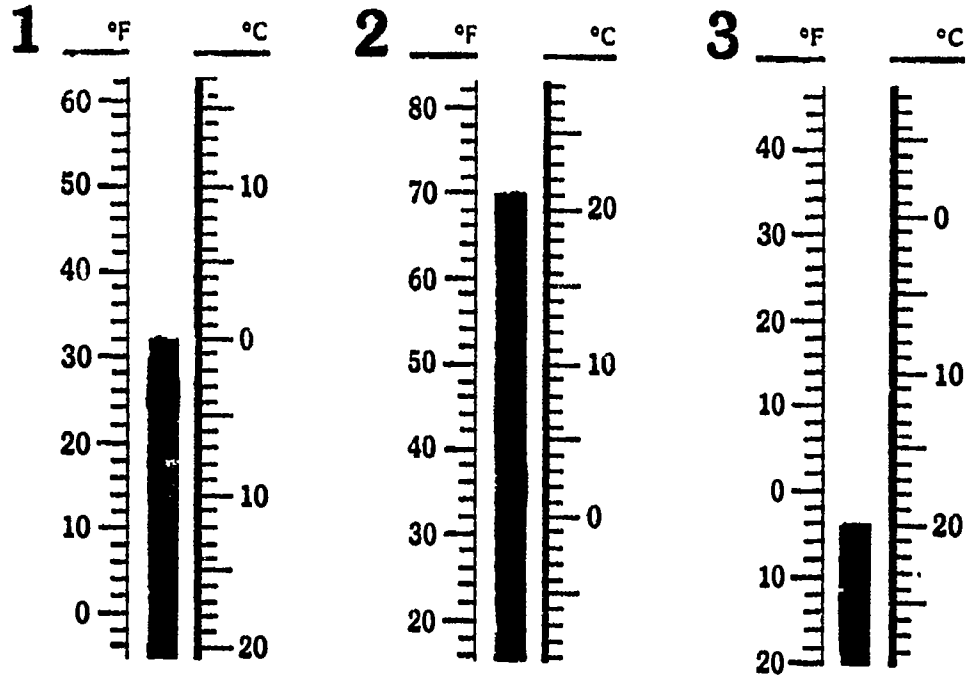
For Further Information:
E D S
5505 East Carson, Suite 250
Lakewood, California 90713
[213] 420-6814

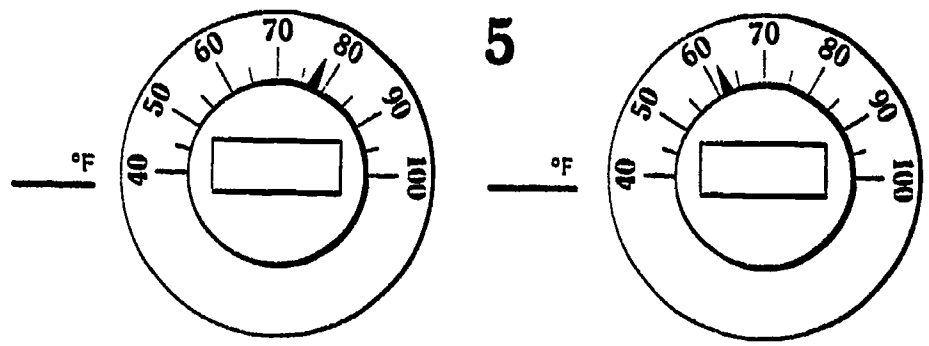
In The Great Hot Air Balloon Race, pupils are introduced to heat energy— where it comes from, how we measure it, how it escapes, and how we try to trap it, by the brother and sister team of Phineas and Annie. Learning is made more fun as the two characters must master a number of skills in order to beat 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.





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

6 -4°F _____ 7 98°F _____ 8 72°F _____

9 40°F _____ 10 57°F _____ 11 85°F _____

POWER SWITCH
Part of the Energy Source Program
Self-contained curriculum kit

Grades: 5 or 6 (Social Sciences)

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

Cost: Free from many utilities

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

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.
4. Conservation for all sectors.

COUNTRY Continent	UNITED STATES N. America	SWEDEN Europe	IRAQ Asia (Middle East)	BOLIVIA S. America	LAOS Asia	MALI Africa
*Yearly energy use per person	112	44	7	7	2	2
Yearly income per person	$8,600	$9,300	$1,561	$477	$85	$96
Average lifespan in years	73	75	53	49	40	41
One car for every ____ people	2	3	87	158	264	580
One radio for every ____ people	1/2	2 1/2	10	13	18	84
One telephone for every ____ people	1 1/3	1 1/2	41	55	**N/A	N/A
One TV set for every ____ people	2	3	31	N/A	N/A	N/A

*All figures are taken or computed from 1988 World Almanac and Energy in a Finite World, Cambridge, Mass: Ballinger Publishing Co., 1981.
** N/A means that these figures were not available.

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.
4. Determine effective conservation practices.

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:

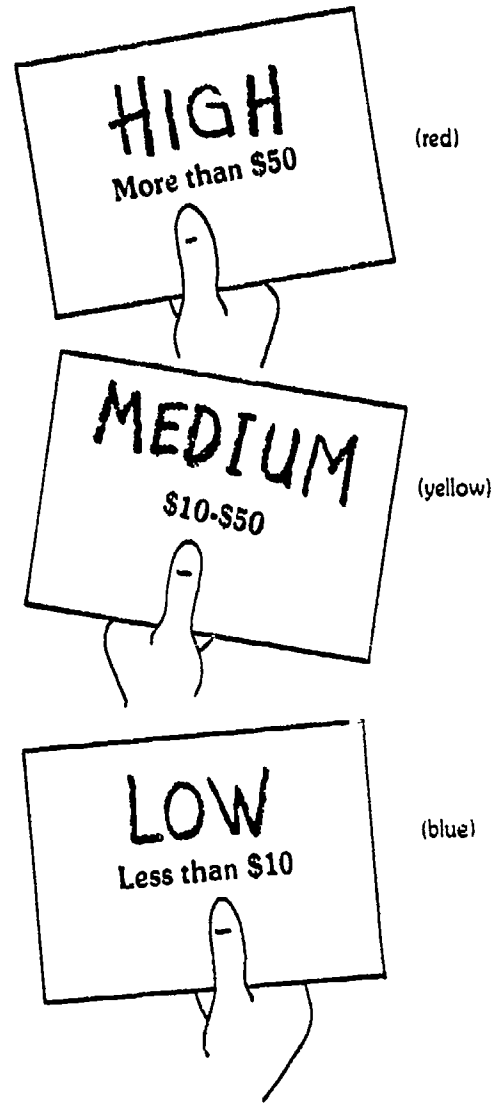
A. **Provide additional group practice on yearly energy costs**

- 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 listed below, one at a time. As each card is displayed, each pupil should hold up the piece of paper that identifies the yearly energy cost range for that energy user. (The correct cost range color is indicated after each energy user.)

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)**



NATIONAL ENERGY EDUCATION DAY PROJECT
Supplemental activities

Grades: 7 through 12, although some for upper elementary

Available From:
California Energy Extension Service
1400 Tenth Street, Room 209
Sacramento, California 95814
(916) 323-4388
or
The NEED Project
1900 Association Drive
Reston, Virginia 22901

Cost: $10 for schools and $25 for non-schools (Carnival is $7.95)

The National Energy Education Project (NEED) was founded in 1980 with a Joint Congressional Resolution that prompted schools through the country to develop energy education programs. NEED combines hands-on experiences, competition and fun to teach students about energy and develop their leadership skills. The emphasis on leadership training encourages students who might otherwise not care about energy education to become involved. One of the strengths of the program is that students are responsible for determining their own level of participation and learning. The format appeals to service groups such as Key or S Clubs, student government, 4-H and Science or Ecology clubs, because it provides ideas for community involvement and fund raising projects. Schools are encouraged to "put it all together" and compete for an all-expense paid trip to Washington, DC.

Schools receive a booklet of resources, organizational hints, an energy poll, an energy play, 16 successful projects including energy rock videos, "Let's Talk Energy Show" and 3 issues of a magazine. One of the most popular activities that is available as a separate packet is the Energy Carnival. The Carnival is a set of six games where students combine their academic skills and energy knowledge with their ability to toss and throw just as if they were on the midway. This Carnival is a good culminating activity to test student knowledge of facts.

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 or week. This activity achieves the goal of energy educating as many community members as possible during the annual NEED celebration.

How to Organize

STEP 1. Before making a commitment to using your placemats, 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 list:

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 Believe-it-or-Not), find-a-words, 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 McDonalds, Main Street Diner. You may want to use two or more colors when having the placemat printed to achieve a really professional appearance. Remember a businessman is not going to put poorly designed mat in his restaurant.

STEP 2. Determine how to list sponsors on the placemat. Some businesses might not want their competitor's name on the placemats to be used in their establishment. In this case you can have the mat printed separately. The printer can easily "strip in" the different sponsors name 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 inks to be used.

Ask them if they would like to purchase your custom-designed NEED placemat for use in their establishment 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. Be sure to visit the establishment on NEEDay to photograph the placemats in actual use.

STEP 5. **PRIZES --PRIZES --** Enter your placemat design in the NEED Placemat 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.

ENERGY PATROL PACKET
Supplemental classroom activity

Grades: 2 through 8

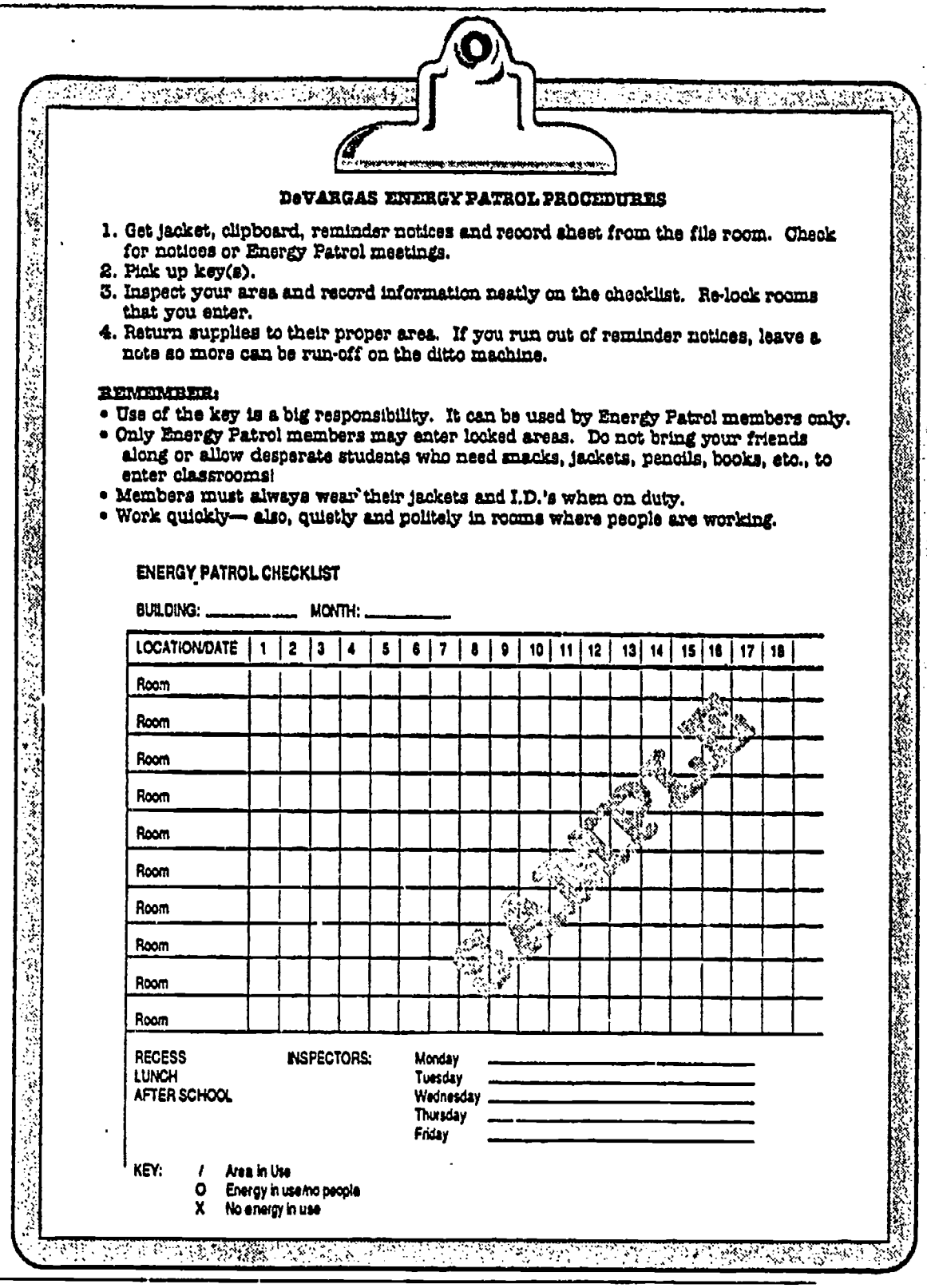
Available From:
California Energy Extension Service
1400 Tenth Street, Room 209
Sacramento, California 95814
(916) 323-4388

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 Gnus) 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.



DeVARGAS 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.

REMEMBER:
- 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

BUILDING: _____ MONTH: _____

LOCATION/DATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Room																		
Room																		
Room																		
Room																		
Room																		
Room																		
Room																		
Room																		
Room																		
Room																		

RECESS
LUNCH
AFTER SCHOOL

INSPECTORS:

Monday _____
Tuesday _____
Wednesday _____
Thursday _____
Friday _____

KEY: / Area in Use
O Energy in use/no people
X No energy in use

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

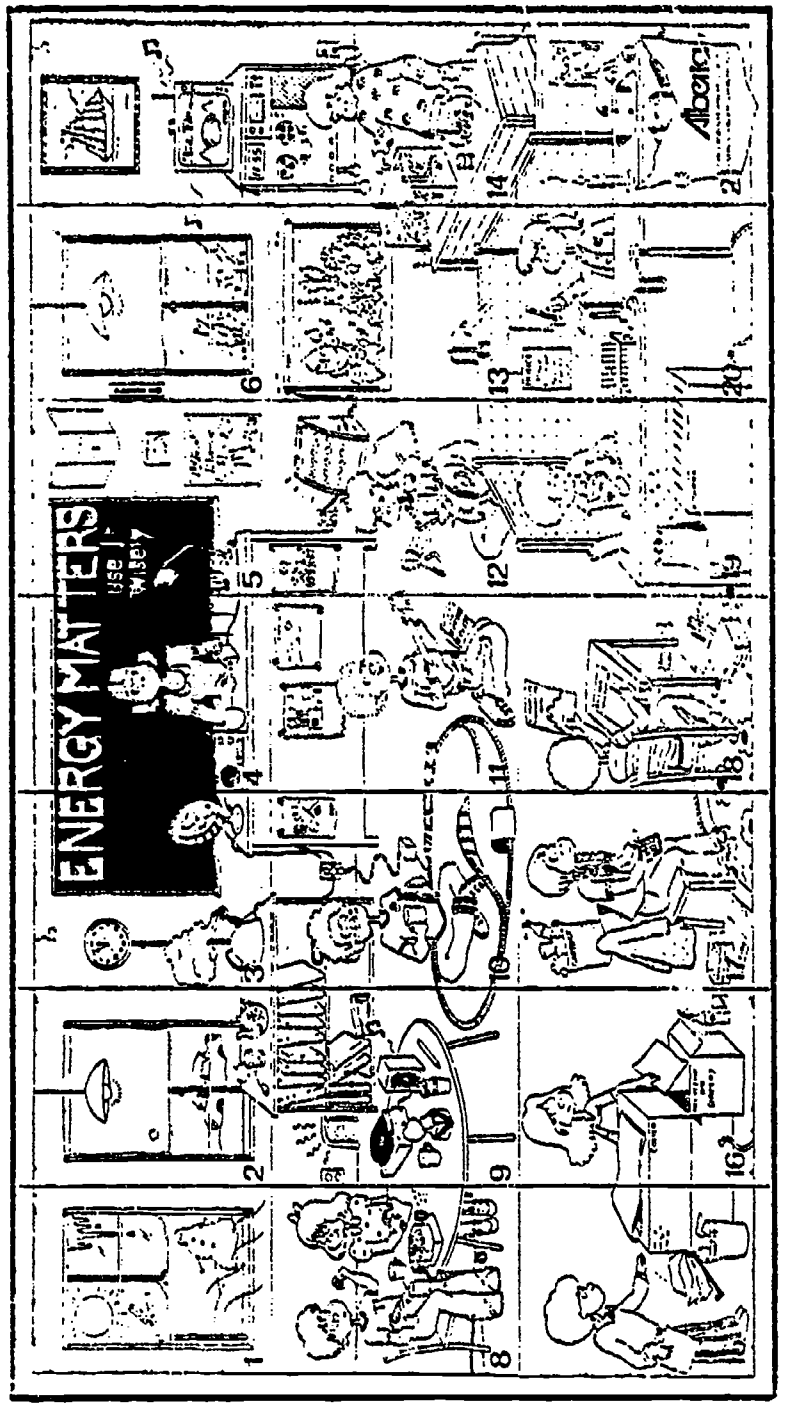
This unique poster/puzzle activity was developed by the Energy Office in Alberta, Canada. The packet consists of instructions for the teacher on using the poster which depicts energy use and abuse in a classroom, discussion questions for each piece of the puzzle, and 21, 8-1/2 x 11 pages that assemble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



HOW TO MOTIVATE STAFF AND STUDENTS TO SAVE ENERGY
Classroom and supplemental activities

Grades: 4 through 12

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

Cost: Free

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.

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. What follows 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

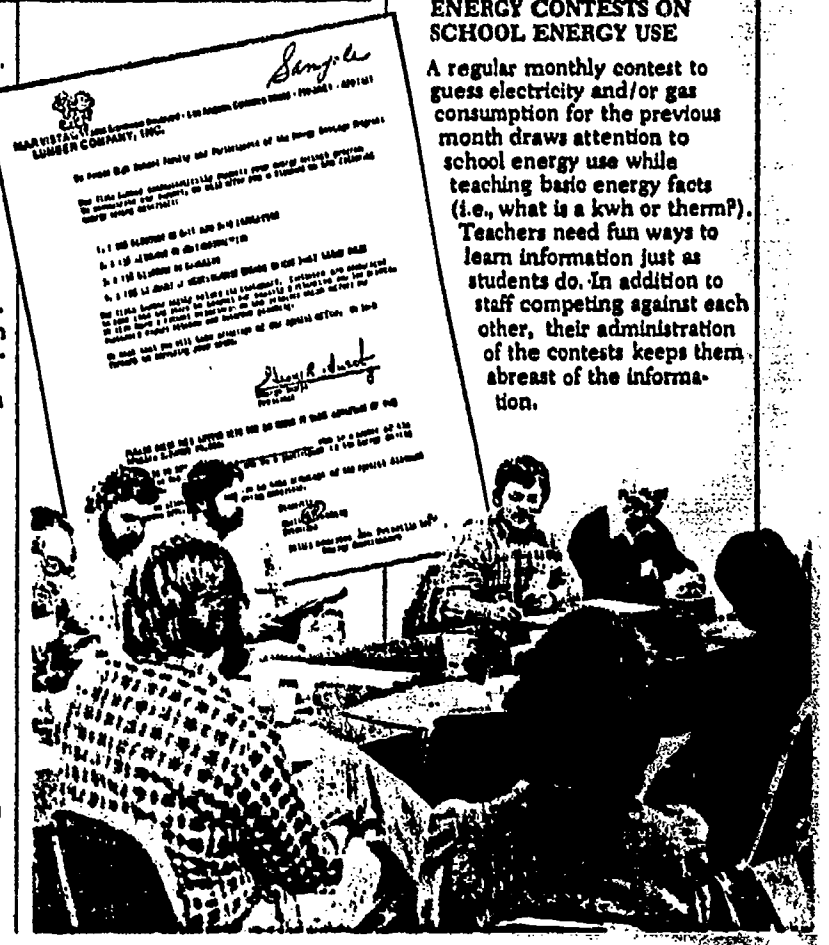
One high school had a staff meeting where home as well as school energy management was presented. Two teachers talked a local hardware store into giving teachers at the school a discount on energy conservation purchases (see flyer). The enthusiasm for saving money at home was carried over to saving energy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



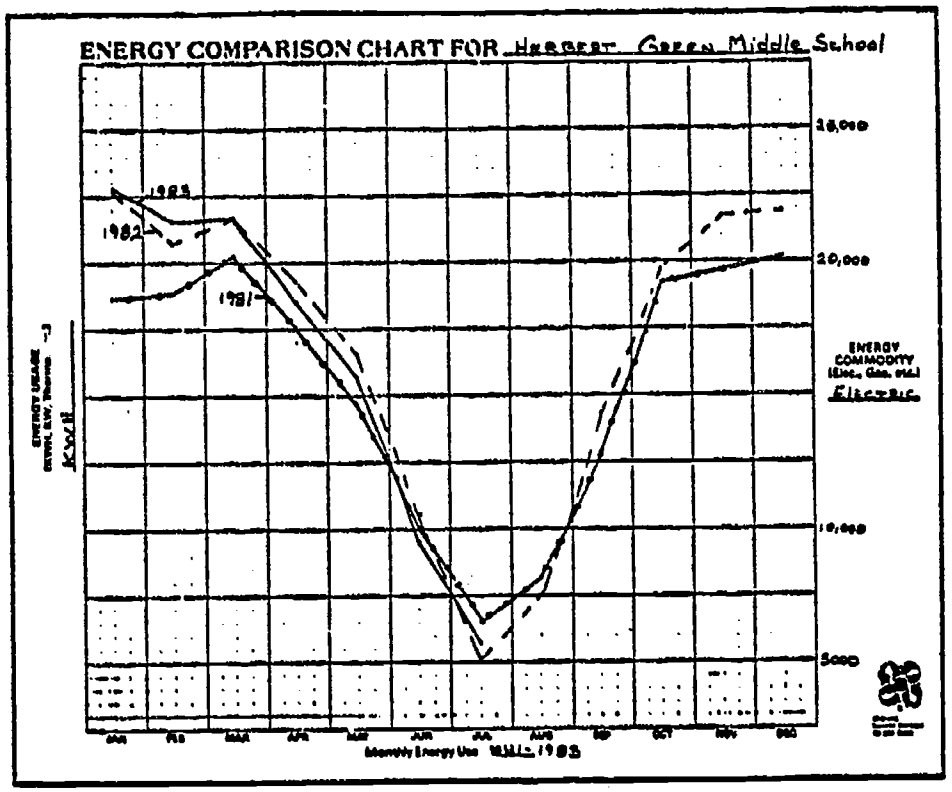
HOW TO ORGANIZE AND COMMUNICATE YOUR ENERGY DATA: A GUIDE TO ENERGY ACCOUNTING
Supplemental materials

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*.



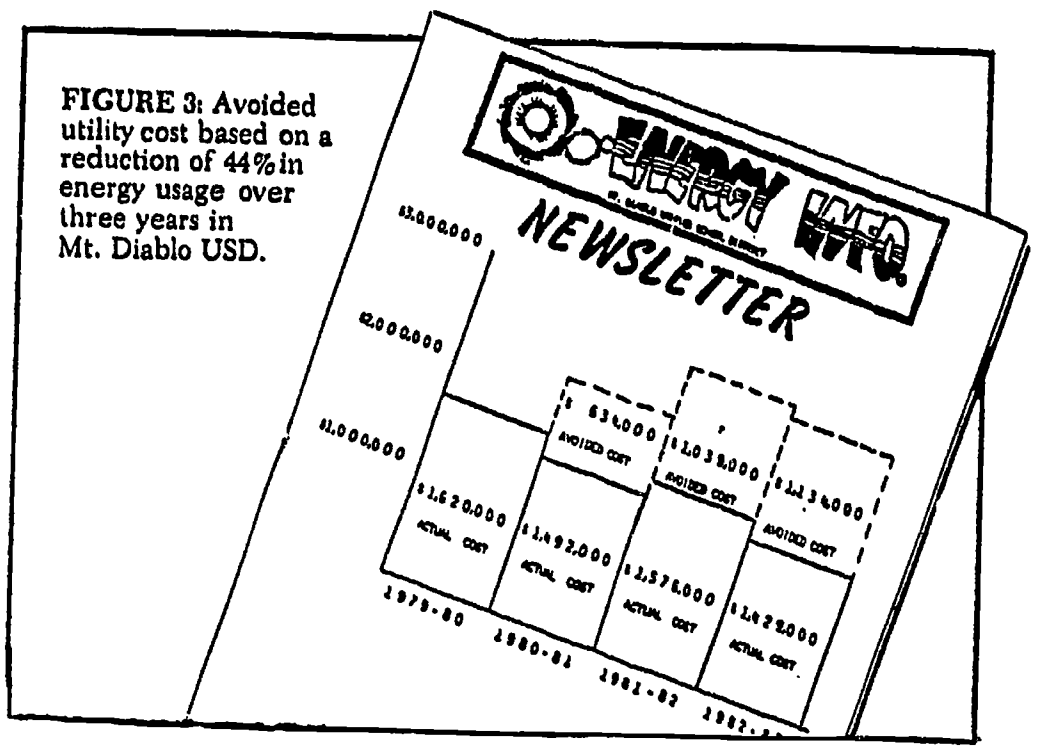


FIGURE 3: Avoided utility cost based on a reduction of 44% in energy usage over three years in Mt. Diablo USD.

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

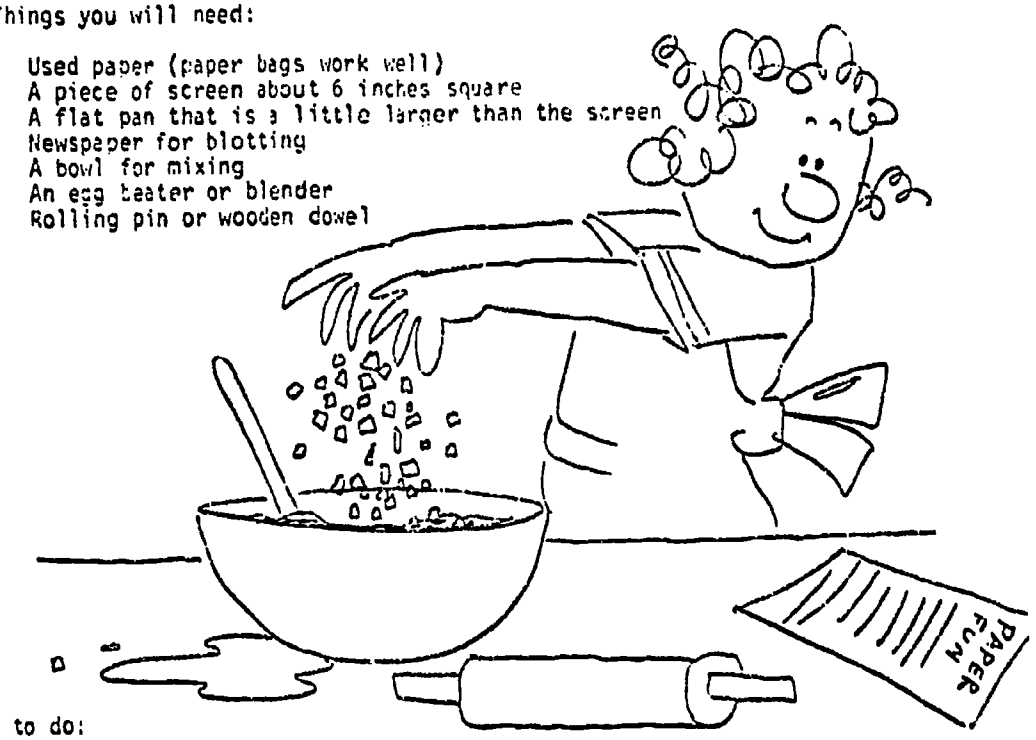
Cost: $5.00 plus 10% of order on shipping and handling

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 out 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. Move 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 now have a piece of recycled paper. Use it for stationery, a picture, or a beautiful background for a leaf print.

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?

___ Insulation keeps your energy bills low in the summer and winter months.
___ Insulation in a home prevents heat from escaping up the chimney flue.
___ The R-value of insulation materials measures the ability of the materials to resist heat flow.
___ It is important that insulation have a vapor barrier.
___ Insulation is only effective if you live in a very cold climate.

List the six types of insulation:

1. rolls, batts, and blankets
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 curriculua and a calendar of events. The Spring supplement is always a Directory of Energy Education Materials. Readers can 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.

Facts Page

TABLE 2 PART 2: Electricity Sales, Utility (10^9 KwH)

Consuming Sector	1985	1986	% Increase
Residential	792.9	820.8	3.5
Commercial	605.9	630.3	4.0
Industrial	820.3	817.4	-0.4
Street & Highway Lighting	14.6	14.9	2.1
Other Public Authorities	62.2	62.0	-0.3
Railroads & Railways	4.7	4.7	0.0
Interdepartmental	5.3	5.2	-1.9
Total Consumer Sales	2,305.9	2,355.3	2.1

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, 356 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. —*jmf*

TABLE 3: International Comparisons

Countries	Generating Capacity (MW)	Consumption Total (10^9 KwH)	Consumption Per Capita (KwH/Person)
U.S.	708,795	2,525.2	10,577
U.S.S.R.	319,293	1,544.0	5,564
Japan	169,528	673.4	5,578
Canada	99,284	460.4	18,127
West Germany	92,704	406.7	6,673
France	88,800	326.4	5,927
China	82,200	410.7	396
United Kingdom	67,607	294.7	5,223
Italy	54,976	182.2	3,189
India	51,180	188.5	246

* *Other Sources include cogeneration, etc.*

** *Does not include Other Sources.*

*** *Other includes geothermal, wood waste, wind and solar produced electricity generated by utilities.*

Classroom Resources & Materials

Classroom Project about Nuclear Waste

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 nuclear waste can be disposed of properly. Some points made should include the different types of nuclear waste and their hazards, where the wastes come from i.e.— 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 Quotes on Peaceful Uses of the Atom and Radioactive Substances." Contact ANS Public Communications Department, 555 N. Kensington Ave., La Grange Park, IL 60525. or call 800-323-3044.

UTILITY EDUCATIONAL MATERIALS CATALOGS

Grades: Pre-school through College

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 materials. 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 Divison, Room 1217
Post Office Box 111
Los Angeles, California 90051
(213 481-6358 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)! Be aware that rapid advancements in technologies make even these materials quickly 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.

See Solar for Tech-Book series for biomass binder.

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, 90051.

For Some, Its Potential Is Hot Stuff

By KATHY SHIRLEY
EXPLORER Staff Writer

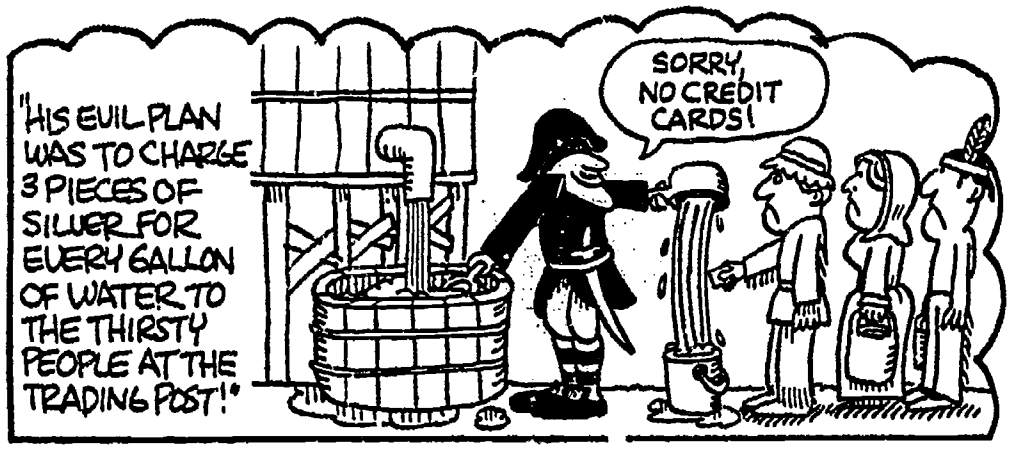
Nearly everyone realizes that the world must diversify its energy base but few agree on how to do the job, most alternate energy sources have serious economical and/or technological drawbacks that are stymieing development.

But several major oil companies and some governments are overcoming the hurdles impeding the worldwide growth of geothermal energy — an energy source almost everyone agrees is workable, economical and environmentally safe.

The first attempt to harness the Earth's heat for energy was in 1904 in Lardarello, Italy by Prince Piero Ginori Conti, according to a paper by C.F. Budd Jr., vice president of forecasting operations with Union Oil Co. of California's geothermal division. That early attempt led to the world's first electrical power station run on steam.

Today geothermal electric generating plants in 15 countries produce about 3,770 megawatts of electricity and that total is expected to almost double by 1983.

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.



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: 84 l/week

16 + 4 + 11 + (77 ÷ 7) + (84 ÷ 7) = 54

54 ÷ 6 = 9 l/day per capita

(NOTE: If the students have not experienced the concept of "per capita" before, this lesson provides a good opportunity to introduce it.)

If the family had to carry its water from the town well, how many trips per week would be necessary, using two 20 litre buckets per trip?

(54 X 7) ÷ 40 = 9.45 = 10 trips/week

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

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 = $16.48	$25.35 X 1.09 = $27.63
$16.48 X 1.09 = $17.96	$27.63 X 1.09 = $30.12
$17.96 X 1.09 = $19.58	$30.12 X 1.09 = $32.83
$19.58 X 1.09 = $21.34	$32.83 X 1.09 = $35.78
$21.34 X 1.09 = $23.26	$35.78 X 1.09 = $39.00
$23.26 X 1.09 = $25.35	$39.00 X 1.09 = $42.51

How much more interest would the pioneers pay in a year if they were charged 9% compound interest/month rather than 9% simple interest/month?

$42.51 − $31.44 = $11.07

***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.*

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 specific 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, Wasington, DC, 20585.

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, Channing 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

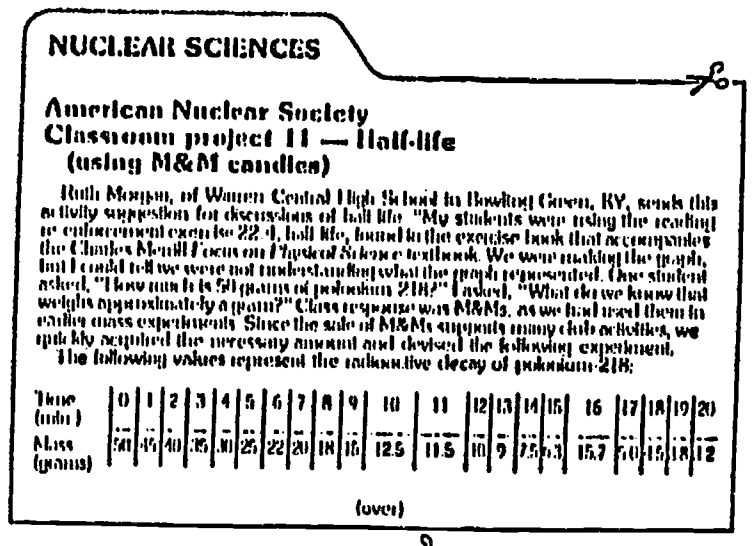
GAS: The American Gas Association (AGA), founded in 1918, represents approximately 300 companies involved in the production, distribution and transportation of natural gas. Their teacher advisory panel includes two representatives from California. A catalog of materials including booklets, films, videos, 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



NUCLEAR SCIENCES

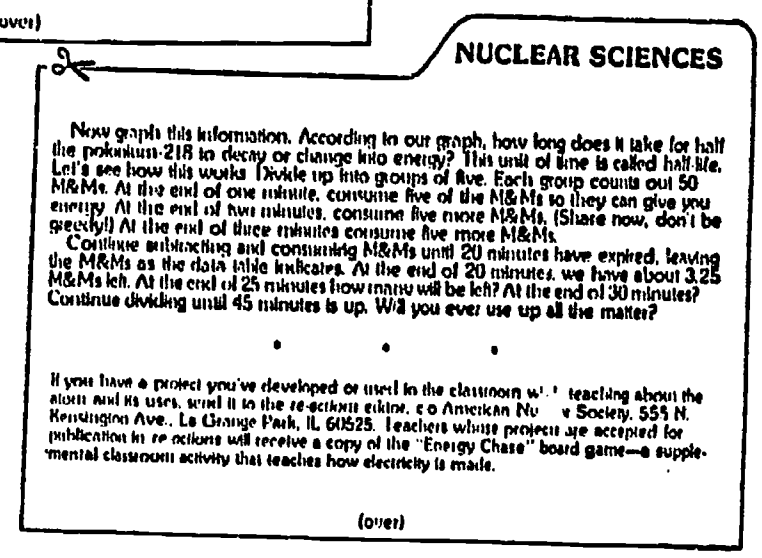
American Nuclear Society
Classroom project 11 — Half-life
(using M&M candies)

Ruth Morgan, of Warren Central High School in Bowling Green, KY, sends this activity suggestion for discussion of half life. "My students were using the reading re-enforcement exercise 22-1, half life, found in the exercise book that accompanies the Charles Merrill Focus on Physical Science textbook. We were making the graph, but I could tell we were not understanding what the graph represented. One student asked, "How much is 50 grams of polonium 218?" Indeed, "What do we know that weighs approximately a gram?" Class response was M&Ms, as we had used them in earlier mass experiments. Since the sale of M&Ms supports many club activities, we quickly acquired the necessary amount and devised the following experiment.

The following values represent the radioactive decay of polonium-218:

Time (min.)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Mass (grams)	50	45	40	35	30	25	22	20	18	16	12.5	11.5	10	9	7.5	6.3	5.7	5.0	4.5	4.0	3.2

(over)



NUCLEAR SCIENCES

Now graph this information. According to our graph, how long does it take for half the polonium-218 to decay or change into energy? This unit of time is called half-life. Let's see how this works. Divide up into groups of five. Each group counts out 50 M&Ms. At the end of one minute, consume five of the M&Ms so they can give you energy. At the end of two minutes, consume five more M&Ms. (Share now, don't be greedy!) At the end of three minutes consume five more M&Ms.

Continue subtracting and consuming M&Ms until 20 minutes have expired, leaving the M&Ms as the data table indicates. At the end of 20 minutes, we have about 3.25 M&Ms left. At the end of 25 minutes how many will be left? At the end of 30 minutes? Continue dividing until 45 minutes is up. Will you ever use up all the matter?

• • •

If you have a project you've developed or used in the classroom w[illegible] teaching about the atom and its uses, send it to the *re-actions* editor, c/o American Nu[illegible]r Society, 555 N. Kensington Ave., La Grange Park, IL 60525. Teachers whose projects are accepted for publication in *re-actions* will receive a copy of the "Energy Chase" board game—a supplemental classroom activity that teaches how electricity is made.

(over)

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) 424-0654.

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.