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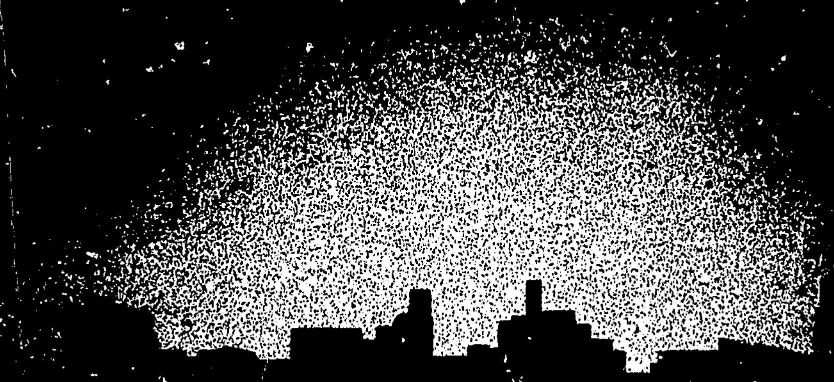
ABSTRACT

This handbook provides public school teachers and administrators of Oregon with teaching ideas and information about the energy crisis. Suggested activities are intended to inform students (kindergarten through community college) about their responsibility toward the energy crisis and to motivate energy conservation. The handbook is divided into four sections. Section I gives background information on the energy crisis, with emphasis on energy in the Pacific Northwest. Sample lesson plans in energy conservation are outlined in Section II. Most plans are interdisciplinary with emphasis on math, science, and social studies. Sections III and IV suggest all-school activities and home activities for energy conservation. A resource list of energy crisis speakers in Oregon is provided, as well as checklists for energy conservation in homes and school buildings. A glossary of terms and a reference reading list are included in the appendices. (Author/RM)



ENERGY CRISIS

ENERGY CRISIS teaching resources

OREGON BOARD OF EDUCATION
942 LANCASTER DRIVE, NE
SALEM, OREGON 97310
DALE PARNELL
SUPERINTENDENT OF PUBLIC INSTRUCTION

A special publication suggesting school activities which stress individual responsibility towards energy crisis problems

ENERGY CRISIS WEEK, DECEMBER 3-7, 1973

Prepared by:

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TOM McCALL
GOVERNOR

OFFICE OF THE GOVERNOR
STATE CAPITOL
SALEM 97310

October 26, 1973

PROCLAMATION

Immediate and long-range shortages of energy resources threaten the health, safety and well-being of all Oregonians. Considerable reductions have been made in consumption of energy by government and business, but avoidance of massive blackouts will require major energy conservation efforts by individual citizens as well.

Most Oregonians already have perceived the need for individual effort in this crisis, but many are not yet aware of the ways in which this may be achieved.

Therefore, the Governor and the State Superintendent of Public Instruction hereby designate the period of December 3 through 7, 1973, as "Energy Crisis Week" in Oregon. The purpose of this designation is to remind all citizens of Oregon that maximum effort must be made to avoid waste of energy resources, whether electricity, gasoline or fuel oil.

Together we have directed appropriate agencies under our administration to disseminate information in such manner as is best suited to accomplish this end, including information on less obvious means by which individual citizens may conserve energy resources to bring this State through a period when these resources will be subject to high demand.

All schools are therefore urged to join in disseminating information to students and to the community generally. We are designating Friday, December 7, 1973, as a day to be set aside for offering intensive instruction of students and others in the community, looking toward implementation of the purposes of this proclamation. All private educational institutions in the State are requested to join in this effort.

Tom McCall
Governor

Dale Parnell
State Superintendent of Public Instruction

INTRODUCTION

THE ENERGY CRISIS—IMMEDIATE AND ENDURING

The "energy crisis" is not a phony campaign; its case is established by the following startling facts:

- Oregon depends on hydroelectric dams for 80-90 percent of its electrical energy.
- During 1973, a very dry winter, spring and summer limited the water resources behind the dams to the lowest level since 1944, one of the five lowest in 95 years.
- As of October 1, the actual reservoir storage in the Pacific Northwest was 27 billion kilowatt hours, 14 billion kilowatt hours below normal capacity.
- During the next few months, Northwest citizens must save the equivalent of the winter season's output of three Bonneville Dams in order to avoid mandatory energy curtailments.

Public schools, as the most comprehensive educational resource in the state, are being asked to inform students about their responsibility toward the energy crisis. Unless an extensive effort is made to motivate energy conservation during the peak energy demands of winter, the predicted state of emergency will undoubtedly occur.

The purpose of this publication is to provide public school teachers and administrators with teaching ideas and information about the immediate energy crisis. We cannot presume that an immediate solution will provide unlimited energy resources for the future. The following information suggests that energy conservation should be an important part of school curriculum *for years to come*:

- American demand for energy has doubled, on the average, every 20-25 years, over the past century.
- More than one-third of the world's energy is consumed by the six percent of the world's population residing in the United States.
- Known and estimated reserves of U.S. petroleum will last for about 10 years at the current rate of use; U.S. reserves of natural gas, about 40 years.
- The Columbia River system will reach its maximum generation capacity with the addition of 30 percent more generation facilities.

The world's supply of energy-producing natural resources is limited. Because most forms of energy are not visible, many people operate under the false assumption that unseen forces of energy will be available forever. The predicted depletion of energy resources will have a serious impact on our present life-style. American consumer studies show a staggering rate of increase in energy consumption for the production of unnecessary consumer goods, and for inefficient forms of transportation.

Because this publication has been prepared on short notice, it cannot provide comprehensive information about the larger and more enduring question of man's future energy resources. We hope that study of the immediate energy crisis will point to the need for a sustained emphasis on the study of energy and man's environment.

ACKNOWLEDGEMENTS

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Cynthia Cambell, Grade 6, Silver Lea Elementary
Julie Gould, Grade 6, Spring Creek Elementary
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Penny Short, Grade 6, Adams Elementary

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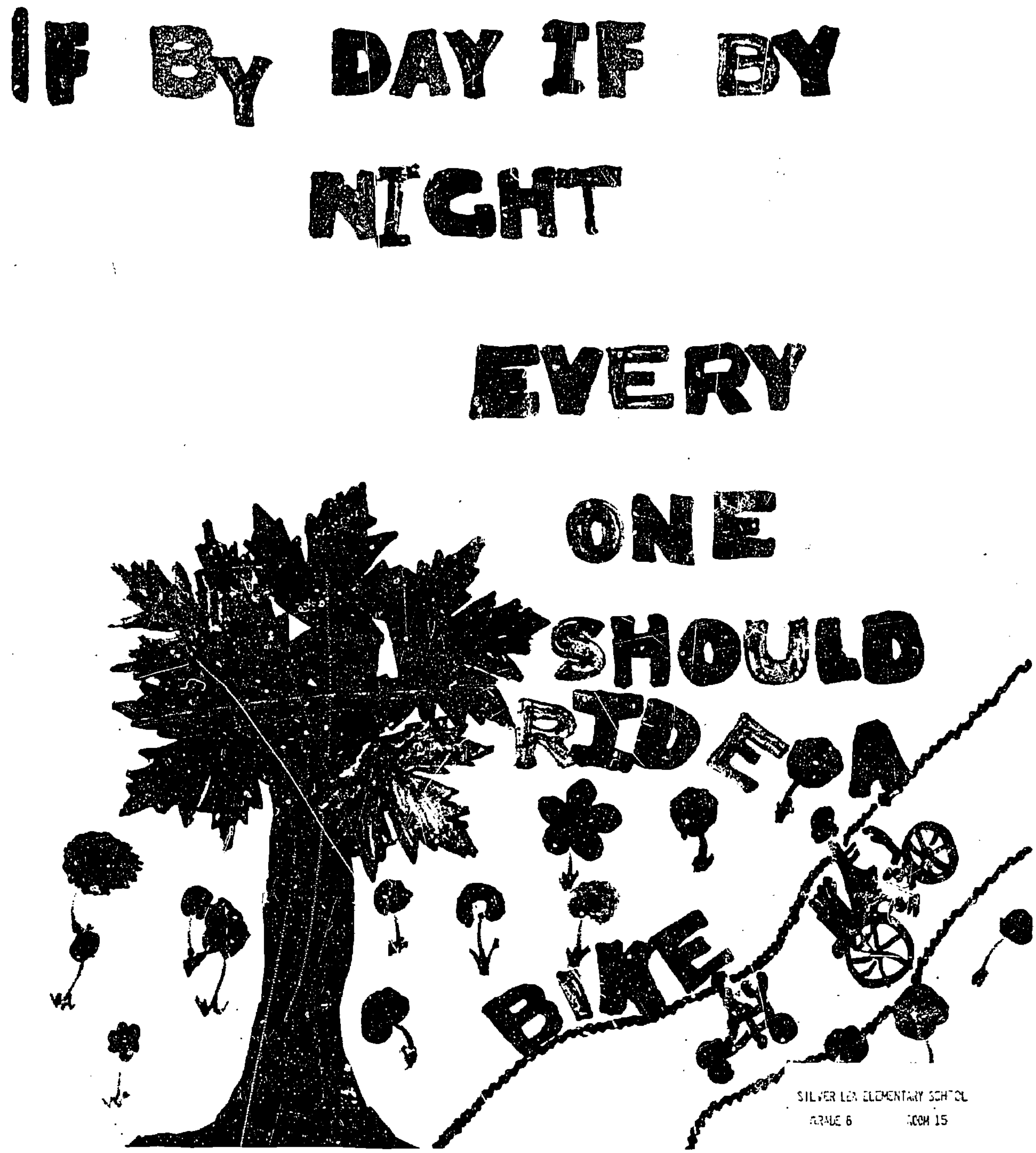
SECTION I

ENERGY CRISIS
INFORMATION FOR TEACHERS



suggestions for the use of section I

Principals:

- Hold an in-service meeting. Use the information in this section as a basis for a discussion relating the energy crisis to school curriculum. Invite qualified staff members to contribute additional information.

- Reproduce enough copies of this section so that every teacher may have an opportunity to read it, especially the graphs, charts and discussion lists which might be valuable for classroom use.

Teachers:

- The information and related concepts in this section will be valuable knowledge for every Oregon citizen in the coming months. Read this section yourself. Then do your best to transfer concepts and information into the daily lesson plans of your specific subject area.

- Reproduce graphs, charts, and fact sheets if they will be of assistance to you in class discussions. Assign students with the responsibility of watching newsapers and periodicals for additional and current information.

- Contact the Governor's Office on Energy Conservation and Allocation (1-800-452-0340, a toll-free number) for facts and/or information that you can use in the classroom. This office plans to issue weekly bulletins on the current status of the energy crisis in Oregon.

- Please send any additional information and/or suggestions for later editions of a teacher's conservation handbook to: Energy Conservation, Emergency Services, State Department of Education, Salem, Oregon 97310.

THE IMMEDIATE CRISIS—ELECTRICITY SUPPLY

Sources of Electric Energy in the Pacific Northwest. The Pacific Northwest has historically depended upon its wealth of falling water resources to supply most of its electrical energy requirements. These resources have been developed over the years by privately and publicly owned utilities and by the federal government.

The Columbia River system will reach its maximum electricity generating capacity when 30 percent more generation facilities are added. Most hydroelectric sites have been fully developed; exceptions are based largely on environmental factors. It is possible to increase the generating capacity of existing plants for "peak" load hours, but this would not produce a significant increase in total energy output.

Because of limited water resources, the trend in the Northwest region is toward the development of thermal plants to supply electricity. Thermal plants can be generated by fossil fuels (coal, petroleum, natural gas), nuclear power, or by heat energy from hot water and steam beneath the earth's surface (called geothermal plants). These new resources are considerably more expensive to operate than hydroplants. Additional advantages of dam construction, such as improved water transportation and irrigation, contribute to the economic efficiency of hydroelectric plants.

At present, the Pacific Northwest relies on hydroelectric plants for 82 percent of its electrical energy, on fossil fuel plants for 12 percent of its energy; on nuclear sources for three percent, and on imported energy for the remaining three percent of electrical energy (see Chart I).

The Electrical Energy Shortage in the Pacific Northwest. The current crisis is caused by a record drought in this area during the past winter, spring and summer. Water levels are approximately 14 billion kilowatt hours short of generating the normal amount of electricity we use. Given the present water storage levels and the projected demand for electrical energy this winter, reservoirs might be completely empty by late February 1973 (see Chart II).

Rainfall during the past month has resulted in the first increase in hydroenergy resources for several months. A continuation of this favorable trend will depend on further precipitation and temperature levels during November and December. It is very likely that most winter precipitation will be held in the mountains in the form of ice and snowpack.

The lack of water to generate electricity has placed heavier demands on a few thermal plants in the Pacific Northwest. Due to the nationwide shortage of both heavy and light fuel oil, energy production from these plants has been limited by approximately 500,000 kilowatts.

The shortage of hydroelectric power has a snowballing effect on the availability of other resources. Natural gas and petroleum, already limited resources, become even less available as they are used to substitute for hydroelectricity.

Facts for Discussion: Electrical Energy Supply and Demand in the Pacific Northwest.

- The Columbia River System produces approximately one-third of the hydroelectric power in the U.S., and over four-fifths of the total electric power used in the Northwest.
- The amount of water available behind dams to generate electricity at a given time is dependent upon rainfall, snowpack and temperature. Snowfall last year throughout the Columbia Basin averaged about 70 percent of the normal rate.
- The lowest wintertime streamflow (September - March) which has occurred in the history of the Columbia River Basin was measured in 1936-37. The 1973 streamflows were well below this level at the end of August.
- The probability of not meeting demands for electrical power this winter, using all available generating resources and based on 40 years of historical records, is about 15 to 20 percent.
- Estimates predict that the area will be about 4.3 *million* kilowatt hours short of meeting area firm loads (guaranteed contracts) during March 1974, and 4.5 *billion* kilowatt hours short through June 30, 1974.
- Hydroelectric generation on the Columbia River system is approximately 80 percent efficient as a means of electricity production. This high rate of efficiency is due to re-use of the same water through a series of dams.
- Thermal powered electric plants achieve approximately 30 percent efficiency. Two-thirds of the energy of coal, oil or

nuclear radiation is lost in the form of waste heat.

- Utilities and government agencies are currently planning to construct coal-fired and nuclear plants to supply additional energy through 1983. It takes about ten years to complete a large generating plant, which emphasizes the need for long-range planning.

- Geothermal energy (heat energy from underground springs and wells) potential in Oregon is estimated at the equivalent of 20,000 megawatts of power production. This source is presently untapped although 18 counties have known geothermal resources.

- Research is being conducted into future possibilities for electricity supply through solar and geothermal energy, wind power, breeder reactors, oil shale, coal liquification and using the unlimited deuterium hydrogen resource of the sea through nuclear fission.

The Statewide Effort to Meet the Energy Crisis. Public and private utilities, government agencies, concerned citizen groups and the news media have been actively initiating action to bring about energy conservation. Appeals have been directed to the three main uses of electrical energy–industrial (50.3 percent), residential (31.4 percent), and commercial (13.8 percent) (see Chart III).

Public and private utilities serve some customers on interruptible rates. Since April, service to industries on interruptible operations has been curtailed from 1,140 to 220 megawatts. As a result of this lack of power, industries directly served by the Bonneville Power Administration are employing about 1,070 fewer workers than they would if power were available.

Utilities and agencies have also been going outside the region–and to other non-utility sources–to purchase power. About 4.7 billion kilowatt hours has been imported, principally from British Columbia Hydro, since October 1, 1972. Northwest industries and California utilities are arranging contracts whereby the industries agree to supply oil to the utilities in exchange for energy.

Representatives of the utilities and government agencies agree that the most important effort being made in energy conservation is the public information program. This is a coordinated effort to encourage voluntary energy conservation in industrial, commerical and residential use of electricity. Special instructions about residential and industrial methods of conservation and suggestions for school activities related to this effort, appear in Sections III and IV of this report.

Government agencies have many programs in operation to help alleviate the energy crisis. Governor McCall began by declaring a state of emergency; by directing all state agencies to reduce their use of electricity, gas and oil; and by requesting individual residents to cut down their energy consumption. The Governor has also issued an executive order to curtail the use of electrical advertising and display signs. In addition, the Governor's newly established Governor's Office of Energy Conservation and Allocation is working to supply information to the public, the media and state agencies concerning immediate energy problems and proposals for their solution.

The Legislature, through Senate Bill 424, has provided for a nine-member Oregon Energy Council assigned to the development of immediate and long-range policies regarding the energy crisis.

So far, the effort to conserve energy on a voluntary basis has proved fruitful. A report for the Pacific Northwest Energy Shortage Region (Washington, Oregon, parts of Idaho, Montana and California) stated that weekly power loads were about 7.8 percent below the forecast load requirement during October. Approximately 5-6 percent of the underrun is attributed to voluntary conservation by consumers of electricity.

Action Priorities for the Energy Crisis. What will happen if preventive conservation measures are not sufficient? Extremely cold weather, mechanical failures in the energy supply system and shortages of gas and fuel oil may continue to create an excessive drain on limited water storage. While the Governor's Energy Council is currently studying emergency priorities, certain predictions can be made about the steps he would take in an emergency situation.

By Executive Order or an order of the Public Utilities Commissioner, it may become necessary for the state government to curtail energy consumption by placing limitations on shopping hours, speed limits, working hours (to use maximum daylight potential), and recreational activities. If such measures are not adequate, limitations may be set on electrical use in private residences and industries serving unessential needs. At this point, with jobs shut down and home electricity restricted, economic and physical hardship would cause major disruptions for Oregonians.

The event of an extreme emergency might call for the determination of services essential for survival (food supply, hospitals, fire and police departments). While energy will be maintained for these vital services, the distribution of electrical energy to other segments will be shut down. This condition is commonly referred to as a "brown-out."

If the shortage of electricity necessitates mandatory (rather then voluntary) energy conservation, the service priorities established by the government and utilities agencies will have a direct bearing on every Oregon citizen. The Special Programs Division of the Executive Department is currently developing a computerized policy guidance information system; this system will analyze the social, economic and environmental ramifications of proposed policies.

An Energy Based Classification System,* based on inter-disciplinary language of energetics and allowing for system analysis according to all energy flows involved, has been designed for use in the policy guidance system. The energy-based information system has already been used to determine energy use in Oregon according to fifteen basic human need categories (food, shelter, clothing, communication, etc.). This system will allow for a complex analysis of the repercussions of policies related to energy supply.

Questions for Discussion: Priorities for Electricity Supply in an Extreme Energy Crisis. If energy rationing becomes necessary, should allocation schemes treat the various sectors of society equally?

- Should energy rations to homes take into consideration the number of residents, age, state of health, etc.?
- Should the same priorities exist for customers of fuel oil, electricity and propane?
- Should energy rations to industry take into consideration the end use of the product (diapers, fur coats, records, etc.)?

Prepared for the Executive Department by interns Berliner, Bennett and Roose of the Western Interstate Commission for Higher Education

- Should energy rations which result in job closure provide alternate means of support? Is this possible in our present system?

What are the issues which should be considered when determining energy priorities in extreme emergency?

- Is physical safety more important than employment?
- Are clothing processes more or less important than communication processes?
- Are educational institutions more or less important than commercial and/or industrial institutions?
- How important is living space compared to working space?

How should emergency services and vital needs be defined? (Use Chart IV in connection with the following questions.)

- What are the most important categories of human need (spiritual activities, materials, etc.)?
- What are the critical functions within each human need category (what foods are essential, what clothing, etc.)?

THE ENDURING ENERGY CRISIS–DIMINISHING SUPPLY OF ENERGY RESOURCES*

World Supply of Energy. Energy is defined as the capacity for doing work. It can't be reused and it is required for every natural and mechanical process, from growing plants to building space ships. The cost of something can be reckoned by how much energy is required to create it.

There are two forms of available energy. One is available daily for man's consumption (sun, wind, water flow, etc.). For millions of years, man has supported his existence through consumption of this kind of energy.

The other source of energy is stored over long

*Information in this section comes from "Our Basic Energy Dilemma," a public address by Robert Davis (Executive Department, Special Programs, State of Oregon. 10, '73), and ENERGY AND MAN'S ENVIRONMENT an Activity Guide edited by Thomas F. Ris (Washington State Department of Education, 1973).

periods of time (fuel oil, natural gas, coal, etc.). During the past hundred years, especially since the industrial and technological revolutions, civilized cultures have come to rely most heavily on stored energy to support their existence.

Since 1945, consumption of stored energy resources has tripled in the United States (see Graph V). The situation can be summarized through the use of a simple analogy. As energy demands have grown with an increasingly mechanized society, man has found his daily "energy paycheck" (income of energy) inadequate to supply his energy needs and is currently exhausting his "energy savings account" (stored energy) to meet these demands.

World Supply of Raw Materials. Unlike energy, which can only be used once, physical materials can be used over and over. The value of physical objects may be determined by how useful they are *and for how long they last.*

World supplies of raw materials are also available in two forms: those which are renewable such as oxygen, trees, and animals; and those which are fixed in quantity and nonrenewable such as tin, lead and copper.

Although many nonrenewable resources are disappearing at rapidly accelerating rates, mankind continues to consume them. The materials are used once and discarded when their usefulness is seen to be ended. Our daily lives and the city dumps are full of examples of this inefficiency—newspapers, bottles, tin cans, old clothes and discarded furniture, lamps, appliances, etc. Between 1946 and 1968 in the U.S., each person's consumption of plastic materials increased by 1,024 percent (see Chart VI).

The fundamental flaw in our way of doing business with nature is that we have only looked for a return on investment in monetary terms. Our basic justification for using nonrenewable resources has been our *apparent* increased prosperity. When mankind discovers that he has used up the raw materials and energy resources in the world's bank, he will be bankrupt with the natural world and with his economic system as well. What good are two cars in the garage if there is no gas to run them?

As fossil fuels and nonrenewable materials become increasingly scarce, and the demand for both continues to grow, the economic principle of supply and demand drives an inflationary spiral until the basic flaw in our thinking and behavior is corrected; we must use our energy and material resources to produce stable energy income processes and to promote recycling of our nonrenewable resources—in order to receive a return on our energy investments. Any other course of action will continue to undermine the physical foundation of our way of life.

Facts and Related Issues for Discussion: Diminishing Supply of Energy Resources.

- *Limited Energy Resources.* Energy producing resources are being used at an ever-increasing rate by affluent societies. Natural gas reserves in the U.S. are expected to be exhausted in about 40 years; the world's petroleum should last for 30-40 years; and the world's coal for 500 years or more. Environmental considerations of air pollution and the destructive effects of mining presently limit our use of coal as a resource.

- *New Sources of Energy.* Scientists working on breeder reactors and solar energy systems predict they may provide an answer to the energy shortage. New energy sources are not presently keeping abreast with demands due to underdeveloped technology, environmental controversy and inadequate funding.

- *Increased Energy Use.* Rapidly expanding consumption of natural resources is particularly significant in North America where one-sixth of the world population consumes one-half of the earth's annual output of natural resources. In the U.S. alone, six percent of the world's population consumes one-third of the world's energy. Consult Chart V for a visual representation of increased energy use in the United States.

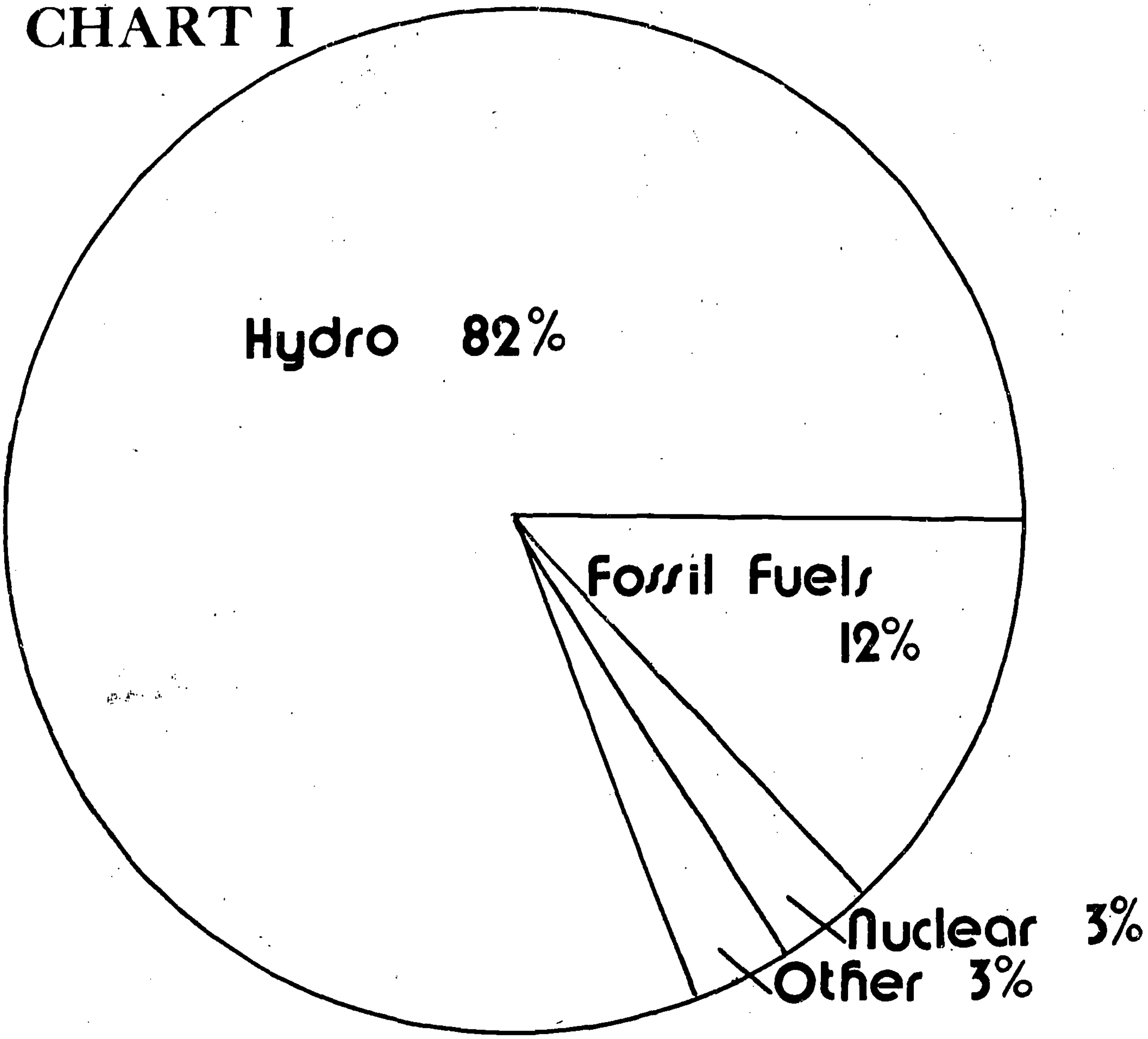
- *Increased Consumption.* Little is being done about what seems to be the most important factor in energy shortages—*the staggering increase in the consumption of nonrenewable resources to make unnecessary consumer goods, and the growing tendency toward inefficient, energy-wasting forms of transportation.* An electric can opener uses very little electricity, but it takes a great deal of energy to produce, as do glass bottles and aluminum cans. Consult Chart VI for related production and consumption statistics.

- *Political Problems.* Experts claim that there are not enough natural resources in the world to support everyone at the same level of affluence. However, the "have not" people of the world aspire to the same standard of living as the more affluent countries. The political ramifications of our dwindling oil supply have been illustrated in the recent Middle-East crisis.

- *Environmental Problems.* The increased production of goods and services has caused environmental problems. Manufacturing creates air and water pollution. Energy powered equipment (like automobiles) accounts for 60 percent of the air pollution problems. Disposal of worn out goods and waste creates litter and solid waste problems which also demand use of energy resources.

- *Population Growth.* The study of population growth in a closed system is a matter of continuing concern. Statistics related to future environmental problems must account for population growth as an additional threat to the conservation of world resources.

CHART I



Northwest Electric Energy Sources

CHART II

STATUS OF PACIFIC NW STORAGE RESERVOIRS as of Oct. 1, 1973

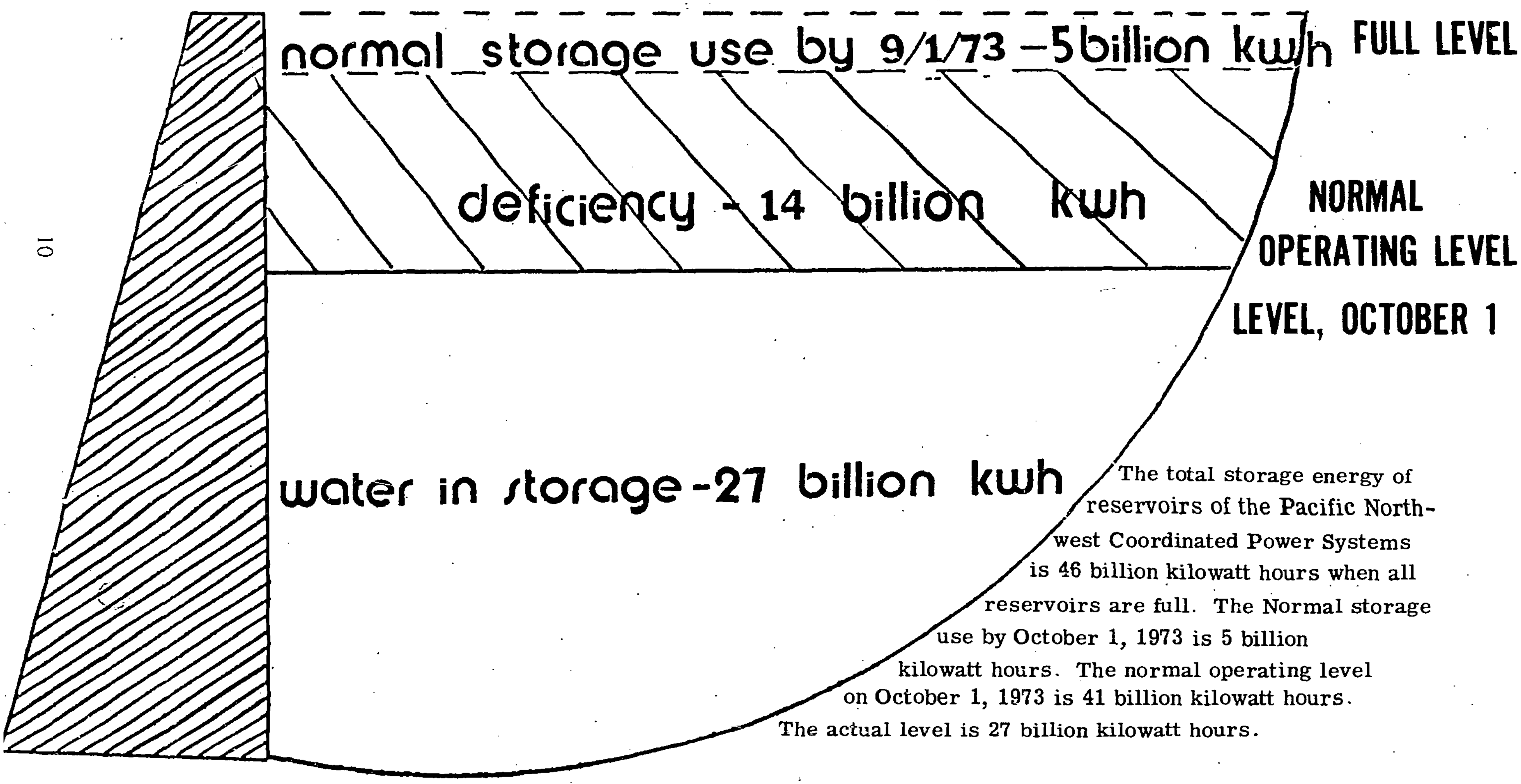
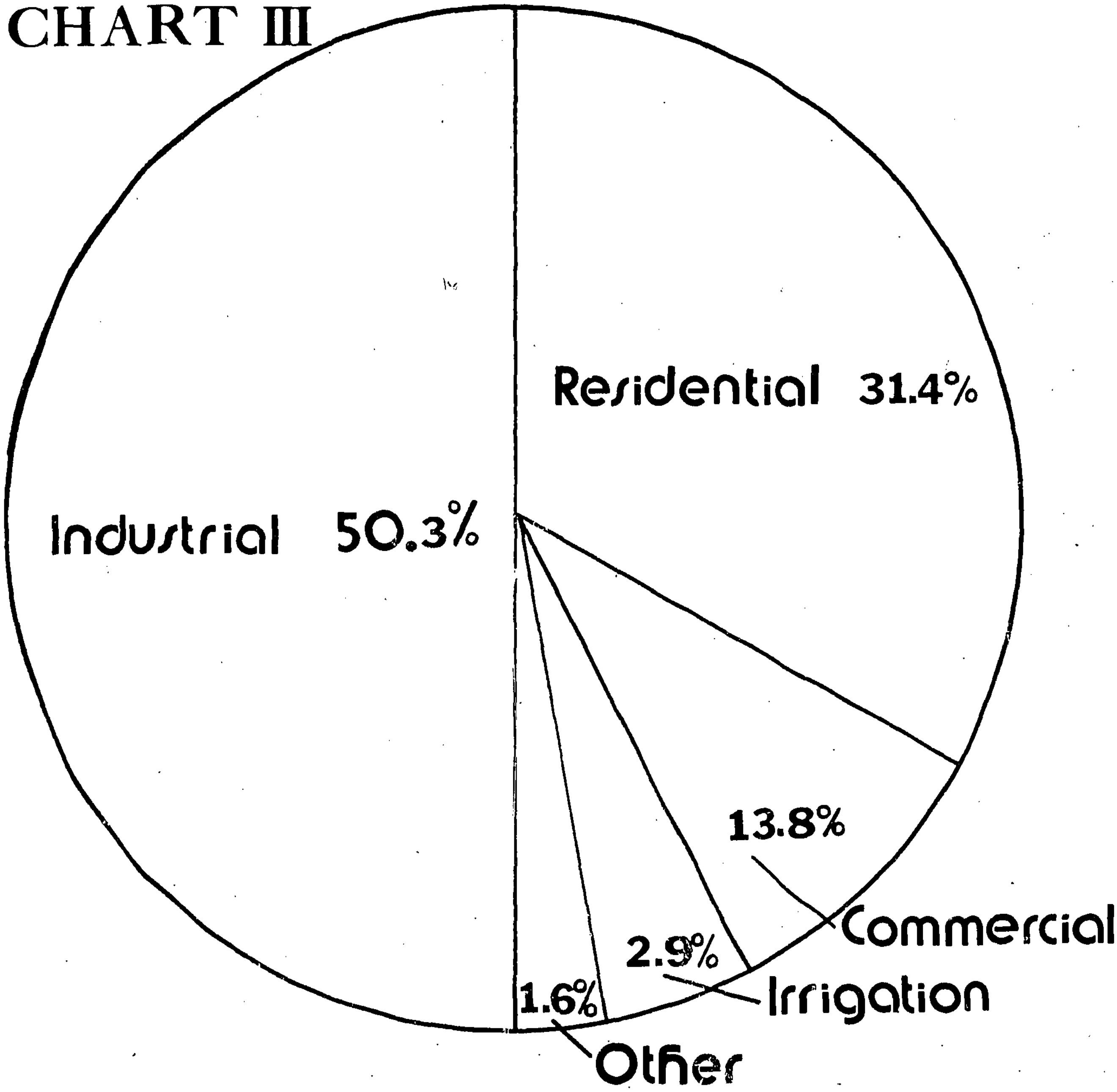


CHART III

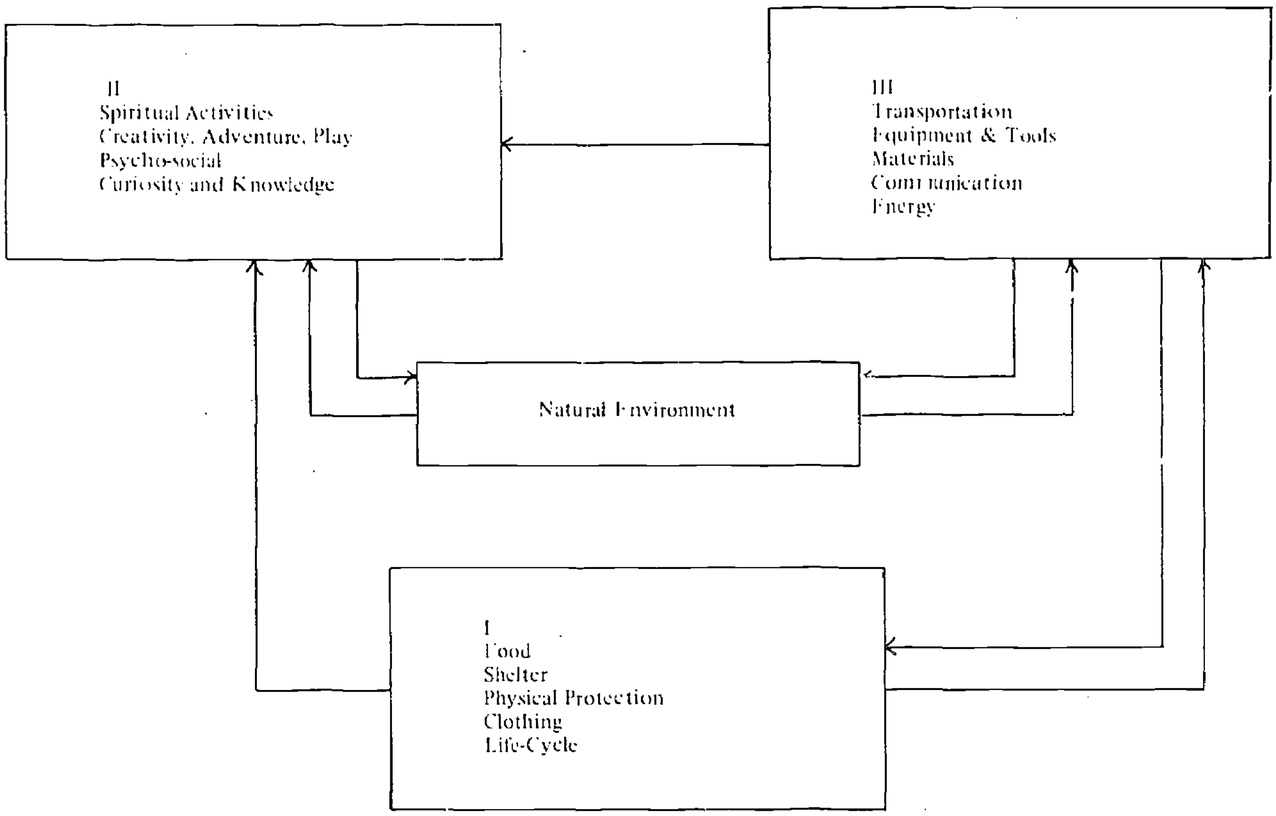


Northwest Uses of Electric Energy

AN ENERGY BASED INFORMATION CLASSIFICATION SYSTEM

The fifteen human need categories defined in *An Energy Based Information Classification System* interact according to the diagram below:

CHART IV



Man interacts with the environment in all his activities. Interaction among other human need categories is also shown. For instance, Group III has output connections symbolizing the use of tools, materials, etc., in the pursuit of other human needs. Group II receives input from the other two major groups, but lacks in significant output. Limited output may exist in Group II, such as the influence of spiritual activities upon food (diet), but such activities are not regarded as primary and are not shown. (See further explanation of these categories on this page.)

AN ENERGY BASED CLASSIFICATION SYSTEM

Food. Dairy, fruits, grain, sugar, bakery, confectionary, meat, vegetables, beverages, miscellaneous (oils and coffee).

Shelter and Physical Comfort. All buildings and their contents, such as houses, apartments, motels, stores, industrial plants, public offices, community centers and bus depots.

Clothing. Outerwear, underwear, footwear, millinery, fur goods and accessories.

Physical Protection. Armies, police forces, fire department and health care.

Life Cycle Processes. Energy support of the human life-death cycle (birth, growth, reproduction, death).

Spiritual Activities. Church attendance, spiritual education, special occasions (weddings, funerals, etc.), and equipment (founts, rosaries, etc.).

Creativity-Adventure-Play. Sports, entertainment, recreational activity, toys and sporting goods, arts and crafts, pets and accessories.

Psycho-Social. Legal and financial services, business groups (Chamber of Commerce, special interest groups, ethnic, consumer, unions, etc.), government, and social service organizations.

Curiosity and Knowledge. Educational processes and institutions, such as schools, libraries, museums and research institutions.

Transportation. Uses of transportation modes (ships, aircraft, motor vehicles, bicycles, etc.) to serve government, commercial, industrial and private parties.

Communication. Electronic (T.V., radio and telephone), written (postal, newspaper, books, periodicals), speech and advertising.

Materials. Primary metals, textiles, electrical equipment, fossil fuels (petroleum and coal), stone clay and glass, leather products, paper and wood products, rubber and plastics, chemical and allied products.

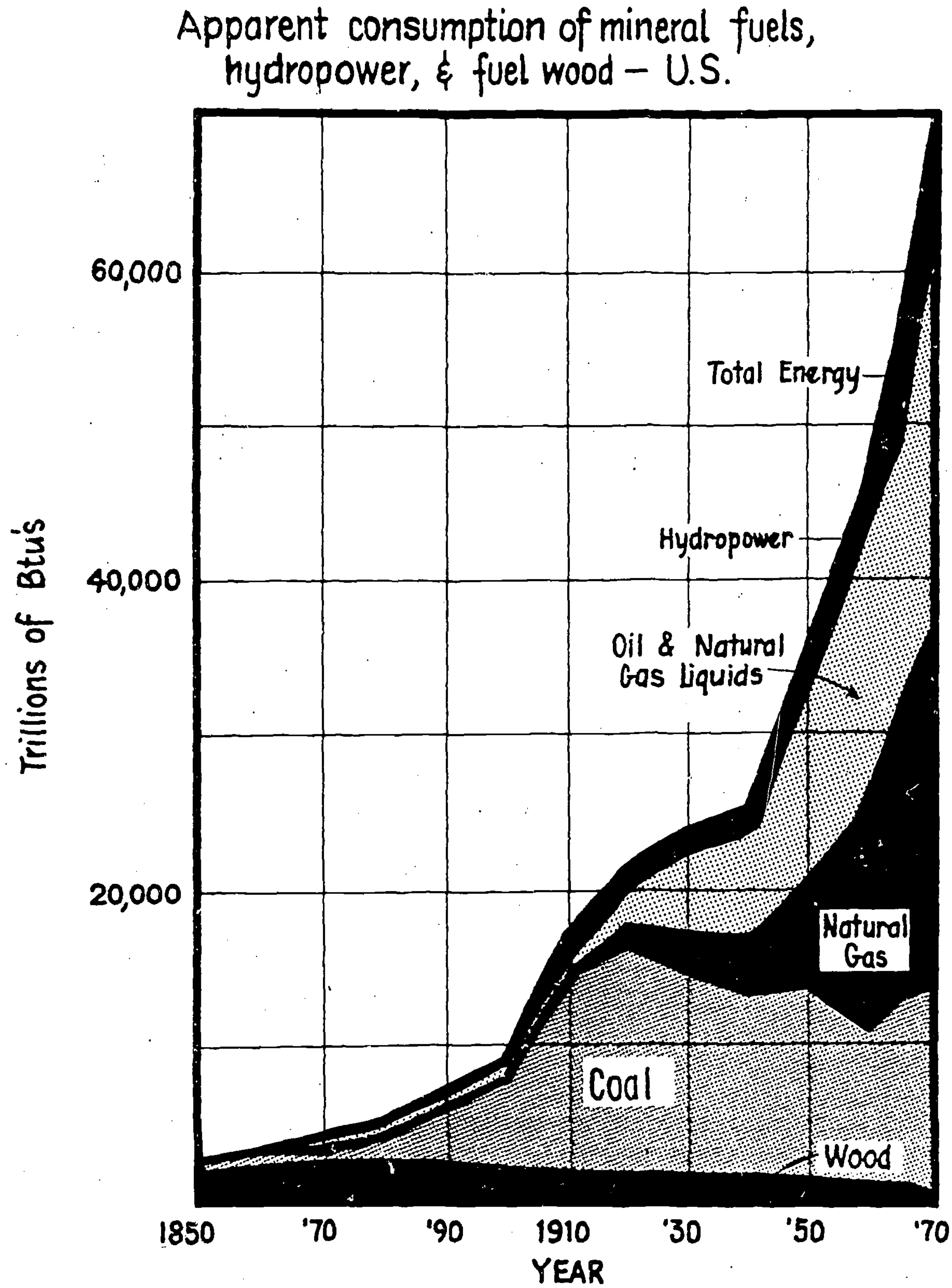
Equipment and Tools. Plumbing, heating and hardware; medical and scientific instruments; engines, office, construction and farm machinery; electrical lighting, wiring, components and test equipment; and artillery (tanks, ammunition and arms).

Energy. Nuclear, hydro, thermal and chemical.

Natural Environment. Land, air, water, minerals and organisms (flora and fauna).

- What kind of system can you establish to limit energy consumption that corresponds with these human need categories?
- What kinds of professional advice (from doctors, lawyers, scientists) might be necessary in establishing a system defining priorities for critical energy needs?

CHART V



The Electric Energy Picture in the Pacific Northwest. U.S. Department of Interior, Bonneville Power Administration, April 1, 1973.

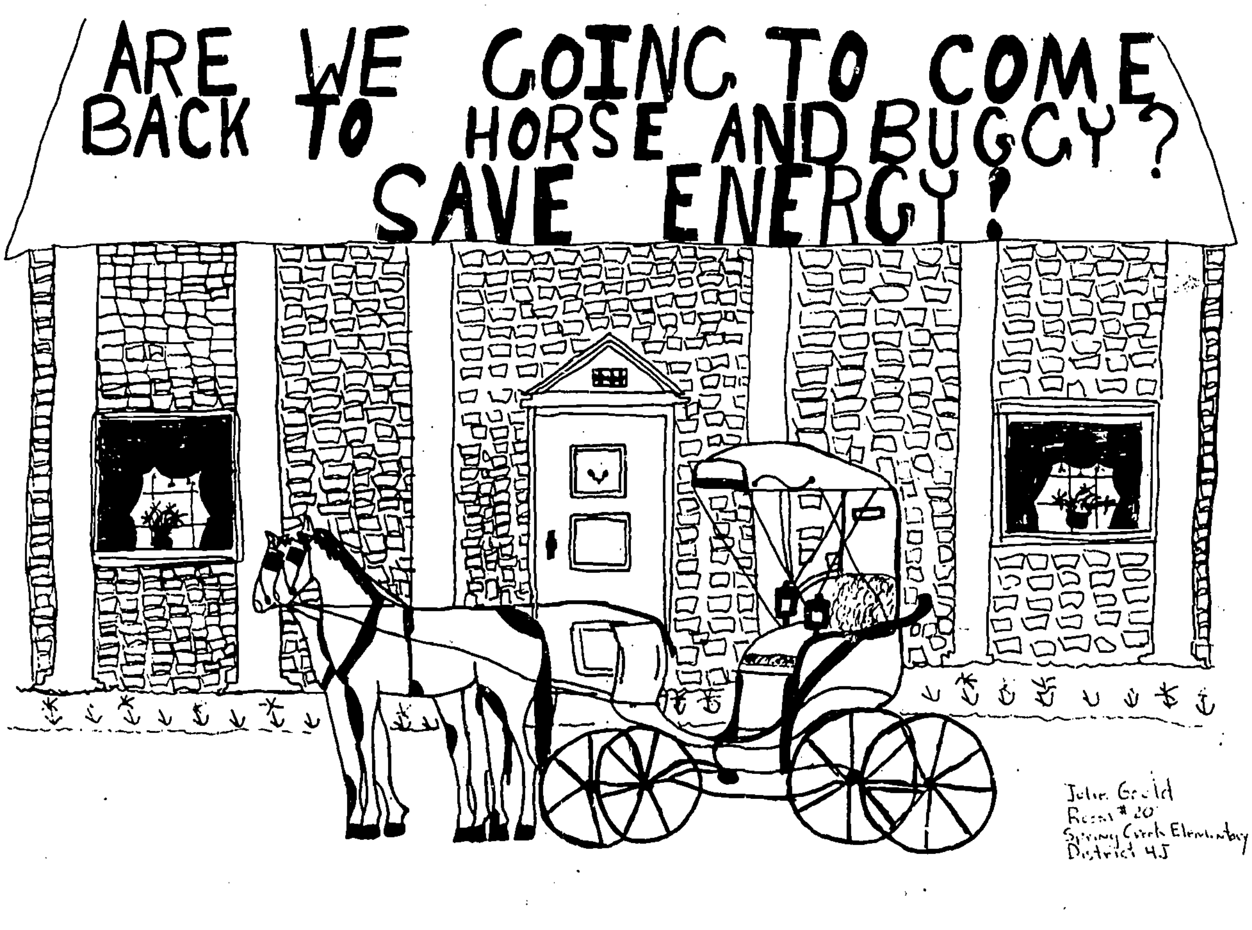
CHART VI

Changes in Production or Consumption Per Capita

Item	Period	%Increase
Nonreturnable beer bottles	1946-69	3,778
Synthetic fiber (consumption)	1950-68	1,792
Plastics	1946-68	1,024
Air-freight -- ton-miles	1950-68	593
Nitrogen fertilizers	1946-68	534
Synthetic organic chemicals	1946-68	495
Chlorine gas	1946-68	410
Aluminum	1946-68	317
Detergents	1952-68	300
Electric power	1946-68	276
Pesticides	1950-68	217
Total horsepower	1950-68	178
Wood pulp	1946-68	152
Motor vehicle registration	1946-68	110
Motor fuel (consumption)	1946-68	100
Cement	1946-68	74
Truck freight -- ton-miles	1950-68	74
Total mercury (consumption)	1946-68	70
Cheese (consumption)	1946-68	58
Poultry (consumption)	1946-68	49
Steel	1946-68	39
Total Freight -- ton-miles	1950-68	28
Total fuel energy (consumption)	1946-68	25
Newspaper advertisement (space)	1950-68	22
Newsprint (consumption)	1950-68	19
Meat (consumption)	1946-68	19
New copper	1946-68	15
Newspaper news (space)	1950-68	10
All fibers (consumption)	1950-68	6
Beer (consumption)	1950-68	4
Fish (consumption)	1946-68	0
Hosiery	1946-68	-1
Returnable pop bottles	1946-69	-4
Calorie (consumption)	1946-68	-4
Protein (consumption)	1946-68	-5
Cellulosic synthetic fiber (consumption)	1950-68	-5
Railroad freight -- ton-miles	1950-68	-7
Shoes	1946-68	-15
Egg (consumption)	1946-68	-15
Grain (consumption)	1946-68	-22
Lumber	1946-68	-23
Cotton fiber (consumption)	1950-68	-33
Milk and cream (consumption)	1946-68	-34
Butter (consumption)	1946-68	-47
Railroad horsepower	1950-68	-60
Wool fiber (consumption)	1950-68	-61
Returnable beer bottles	1946-69	-64
Work animal horsepower	1950-66	-84

SECTION II

CLASSROOM IDEAS FOR ENERGY CRISIS WEEK



suggestions for the use of section II

Principals:

- Materials in this section will be most useful for teachers to have in the classroom. Survey the content of this section. Then make copies of lesson plans, etc., for distribution to teachers whose subject area corresponds with the general topic of the sample lesson plan.

- The suggestions for teaching activities might provide good planning and discussion material in department and/or faculty meetings. Again, it might be helpful to distribute as many copies as possible.

NOTE: Do not limit your distribution plan to the curricular areas and age levels noted on each plan. While they indicate possibilities for use of the material, most lessons are easily adaptable to other age levels.

Teachers:

- Lesson plans in this section may provide some beginning suggestions for units of study in energy conservation. Use these plans as a springboard for your own ideas and approach to the subject.

- Use the suggestions as a basis for discussion with teachers and students about a curriculum design for energy conservation which will suit the needs of your particular area.

- Please contribute any additional ideas and/or lesson plans to our currently growing fund of resources. Send materials to: Energy Conservation, Emergency Services, State Department of Education, Salem, Oregon 97310.

This section is the *beginning* of a collection of sample lesson plans and classroom ideas which stress the immediate conservation of energy. These plans are generally interdisciplinary, with emphasis in the areas of math, science and social studies. Each lesson is suggested for one or more of the following grade clusters: K-3, 4-6, 7-9, 10-12, and C.C. However, *most plans are easily adaptable to levels other than those suggested.*

Classroom Objectives. The lesson plans that follow do not each include stated goals and objectives, with the understanding that, collectively, the following behavioral objectives apply:

- Students personally will carry out those tasks at home, school and throughout the community that will most effectively contribute to voluntary cutback of all energy uses, in order to avoid mandatory curtailments. Performance of these tasks will be motivated by an understanding of the concepts dealt with in the various lesson plans.
- Students will communicate with parents and other community members to help maintain a constant awareness of energy conservation measures.

Related Activities. The lesson plans offered here are accompanied, in most cases, by suggestions for related activities, ways to extend the activities, and lists of additional concepts around which the teacher may develop further lesson plans. These carry with them the following long-range goals:

Today's students will become a generation of environment-conscious citizens, who will:

- understand the global nature of environmental problems.
- understand the complex interdependence of the consumption of raw materials and energies to produce goods and services locally, nationally, and internationally.
- subscribe to life styles that are in harmony with the above understandings.

The classroom ideas in this section are presented in the following order, according to three main categories: 1) Sample Lesson Plans, 2) Community College Activities, and 3) Additional Teaching Suggestions.

meter reading

(Math, Science: adaptable to all levels)

TYPE OF ACTIVITY: METER READING LESSON

Ability to read a kilowatt hour meter is basic to several of the suggested activities in this booklet. Adequate information for teacher background, teaching suggestions and practice and answer sheets are included in the Home Survey portion, Section IV of this book.

RELATED ACTIVITIES:

1. The dial type meters may be integrated into primary math to reinforce grouping concepts.

2. Students may try to figure out why pointers on adjacent dials rotate in opposite directions. Intermediate or older students may attempt to secure an old meter from a local utility company to disassemble.

3. Build a model kilowatt meter out of tagboard, styrofoam, wood, etc. Work out a gearing system so that adjacent dials rotate each other in a ratio of 1:10 (left to right).

insulation

(Social Studies: Gr. K-3, 4-6)

TYPE OF ACTIVITY: EXPLORATION

ENERGY AREA: ALL ENERGIES USED FOR HOME HEATING

MATERIALS NEEDED: SMALL QUANTITIES OF VARIOUS KINDS OF INSULATING MATERIALS DEMONSTRATOR OR MATERIALS TO CONSTRUCT DEMONSTRATOR THERMOMETER

DESCRIPTION OF ACTIVITY:

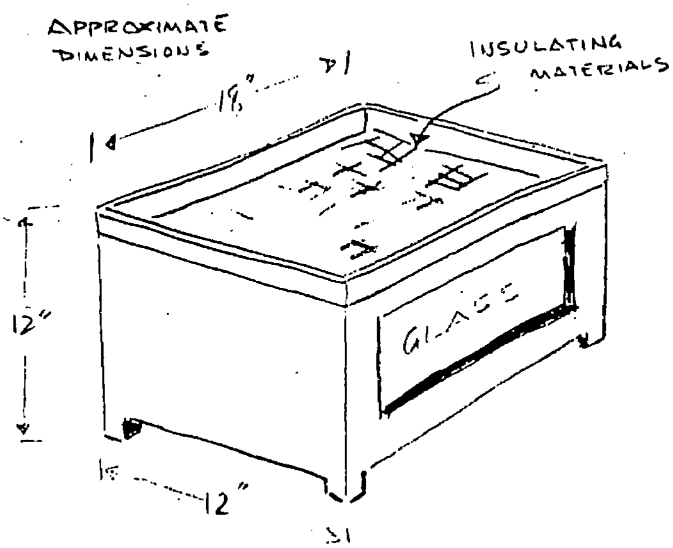
1. Students develop a list, from research or background, of all the insulating factors in the home.

2. Secure or build an insulation demonstrator.

Guidelines for building:

Small and portable (about 12" x 12" x 18").
Heat with light bulb(s).
Provide one or two windows.

Insulating materials



Construct of 1/4" plywood and 1 1/2" framing.
Floor–single thickness plywood with provision for adding insulation.
Walls–Double construction, one piece to be easily detachable to add or change insulation.
Ceiling–Essentially a lid which serves as a shallow tray to hold insulating materials.
Window–Include provision to install "storm" windows (a second pane with air space between the two).

3. Devise as many variations as possible of testing different insulating materials and combinations thereof.

   (Use temperatures both inside and immediately outside the demonstrator.)

4. Assemble a product file on various materials.

5. Tabulate consumer prices on various materials.

6. Compare advantages and disadvantages, including per dollar value, on various materials.

7. Make a class study of the ways in which homes represented are deficient in insulation.

8. Secondary students might be able to use data thus far derived to predict kwh's or B.T.U.'s conserved by correcting various deficiencies found in item 7.

electrically powered toys

(Social Studies: Gr. K-3, 4-6)

TYPE OF ACTIVITY: EXPLORATION

ENERGY AREA: ELECTRICITY

MATERIALS NEEDED: NONE

DESCRIPTION OF ACTIVITY:

1. Students bring to school electrically powered appliances and toys which function solely in recreation or entertainment. Have class discussion to:

   a. Avoid duplications;

   b. Decide whether or not battery-powered items should be included.

2. Students attempt to research for each item such questions as:

   a. How long has this item been on the market?

   b. Was it marketed to fill a need, or did its appearance on the market, along with advertising, create its own need?

   c. If it indeed fills a need, can we think of alternative diversions which require no energy consumption? These may already exist, or could be created by the students.

   d. Explore what the children in colonial days used for recreation. Did they have the same needs for recreation as we have today?

3. Set up a display of the electricity powered items and their nonpowered counterparts.

RELATED ACTIVITY:

By observing at local department and stationery stores, students make a list of games, puzzles, and diversions which are commercially produced versions of activities that can be done (and have been for years) with no materials, or common household items (pencil and paper, a few marbles, toothpicks, etc.). Have students discuss why sale of these items is successful. Older students may be able to relate this to generic principles that underlie attitudes regarding the general American lifestyle—affluence, materialism, status, prestige, etc.

gasoline conservation through car pools

(Interdisciplinary: Gr. K-3, 4-6)

TYPE OF ACTIVITY: EXPLORATION, DISCUSSION

ENERGY AREA: GASOLINE

MATERIALS NEEDED: NONE

DESCRIPTION OF ACTIVITY:

1. Make a survey (through class discussion of family practices or by actual count along a busy street at a rush hour) of vehicles transporting the driver only.

2. Discuss as many ways as the children can think of (bring ideas from home) to reduce "driver only" trips. Examples:

   How many boys in a neighborhood are transported to a scout meeting?

   Could several neighborhood mothers combine their marketing trips?

3. Out of as long a list as you can make, rank the ideas in order of practicality, and devise a plan to actually implement those kinds of car pool ideas which seem most likely to work. Involve parent clubs.

RELATED ACTIVITIES:

1. Have students keep record of the number of times (in one week, one day, etc.) that several trips from home have been made in the family car when, with planning, one trip might have been sufficient. Compile class results.

2. Have students do creative writing relative to gasoline rationing or curtailment. Example:

   "How would life in my family be affected if our gasoline supply were cut in half?"

3. Compute class totals or averages of "unnecessary mileage" before and after conservation plan is implemented. Show comparisons on line or bar graphs.

4. Collect data on gas prices. Determine rate of gas cost increase over a given period of time. Research reasons.

5. Learn to compute miles per gallon.

using fewer watts at home

(Math, Social Studies: Gr. 4-6)

TYPE OF ACTIVITY: EXPLORATION

ENERGY AREA: ELECTRICITY

VOCABULARY: ELECTRICAL APPLIANCE, WATT

MATERIALS NEEDED: NONE

DESCRIPTION OF ACTIVITY:

1. Class makes the longest possible list of electrical appliances found at home and school.

2. Find out how many watts each uses and include this on the list. (This can be discovered by looking on the appliance. If it is not given, parents or teachers may compute the watts by the formula: watts = volts x amps.)

3. Have the class discuss which appliances are used the most. How many of these have high wattage figures?

4. Let the children decide which of the appliances they think their home or school could do without or use less often. The children could discuss this with parents and make curtailment plans.

5. Following a predetermined time period (one day, one week, etc.), have the class make a list of all the appliances their homes have done without or used less often.

RELATED ACTIVITIES:

Average kilowatt hours used before and after the curtailment can be computed and illustrated in line or bar graphs.

energy use-time distribution

(Social Studies: Gr. 4-6, 7-9, 10-12)

TYPE OF ACTIVITY: EXPLORATION, DISCUSSION

ENERGY AREA: ELECTRICITY

MATERIALS NEEDED: RECORD KEEPING SHEETS

SKILLS NEEDED: ELECTRIC METER READING

DESCRIPTION OF ACTIVITY:

Premise: Electrical energy is not "stored," but produced as needed.

1. Through discussion of current life styles, family activity patterns, etc., predict the hours of peak demand.

2. If possible, on weekends or by special assignment arrangements, have several team or individuals read home meters hourly over a given period of time. Compile results as a class. Compare with predictions.

3. Explore ideas to spread some of the demands of the peak hours to periods of lighter demands. Concentrate on ideas that students themselves might implement; i.e., deferring television watching to different hours.

4. Report to class which ideas worked and which seemed impossible.

5. Explore ideas of how entire communities might juggle schedules to even out the electrical demand hours.

researching community cooperation in voluntary energy use curtailment

(Math, Science, Social Studies: Gr. 7-9)

TYPE OF ACTIVITY: EXPLORATION, DISCUSSION

ENERGY AREA: ELECTRICITY

MATERIALS NEEDED: NONE

DESCRIPTION OF ACTIVITY:

1. Assign teams to observe in the community:

   Restaurants
   Grocery Stores
   Gas Stations
   Manufacturing Companies
   Schools
   Public Buildings and Parks
   Homes
   Motels and Hotels

2. Observe the obvious things that have been done to reduce energy; lights, signs, etc.

3. If possible, when they are not too busy, interview some of the managers of these establishments to find out other ways they may have reduced energy use that are not obvious to you as an observer.

4. Have each team assemble a report of their study to present to the class.

RELATED ACTIVITIES:

1. Does it appear that most businesses and homes in the community are cooperating with the request to conserve energy?

2. Do you feel it is important that all areas of the community should be asked to cooperate to conserve? Why?

3. Did you observe or think of any more ways that energy could be conserved without seriously affecting that business or home?

reducing home kilowatt hours

(Math, Social Studies: 7-9, 10-12)

TYPE OF ACTIVITY: EXPLORATION, PROBLEM SOLVING

ENERGY AREA: ELECTRICITY

VOCABULARY: WATT, WATT HOUR, KILOWATT HOUR, VOLT, AMPERE, AVERAGE

MATERIALS NEEDED: NONE

DESCRIPTION OF ACTIVITY:

1. Through discussion, students develop a list of all appliances in the home which consume electricity. From this an inventory sheet is published. (An adaptation of the checklist in Section IV of this book may be used, but a student-developed instrument is desirable.) Include all the lighting.

APPLIANCE	WATTAGE	HRS USED PER 24

Each student takes this home and keeps a complete 24 hour record. Compute total KWH's. Determine average per family unit.

2. Class results are compiled into a composite showing totals.

3. Based on discussion with parents, plan priorities for usage.

4. Predict and compute the kwh savings.

5. Attempt to implement the plan for a given period of time (24 hours). Repeat inventory if necessary.

6. Develop graphs, charts, etc., showing the original average per family kwh consumption, the predicted savings, the actual savings, and a projection for a neighborhood or community of a given size.

RELATED ACTIVITIES:

Art department may produce posters illustrating the project and display in store windows, etc.

gasoline conservation through driving habits

(Math, Science: Gr. 7-9, 10-12)

TYPE OF ACTIVITY: EXPLORATION, PROBLEM SOLVING

ENERGY AREA: GASOLINE

MATERIALS NEEDED: DATA SURVEY SHEETS

DESCRIPTION OF ACTIVITY:

1. Use a class survey to gather the following data (use larger samplings if possible).

   a. Average automobile miles driven in one week.

   b. Average miles per gallon of family cars.

   c. Percentage of drivers that use "jack rabbit" starts at traffic signals. (Assign teams to observe and tally at several typical traffic light intersections.)

2. *Automotive Information* (September 1973) states that fast starts can increase gas consumption as much as 18 percent. Using data gathered, compute the amount of gallons of gasoline consumed by the families represented by the class. (Assume that the percentage found in item 1.c. is typical and applies to this group.)

3. Possible Extensions of this Activity:

   a. Find a per family average: compute the savings for the community.

   b. Find the community's annual savings.

   c. Research the accuracy of your averages.

   d. Develop graphs, posters, etc., to dramatize your findings. Display them in windows of local businesses willing to participate.

   e. Similar projects could be done with other known fuel topics; i.e., vehicle operating condition, most efficient driving speeds, vehicle weight as it relates to miles per gallon. (See Driving Hints in Section IV of this book.)

   f. Discussion problems:

      1. A delivery man gets $5 per hour in wages. His truck gets 18 miles per gallon if he drives 50 mph but only 11 miles per gallon if he drives 60 mph. On a 500 mile trip, at which speed should he drive in order to make his trip as economical as possible?

      2. Can a person lose weight by turning down heat in his home? (This might take some research.)

      3. Does it cost more to light one 100 watt bulb or two 50 watt bulbs for the same length of time?

water conservation
(Math, Science: Gr. 7-9, 10-12)

TYPE OF ACTIVITY: EXPLORATION, PROBLEM SOLVING

ENERGY AREA: ELECTRICITY

MATERIALS NEEDED: MAY VARY WITH SELECTED PROJECT

DESCRIPTION OF ACTIVITY:

Premise: Stored water in hydroelectric reservoirs is, in fact, potential electrical energy.

1. With students, develop an idea list of ways in which water is wasted. Include small amounts (such as dripping faucet) as well as larger amounts (operating a dishwasher partially loaded, using more water than necessary for bathing, etc.), or what seems to be municipal or industrial water waste.

2. Divide class into committees; have each select at least one item from the list above.

3. With teacher guidance, each committee devises a formula or technique for computing the amount of waste in gallons per hour or gallons per month. Translate this into a community total. Use your community population (Oregon Blue Book, 1973-74, p. 209) to estimate the number of family units, if this is necessary for your project.

4. Based on the Bonneville Power Administration figures of 6,330 gallons of water to generate one kilowatt hour of electricity through the turbines at Bonneville Dam, translate the water wasted into kilowatt hours.

conserving energy used to heat water
(Math, Physics: Gr. 10-12)

TYPE OF ACTIVITY: PROBLEM SOLVING

ENERGY AREA: ELECTRICITY

MATERIALS NEEDED: NONE

DESCRIPTION OF ACTIVITY:

I know a person that insists that three inches of water in a tub is adequate for bathing, but many people fill the tub to a depth of ten inches. How much electric energy is required to bathe in this luxury?

SOLUTION:

Assume the water is heated from 40° fahrenheit ($\simeq$4.5 C) to 100° F ($\simeq$37.7 C).

NOTE: $(C) = \frac{5}{9}(F - 32)$

Assume also that a tub holding water to a depth of 10 inches contains 189,000 c.c. of water.

NOTE: 1 cubic inch = $(2.54)^3$ cubic centimeters

To compute the watt-hours of electricity use the formula:

$$(\text{watt-hours}) = \frac{4.18(\Delta C)\ V}{3{,}600}$$

$$= \frac{4.18\ (33.2)\ (189{,}000)}{3{,}600}$$

$$= 7{,}285 \text{ watt hours}$$

How long would this amount of energy operate a 50 watt bulb?

energy conservation in home heating

(Social Studies, Science: Gr. 10-12)

TYPE OF ACTIVITY: PROBLEM SOLVING

ENERGY AREA: ANY USED FOR HOME HEATING

MATERIALS NEEDED: NONE

DESCRIPTION OF ACTIVITY:

Compute the difference in the amount of heat required to heat a house to 70° rather than 65° if the average winter temperature in the Willamette Valley is 45°.

The amount of heat required for a given house increases with the square of the difference between the inside and outside temperature. For example, if the temperature outside is 60°, and the inside temperature is 70°, the difference, 70° - 60° = 10°. If the outside temperature drops to 50°, the difference then is d = 70° - 50°, or 20°.

Heat required = K d^2, where K is the constant depending upon the size of the house, how well it's insulated, etc.

Heat required when the temperature is 50° is four times that required when the temperature is 60°, since $20^2 = 400$ or four times $10^2 = 100$.

SOLUTION:

$D_1 = 65° - 45° = 20°$

$D_2 = 72° - 45° = 27°$

The heat required at 65°

$H_1 = K\ 20^2 = 400\ K$

The heat required at 72°

$H_2 = K\ 27^2 = 729\ K$

Therefore, the amount of heat required to heat to 72° is

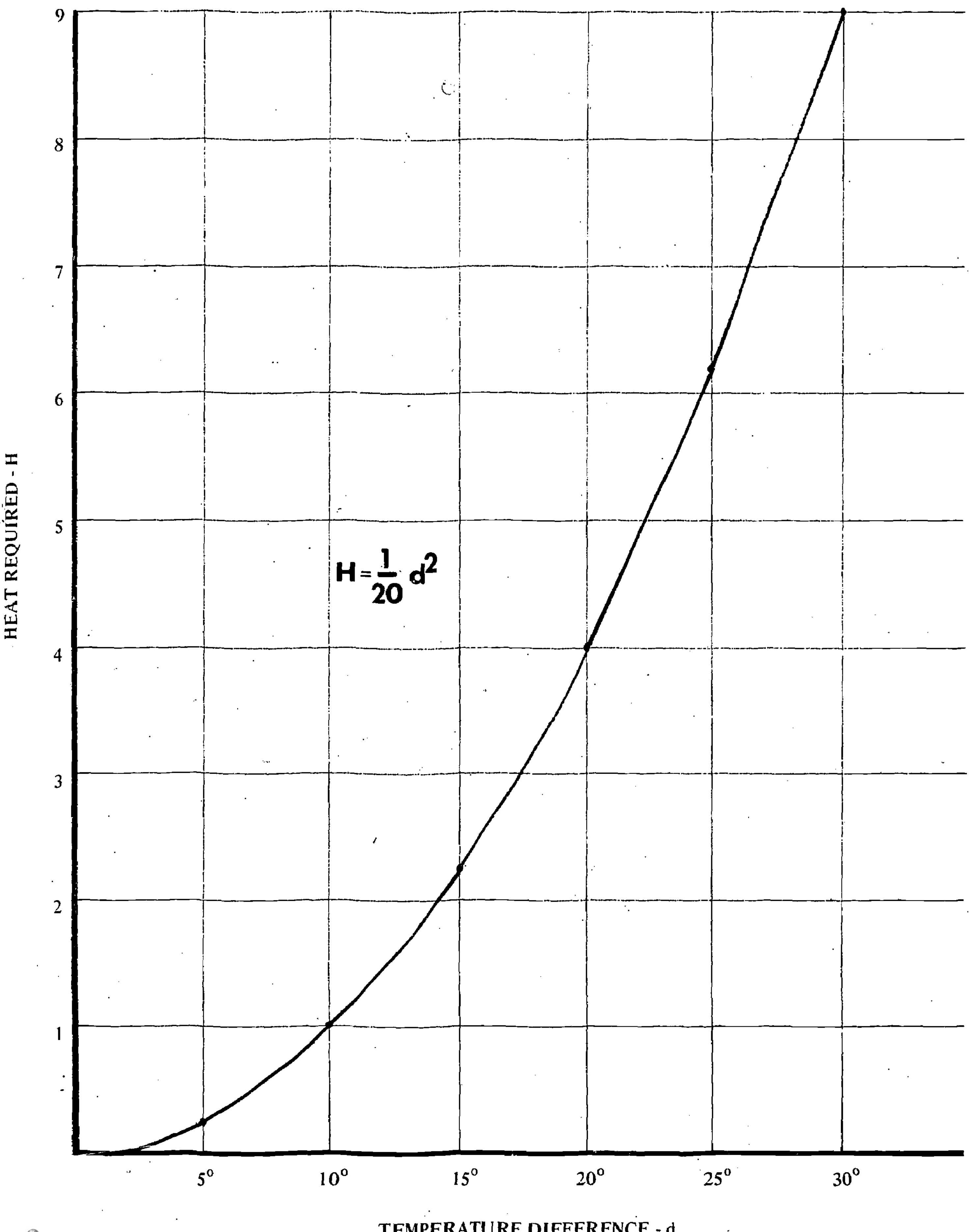
$$\frac{729\ K}{400\ K} = 1.8225$$

1.8225 times that required to heat to 65°, or 82% more.

If H is heat required, d is temperature difference, or inside temperature minus outside temperature

$H = f(d) = Kd^2$ if $K = .05$, graph the function $H = .05\ d^2$

Discuss the significance of this in terms of fuel savings.


HEAT REQUIRED - H
TEMPERATURE DIFFERENCE - d
$H = \frac{1}{20} d^2$
1
2
3
4
5
6
7
8
9
5°
10°
15°
20°
25°
30°

life-style and energy conservation

TYPE OF ACTIVITY: DISCUSSION, RESEARCH

ENERGY AREA: ENERGY AND GOODS CONSUMPTION IN GENERAL

MATERIALS NEEDED: NONE

DESCRIPTION OF ACTIVITY:

Premise: The general long-standing attitude that raw materials and energy sources are inexhaustible have led most Americans to become overconsumers and energy gluttons.

Premise: Psychologists and common sense tell us that there is a close correlation between a pleasant, well-designed environment and a sense of personal well-being.

1. Consider the two premises above. Students may wish to accept, reject or revise either or both.

2. To what extent do they conflict with one another?

   a. Students select (preferably as a group) a man made mini-environment (a classroom, a church, a home, etc.) which they agree is reasonably pleasant and well designed.

   b. Students make as complete as possible an inventory of the manufactured items in the environment selected.

   c. Select a few of these items (such as vinyl, metal or wood trim on a chair, wheel discs or hub caps on automobile, etc.) to consider the following:

      (1) To what extent does it contribute to the pleasantness or good design of the mini-environment?

      (2) Have we been influenced by industry which produces the item to think that it is essential?

      (3) Conduct an energy flow study on the item. Consider the energy required to extract the raw material, transport it, refine it, transport it again, and all other steps leading to the end product.

      (4) Attempt to extrapolate the total B.T.U.'s involved in what might be the total annual consumption of this item.

   d. Consider the elimination or modification of this item in terms of the "pleasant environment" concept.

      (1) Suppose the class agrees the item could and should be eliminated. Could the same rationale apply to many other goods designed to enhance our environment?

      (2) In what ways would this affect the nation's economy, labor market, etc.?

COMMUNITY COLLEGE ACTIVITIES

1. **Research.** Students in technical and vocational courses are encouraged to explore alternative energy sources such as wind generators, solar furnaces, solid waste energy converters, ways of harnessing wave action, tides and geothermal energy. These and other areas are wide-open frontiers.

   a. Students may construct prototypes of energy producing devices utilizing wind and/or solar power.

   b. Methods must be devised to tie such devices into present energy sources.

   c. Prototypes could be displayed and demonstrated in places such as shopping centers, or any place that will attract public attention.

   d. Students may wish to explore the efficiency factors of present energy consuming devices such as the internal combustion engine.

   NOTE: Further information regarding what is being done in this area may be obtained from Mr. Ray Barrett, Educational Director, OMSI, 4015 SW Canyon Road, Portland, Oregon 97221, phone 224-9500.

2. **Service Pool.** Students who have the suitable background, interest and enthusiasm may serve as resource persons:

   a. To elementary and secondary schools in any energy-related curricular area.

   b. To educate private citizens to read their kilowatt hour meters and implement practical voluntary curtailment plans.

   c. To be available on call to perform free services such as lowering hot water thermostat settings.

3. **On Campus Assemblies.** Present programs utilizing students who have specialized in particular areas of energy research, or outside speakers.

additional teaching suggestions

Primary Grades

1. Make a list of all equipment in the schoolroom that is powered by electricity.
2. Ask the custodian to come into the classroom and explain how electricity helps him in his work.
3. Make a science display of items that are powered by electricity for classroom use.
4. Schedule a field trip to the home to look at the ways electrical energy is used there.
5. Ask parents to come to the classroom and discuss how they use electricity in their work.
6. Look at the wattage on light bulbs, read the wattage figures, add the amount used and compare home consumption with classroom consumption.
7. Read power consumption data on appliances. (Consult custodian or local electrician for assistance.)
8. Make a display chart showing how much energy is consumed by each.
9. Make a reading experience chart containing statements about the conservation of energy.
10. Introduce the spelling of words associated with electricity:

    a. watts
    b. volts
    c. bulb
    d. motor
    e. plug
    f. wire

11. Study parents' occupations and determine how a shut down in electrical comsumption would affect each job.
12. Make a bar graph comparing the amount of electricity consumed by one device with another (light bulb, electric mixers, stove or hot plate, popcorn popper).
13. Begin to explore techniques of electrical energy measurement. Watts and volts are new concepts that must be introduced at an unsophisticated level.
14. Ask students to express their views about

conserving electricity in a one-page paper. Provide them with a key word list.

15. Begin to explore the interrelationship of weather and the energy crisis in the Pacific Northwest (i.e., increased snowpack means a greater water supply which will be used to generate electricity). Compare snowfall and rainfall measurements.

16. Develop a vocabulary of terms associated with electricity:

a. energy	e. rain
b. power	f. gauge
c. hydro	g. resistance
d. snow	

17. Let children create projects (paintings, models, etc.) which require a minimum of commercially produced materials (paper, glue, crayons, etc.).

18. Make a display of disposable products (use once and discard) which waste natural resources in terms of raw materials and energy to produce.

Intermediate Grades

1. Ask students to explain why people do not wish to do without those convenience items that consume electricity.

2. Ask students to detail the occupations that provide services which are essential to the survival of a community and how those services consume electrical energy (water pumping stations, sewage treatment plants, scheduling of transportation services).

3. Study the ways electrical energy is produced in the state.

4. Study home consumption of power and determine which appliance is the largest user. Ask your local utility to help the class find out which industry, plant or single consumer is the largest single user of power in the community. Does this user benefit the community?

5. Carry out an essay competition entitled "How Can Energy be Saved in the State of Oregon?"

6. Introduce the formulas for power consumption, transmission, and generation. Some science programs present these formulas at this grade level.

7. Discuss reasons why electrical energy is preferred to other kinds of energy for given jobs (clean, easily transported, easily maintained equipment, etc.).

8. Discuss whether existing sources of energy (particularly electrical) have been utilized intelligently in the state of Oregon. Some sources are not used—why? (i.e., hog fuel—air pollution; coal—too expensive to transport; natural gas—interruptible).

9. Visit some electricity distribution centers. Ask the engineers to explain how electrical energy is distributed. Visit an oil tank storage area, a natural gas control center, etc.

10. Distribute leaflets to homes in the neighborhood, describing the power shortage and indicating ways the children have identified as reasonable methods to conserve power.

11. Ask permission from a local radio station for students to conduct a talk show, featuring ideas on how local citizens could conserve energy.

12. Arrange for students and school administrators to work together to find ways to save energy within the school.

13. Compose short stories or plays around possible results of energy failure, or the energy conservation effort.

14. Write articles, poems, cinquains, haikus, dealing with energy for publication in the school newspaper.

15. Correspond with students in other schools to compare conservation efforts.

16. Collect newspaper and magazine articles on the energy crisis. Use them to discover and graph trends, make bulletin board displays, or for a collage or mobile in an art project.

Junior High Level

1. Study available sources of energy fuels. What is the generation capacity in various areas of the United States, and the per capita earnings for individuals in those areas?

2. Ask each student to investigate one form of energy, its long-term strengths and weaknesses as an energy source and its effect on the local community, state, and nation.

3. Discuss with students why individuals are reluctant to give up their conveniences.

4. Construct models of generating facilities (steam, hydro) and determine their efficiency.

5. Study power transformers, their design, use and long-term effectiveness.

6. Study the relative efficiency of methods used to transport electricity.

7. Produce a chart illustrating the development of a given source of power and its delivery to the consumer.

8. Measure the calories consumed when people exercise. How much food is required to provide a given amount of calories?

9. Explore efficient ways to use foods available locally (i.e., compare foods which must be transported to Oregon in mid-winter to those available locally; does the food value of the imported product justify the fuel consumed in shipping?).

10. Discuss the efficient purchase of those foods which require less energy for production (i.e., human effort, fuel for transport, effort of retailers, etc.).

11. Compare products to find those which most efficiently carry out designated tasks (i.e., a small car may serve two people as well as a large car; a home which is large enough for your family may serve as well as a larger house).

12. Explore effective use of appliances which have been purchased to better the family standard of living.

13. Investigate the effects of available energy supply upon the standard of living in various areas of the United States during the past 40 years.

14. Given a curtailment of energy in the local community, determine which energy consumers should receive first priority. Discuss the criteria used in making these judgments.

15. Study the ways people have been motivated to use more energy in the past. Discuss the possibility of reversing the trend from promotion to reduction of energy consumption.

16. Draw a map showing the sources of fossil fuels in the United States. Discuss how they were formed and present mining techniques.

17. Study the construction of a nuclear electrical generation facility and the process used to generate energy.

18. Compare forms of energy generation to find which are presently economical and which are not. Find the reasons why some forms are not economical.

19. Given an opportunity to work with small engines, find the amount of fuel a small engine consumes when it is out of tune, compared to when it is properly adjusted. Measure on a time basis at a given r.p.m.

20. Compare total energy considerations in the use of hot air blowers which have replaced paper towels in many public washrooms.

21. Determine through weather records of the past year (or years) how many days clothes could have been dried out of doors rather than in a clothes drier. How many kwh does this represent in your community? How many gallons of water does this represent in the hydroelectric reservoir?

High School Level

NOTE: Consider a mini-course for the high schools on the energy crisis. It would be designed for the junior or senior year with a 45-hour instructional time block. Concepts introduced in the elementary grades would be expanded and developed.

1. Determine those events in the last 50 years which have led to utilizing greater amounts of energy. Was the impact on an international, national, state or local scale? For example, building a national network of freeways; advertising that bigger cars are better; lighting streets for safety, assuming that the more they are lighted the safer. Many more events can be named and their implications explored.

2. Ask students to evaluate the purchase of a home from an energy consumption point of view (i.e., insulation, cubic feet, storm windows, effective heating system, length of hot water lines and their insulation, etc.).

3. Compare the rental and operational costs of apartments to the purchasing and operating cost of homes. Relate energy consumption in these dwellings to the number of cubic square feet in the residence, the temperature at which the area is maintained, the square feet of uninsulated glass in the residence and other possible factors.

4. Find which types of clothing retain body heat and remain comfortable in a residence or working place with a reduced temperature. Include clothing that is used for work as well as dress.

5. Compute the alternatives to vehicle ownership. Explore car rental possibilities. Relate car size to particular needs. Determine potential repair and maintenance costs of vehicles. Explore the fuel consumption of different modes of transportation.

6. Investigate the local and statewide political implication of the power shortage. Will people vote against public officials whose actions tend to reduce present convenience? What positions are being taken by elected officials?

7. Introduce young people to the idea of growing some of their own foods, purchasing local foods in season and preserving them, and in other ways making best use of the resources around them. Discuss the most efficient methods of food preservation.

8. Discuss the kind of campaign that would be most effective in reducing electrical energy consumption. Who should pay for the campaign? Is this a negative kind of educational effort (i.e., urging people *not* to use something)?

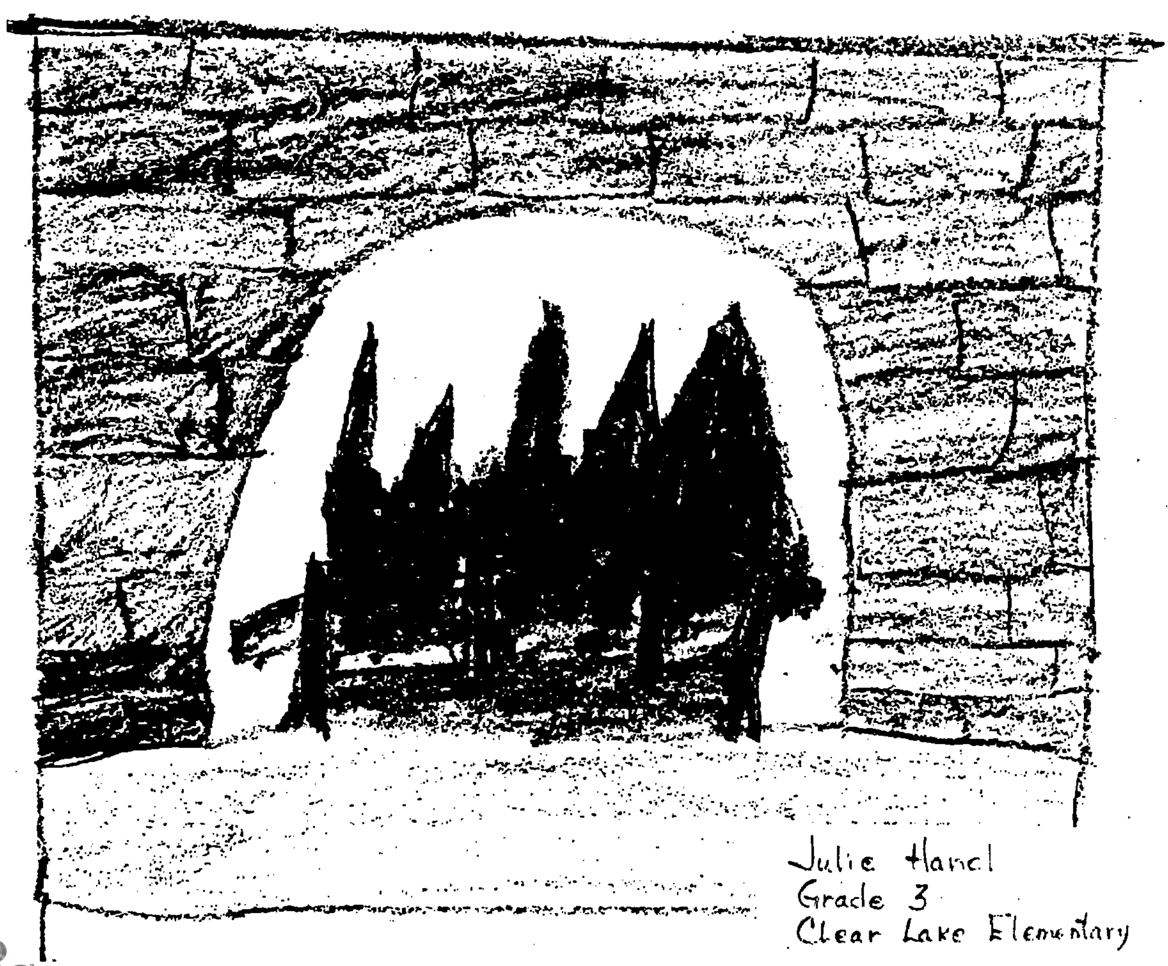
9. Pose hypothetical problems regarding the energy crisis, such as: "Government has mandated a 50% reduction in electrical, petroleum and natural gas consumption." Instruct students to establish priorities and work out a solution.

10. Make a study of the effect of lowered urban and highway illumination on crime and vandalism.

11. A recent news report stated that large quantities of scrap aluminum are being exported. Compare the energy cost of recycling scrap aluminum to that of producing from bauzite.

SECTION III
ALL-SCHOOL ACTIVITIES FOR ENERGY CONSERVATION

Use your fireplace



suggestions for the use of section III

Principals:

- Use the all-school activities suggestions for assistance in planning Energy Crisis Week, and in particular, Energy Crisis Day. This day has been designated for special emphasis—as a day for culminating activities and "spreading the word" about individual responsibility toward the crisis in the months ahead.

- Try to encourage and develop programs that will have a sustained effect over the coming months. For instance, Energy Crisis Week is a good time to launch community surveys on conservation. If the surveys continue throughout the year, however, they will be more effective than a "one day" event.

- The checklist for energy conservation suggests measures that might be taken in your school to reduce power consumption. Check those items that apply to your particular school building and needs. Then see that the appropriate staff members (custodians, teachers, etc.) receive instructions that will help them carry out conservation measures. Give one person the responsibility of follow-up to see whether these measures have had any effect. Seek your own methods of conservation as well.

ALL-SCHOOL ACTIVITIES FOR ENERGY CONSERVATION–CREATING ENERGY CONSCIOUSNESS

The school provides many opportunities to assist with the energy crisis outside of the classroom. This section provides suggestions for all-school activities in two categories: 1) student activities which will stress awareness of the energy crisis; and 2) actions which can be taken by occupants of a school building to conserve energy.

We urge school principals to undertake the responsibility of organizing the all-school effort, distributing these materials to appropriate personnel, assisting in the organization of related activities, and encouraging individual contributions from teachers, staff and students. The following ideas may be of some assistance in organizing activities for Energy Crisis Day.

School Assemblies. A number of local authorities are available to tell students what they know about the energy crisis and energy conservation. One good contact for such speakers is the local public or private utility company that serves the school. These companies have special employees available to speak on the energy crisis, and also maintain resource lists of community groups and individuals. Utility companies also have films and filmstrips available for school use.

Another excellent source for speakers and topics are the newly established speaker bureaus at community colleges, which have been organized at the request of Dr. Parnell, See Chart VII for the person to contact at each community college.. These people are operating clearinghouses for speakers informed about the energy crisis.

An exemplary list of speakers and topics available in the Lane County area has been developed by Lane Community College. Consult this list (Chart VIII) for ideas about what topics to look for and what organizations to contact for speakers. You may want to develop a similar list of speakers for use in your area.

Valuable information resources on the energy crisis probably exist right in your school. Teachers and students can organize an effective assembly by relying on debate teams and forensic clubs, drama groups and specialists in related areas of science, home economics, shop, etc.

Information Campaigns. The most important aspect of energy conservation is getting people informed about: 1) energy crisis conditions, and 2) actions which might improve those conditions. The following activities can assist in the statewide information campaign.

- *School Paper.* The school paper might contain weekly stories on energy supply conditions and efforts to conserve energy. A valuable source of information is the Governor's Office of Energy Conservation and Allocation.

- *Energy Crisis Information Center.* Help students organize an energy crisis information center in your school. They might collect information for the classroom, organize lists of references and speakers, provide conservation tips to students for their homes, etc.

- *Community Information Campaigns.* School clubs and/or classrooms may want to organize information campaigns that reach into the community such as: 1) weekly residential checks on energy conservation, 2) a campaign to discourage electric Christmas displays, and 3) a survey of the economy measures being adhered to by local business and industry.

Competitions Related to the Energy Crisis. School competitions can add a little excitement to the business of spreading energy crisis information. Several schools have already organized poster competitions. Other ideas for competitions are: 1) slogan contest, 2) song contest, 3) essay competition, 4)speech competition, 5) conservation suggestion list contest, and 6) outstanding class project list. Organize a competition between schools for greatest percentage of energy conservation (ground rules would have to insure health and safety measures).

Activities for Special Interest Groups. Encourage special clubs and organizations to think up their own way to contribute to energy conservation. Some suggestions are listed below:

- *Rally teams.* Make up "save it" yells and slogans for games.

- *Forensic Clubs.* Prepare speeches related to the energy crisis and make speakers available to the community.

- *Science Clubs.* Look for new ways of conserving energy and provide information to school papers.

- *Service Organizations.* Prepare signs listing conservation measures to be posted in appropriate areas (office, hallways, etc.). Organize a system to monitor electricity use in the school.

Special Save-Energy Day. Plan a special school day for minimum energy use. Keep records to derive average energy consumption by the school for a given time period, in the areas of transportation, heating, lighting, etc. Within the limits of safety and good judgment, plan a day which might involve some of the following: 1) no electrical AV equipment; 2) cold lunch (sacks or prepared by cafeteria staff); 3) no electrical clocks, bells, or intercoms (use whistles and runners); and 4) let students and faculty brainstorm for further ideas. Make it a challenge—a backward journey through time to colonial days. Dream up a title (example: AMEC Day—Absolute Minimum Energy Consumption Day) for use in publicity, before and afterward. Determine, in discussion with students, the activities that would be practical to put into daily practice.

Participation in Statewide Energy Crisis Events. A number of organizations are in the process of planning information exchange activities related to the energy crisis. Teachers and students can contribute to these events by attending conferences, preparing helpful and informative material, etc.

The Oregon Museum of Science and Industry and the State Department of Education are currently cooperating to plan a statewide "Environmental Proposium" to be held the week of May 16-26. The purpose of this conference will be to share ideas and activities of this year which were related to environmental issues.

Information is now being collected for the conference in the form of an "Environmental Proposium Yearbook." The book will contain ideas about methods to conserve energy and improve the environment including suggested activities for Earth Week in April. Each school submitting ideas for the yearbook before December 15, 1973, will receive a free copy early in January. Suggestions and information for the yearbook should be mailed to: Environmental Proposium Steering Committee, 4015 SW Canyon Road, Portland, Oregon 97221.

Administrators are encouraged to find out about other ongoing programs in the state related to energy and the environment, and to establish regular channels for distributing such information to students and teachers.

ENERGY CONSERVATION IN SCHOOL BUILDINGS

Dr. Parnell's request that public school employees reduce energy consumption in school buildings has met with aggressive action. School administrators have assumed a leading role in helping initiate measures to conserve both electricity and fuel.

In a spot survey conducted by the Department of Education, all of the 20 districts that were contacted reported taking some action to conserve energy. Their activities have been reviewed and integrated into the checklist for energy conservation which appears immediately following this report.

Pacific Power and Light Company has conducted a cursory survey of public schools which have large accounts, to compare their use of electricity during October 1972 and October 1973. According to the 165 accounts reviewed, 64 schools reduced their consumption of electricity by 20 percent or more and 111 schools achieved a reduction of at least 7½ percent. Schools achieving meter reductions of over 40 percent were Taft High School (Lincoln City), Mohawk Elementary (Springfield), Redmond Middle School, Pendleton High School, Blue Mountain Community College, Umpqua Community College, Henley High School (Klamath Falls), Pilot Butte Junior High School (Bend) and Roseburg Senior High School.

Even greater conservation of energy consumption is possible, with some additional effort. Donald Dubois, Chief of Facilities for the Salem Public Schools, prepared an extensive list of conservation measures for the Salem District. The response of schools to items on the list resulted in a 50 percent reduction of electricity consumption for the month of September compared to one year ago. While such impressive economy is probably not possible to sustain during winter months, because of shorter daylight hours and colder temperatures, this achievement showed the possibilities for saving through use of an organized approach by the entire district.

School administrators are urged to use the following checklist, based on the list prepared by the Salem Public Schools, to extend their energy conservation efforts.

CHART VII speaker's bureaus

Institution	Speakers Bureau Name	Address	Telephone
Blue Mountain	Larry O'Rourke Director of Community Services	P.O. Box 100 Pendleton 97801	276-1260
Central Oregon	Harold Black	College Way Bend 97701	382-6112 Ext. 289
Chemeketa	Clarence Caughren	4389 Satter Drive NE Salem 97303	585-7900 Ext. 244
Clackamas	Mrs. Gloria Tomlin	19600 S. Molalla Ave. Oregon City 97045	656-2631 Ext. 232
Clatsop	Roger Tetlow	16th & Jerome Astoria 97103	325-0910 Ext. 229
Lane	Larry Romine	4000 E. 30th Ave. Eugene 97405	747-4501 Ext. 340
Linn-Benton	Kirk Berger Coor., Public Information	P.O. Box 249 Albany 97321	928-2361 Ext. 202
Mt. Hood	Linda Saari	26000 SE Stark Gresham 97030	666-1561 Ext. 225
Portland	Darlene Laughlin	12000 SW 49th Ave. Portland 97219	244-6111 Ext. 394
Rogue	Phil Hart Dir., Community Services	P.O. Box 638 Grants Pass 97526	479-5541 Ext. 54
Southwestern Oregon	Maynard Jensen Dir., Community Services	Coos Bay 97420	888-3234 Ext. 245
Treasure Valley	Al Carr Dir., Community Services	650 College Blvd. Ontario 97914	889-6493 Ext. 36
Umpqua	Sheril Wells	Box 967 Roseburg 97470	672-5571 Ext. 45

CHART VIII

THE ENERGY CRISIS SPEAKER LIST
LANE COUNTY AREA

"Alternate Energy Sources" or "Energy Conservation in Short- and Long-Range Terms" or "Pros and Cons of the Nuclear Energy Controversy," Ray Wolfe, University of Oregon biochemist, 345-0639.

"Alternative Energy Sources" or "Conservation of Energy," Linda Milasich and others in the League of Women Voters, 747-6129.

"Anything That Stands Still, Insulate It" and "Home Improvements to Save Energy," Don Read and John V. Read, owner-manager and assistant manager, respectively, Lane Construction Co., 688-5836.

"Conservation of Energy" or "Alternative Energy Sources," Margaret Patoine, Eugene Future Power Committee, 345-3608.

"Conservation of Resources in the Home," Gladys Belden, LCC home economics chairman, or Dyna Besse, LCC coordinator of HELPS program, 747-4501, ext. 208.

"Economics of Power Use and Production" or "Alternative Energy Sources" or "Long- and Short-Term Conservation of Energy," Fred Keppel, consulting engineer, 746-6703.

"Electric Utilities: Regulation and Control," Donald Brodie, associate professor of law, University of Oregon, 686-3867.

"Energy Conservation" (Any Aspect), John Reynolds, associate professor of architecture, University of Oregon, 686-3662.

"Energy Crisis" (Any Aspect), Jerry Finrow, director of Center for Environmental Research, University of Oregon, 686-3612.

"Energy Crisis in the Petroleum Industry," Robert Newburn, partner, Fraedrick Skillern Co., 687-1234.

"Eugene's Relationship to the Bonneville Power Administration and Utilities in the Northwest" or "Nuclear Power Problems" or "The Hydrothermal Program" or "Energy Conservation in Long- and Short-Range Terms" or "Alternative Energy Sources," Chris Attneave, Eugene Future Power Committee, 345-6751.

"…othermal Energy," William Holser, head, geology department, University of Oregon, 686-4575.

"How We Can Save Energy in Our Homes," Rhoda Love, LCC science instructor, 345-6241.

"Nuclear Energy," Peter Swan, associate professor of law, University of Oregon, 686-4607.

"Projections of Energy Needs" or "Ways to Cut Down the Short- and Long-Term Needs for Power," Marian Frank, Eugene Future Power Committee, 343-8993.

"Residential and Business Insulation," Lester M. Green, president, Builders Insulating & Roofing Co., 686-2023.

"Scope of the Energy Crisis: History, Outlook Need for Changes in Life Styles," Lyle Wilhelmi, coordinator of science and environmental education, Eugene School District 4J, 687-3316.

"Solar Energy," David McDaniels, professor of physics, University of Oregon, 686-4765.

"The Energy Crisis as it Relates to the Housing Industry," Ray Wiley, vice president for design and cost control, registered architect and engineer, Breeden Bros., 686-9431.

"The Immediate Energy Crisis and the Long-Range Energy Supply Picture," Jack Criswell, superintendent, Springfield Utility Board, 746-8451.

"The Truth About the Natural Gas Supply," Richard Case, district manager, and Warren Harris, district operations manager, Northwest Natural Gas Co., 342-3661.

"Things the Family Can Do to Cut Down the Use of Power," Velma Mitchell, Lane County Extension home economist, 342-5539.

"What Caused the Energy Crisis, What's Being Done About It," Dave Coon, energy crisis counselor, or Bill Eaton, administrative assistant, Eugene Water and Electric Board, 343-1661.

"What the University of Oregon is Doing About the Energy Crisis," Harold Babcock, director of physical plant, University of Oregon, 686-5243.

"Energy Conservation in Industry," Don Dils, region public affairs manager, Weyerhaeuser Co., 746-2511.

Prepared by Lane Community College
October 31, 1973

A CHECKLIST FOR ENERGY CONSERVATION IN SCHOOL BUILDINGS

The following list has been prepared by Donald Dubois, Chief of Facilities, Salem Public Schools, with some minor additions by the State Department of Education. This list is not all-inclusive, but rather a sample of some measures which reduce consumption of electricity and oil products. Any of the following activities might be initiated in a school building, keeping in mind two important factors: 1) the health and safety of students and employees; and 2) the prevention of vandalism.

Lighting

- *Daylight Hours*

____Do not turn on lights in instructional areas unless it is essential to the teaching-learning process. Faculty members are in the best position to adjust lights according to needs (off during class discussion, on for reading and writing, etc.).

____Avoid turning lights off for very short intervals. The energy surge required when the light is turned back on is greater than the energy saved.

____Do not turn on lights in outside covered play areas and walkways.

____Reduce lighting by one-third in interior gyms, locker rooms, shower rooms, shop rooms, libraries and general work areas by turning on one row of lights at a time until a safe level of lighting is reached.

____Turn off lights in nonproductive areas, except for minimum safety requirements (cafeteria, hallways, storage rooms).

____Do not plan Christmas trees or holiday displays that require electric lights.

- *Evening Hours*

____Do not use exterior lights except at outside stairs and entry ways in use.

____Use only one-half the lighting capacity of hallways and stairwells in use.

____Reschedule 50 percent of housekeeping cleaning to daylight hours. Request night custodians to light only the areas they are working in.

____Schedule all school meetings during daylight hours. Encourage community groups using the school building to reschedule their meetings during daylight hours.

General Use of Electricity

____Keep television sets, radios, typewriters and other office equipment turned off when not in use.

____Reduce by one-third the use of electrical appliances in home economics classes and consolidate use of refrigerators to one in each room.

____Reduce by one-third the use of power tools in classroom shops.

Heating, Ventilating and Air Conditioning

- *Air Conditioning*

____Immediately discontinue the use of air conditioning systems.

- *Ventilating*

____Do not turn on ventilating systems until one-half hour after the buildings have been occupied.

____Shut off ventilating systems immediately after classes are dismissed for the day.

____Do not use ventilating systems for evening occupancy.

- *Heating*

____Control office and classroom temperatures at no more than 70 degrees during occupancy. Utility companies are recommending reducing the temperature to 68 degrees if possible.

____Maintain temperature of gyms, shops and restrooms at 66 degrees during occupancy.

____Do not heat interior hallways and/or storage rooms.

____Encourage students and employees to wear warmer clothing to accommodate cooler temperatures.

___ Maintain heating in buildings at 55 degrees during unoccupied times. This especially applies to evenings, weekends and holidays during the heating season.

___ Constantly inspect heating systems to guarantee maximum efficiency.

- ___ Check filters to make sure they are clean (monthly).
- ___ Check oil burner nozzles for proper combustion (monthly).
- ___ Check steam supply systems for steam leaks (weekly).
- ___ Check boiler return systems, including vacuum pumps and water injection controls (monthly).
- ___ Clean boiler fire tubes and sections to keep them free of a build-up of fly ash (monthly).

___ Report immediately any needed repairs for heating systems and temperature controls that cannot be accommodated by in-house engineers.

___ Persuade students to prevent heat from escaping unnecessarily through open doors.

Athletic Events

___ Schedule all junior varsity events during daylight hours.

___ During night varsity games, minimal lighting (one bank of lights) should be used until ten minutes before game time, during halftime, and immediately upon completion of the game. Full lighting should be used during regulation play.

Motor Vehicle Use—Fuel Conservation

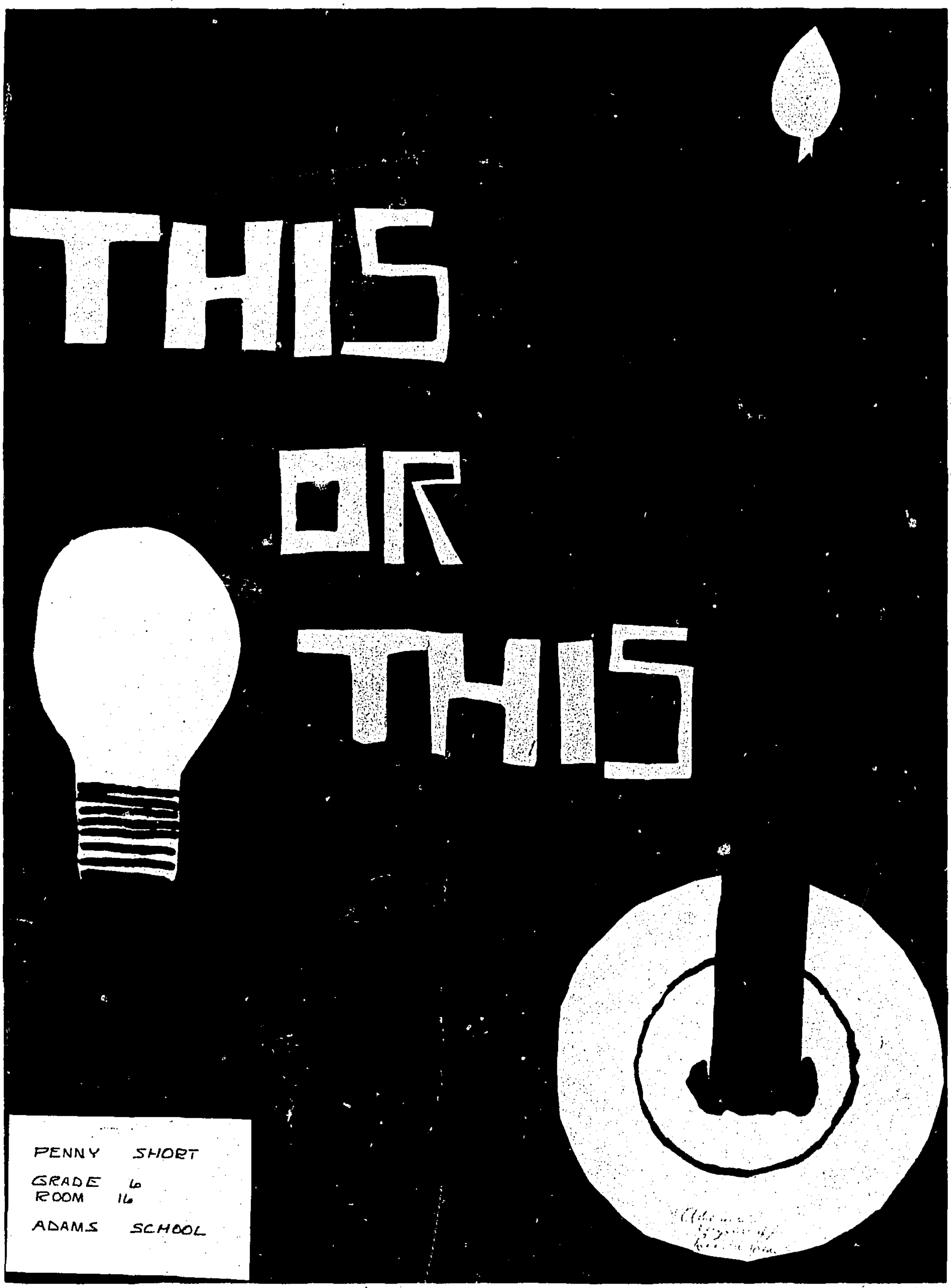
___ Reduce the number of business trips and limit speed to 55 MPH.

___ Cut down on field trip scheduling. Do not, however, cancel game buses for rooters unless you are sure that many students won't make the trip in cars as a result. Fuel allotments may well cause curtailment of extra trips.

___ Encourage students to use school buses, municipal buses, bicycles or their own two feet to and from school, and to leave their cars at home.

___ Encourage teachers to use public transportation and/or organize car pools to and from work.

SECTION IV
HOME SURVEY HANDBOOK FOR ENERGY CONSERVATION



suggestions for the use of section IV

Principals:

- This section contains the following: 1) some tips on energy conservation in the home, 2) a checklist of energy conservation measures for use in the home, and 3) a lesson in reading kilowatt-hour meters. Hopefully, every student will learn to read electric meters and will use the checklist at home.

- Look for ways that this information can become part of "take-home" units of study throughout your school. The best outlet for the meter-reading lesson is a math or science class. The home checklists can be used in almost any class setting.

Teachers:

- You can help sponsor home energy conservation by encouraging students to be their own energy monitors. Part of this section deals specifically with how to use and read an electric meter. Make this a unit of study in your classroom during Energy Crisis Week.

- Using the chart which is included in this section, students can record the energy consumed at home. Have them report to the class the conservation measures being taken at home. Hold a contest for the greatest energy savings.

- Encourage students to use the Home Checklist for Energy Conservation. Plan classroom activities around the ideas in the checklist. For example, have students make "reminder" signs for appropriate places at home—over the washer and dryer, by the thermostat, in the kitchen, on top of the TV, etc.

In order to reduce consumption of energy in the home, the following steps are important:

1. ascertain the general principles of energy conservation;

2. translate these principles into specific activities, and

3. determine whether or not these actions were effective.

This section provides tools for this process: 1) General Tips for Home Energy Conservation; 2) A Home Checklist for Energy Conservation; and 3) A Lesson in Reading Electric Meters.

GENERAL TIPS FOR HOME ENERGY CONSERVATION

DETERMINE THE IMPORTANCE OF "CONVENIENCE." Today's homes are stocked with countless objects which we commonly refer to as "modern conveniences." Some conveniences greatly increase comfort and efficiency in the home (refrigerators, water heaters); others, like electric toothbrushes and power tools, merely cut down on the amount of physical energy required to do a certain job. Try to determine which home conveniences would be most expendable in a severe energy shortage.

IDENTIFY THE BIGGEST ENERGY USERS. In order to save energy efficiently, it is important to know which appliances use the most energy in the home. Chart IX shows the relative energy consumption of common household appliances. The greatest energy (use) is for home heating and water heating.

The energy required to heat homes represents about 57.3 percent of all home energy consumption. Good insulation can markedly reduce this percentage. Heating water consumes about 15 percent of all energy used in the home. Water heaters are usually out of sight and we don't turn them on and off like other appliances. Reducing the temperature control on water heaters can increase energy savings.

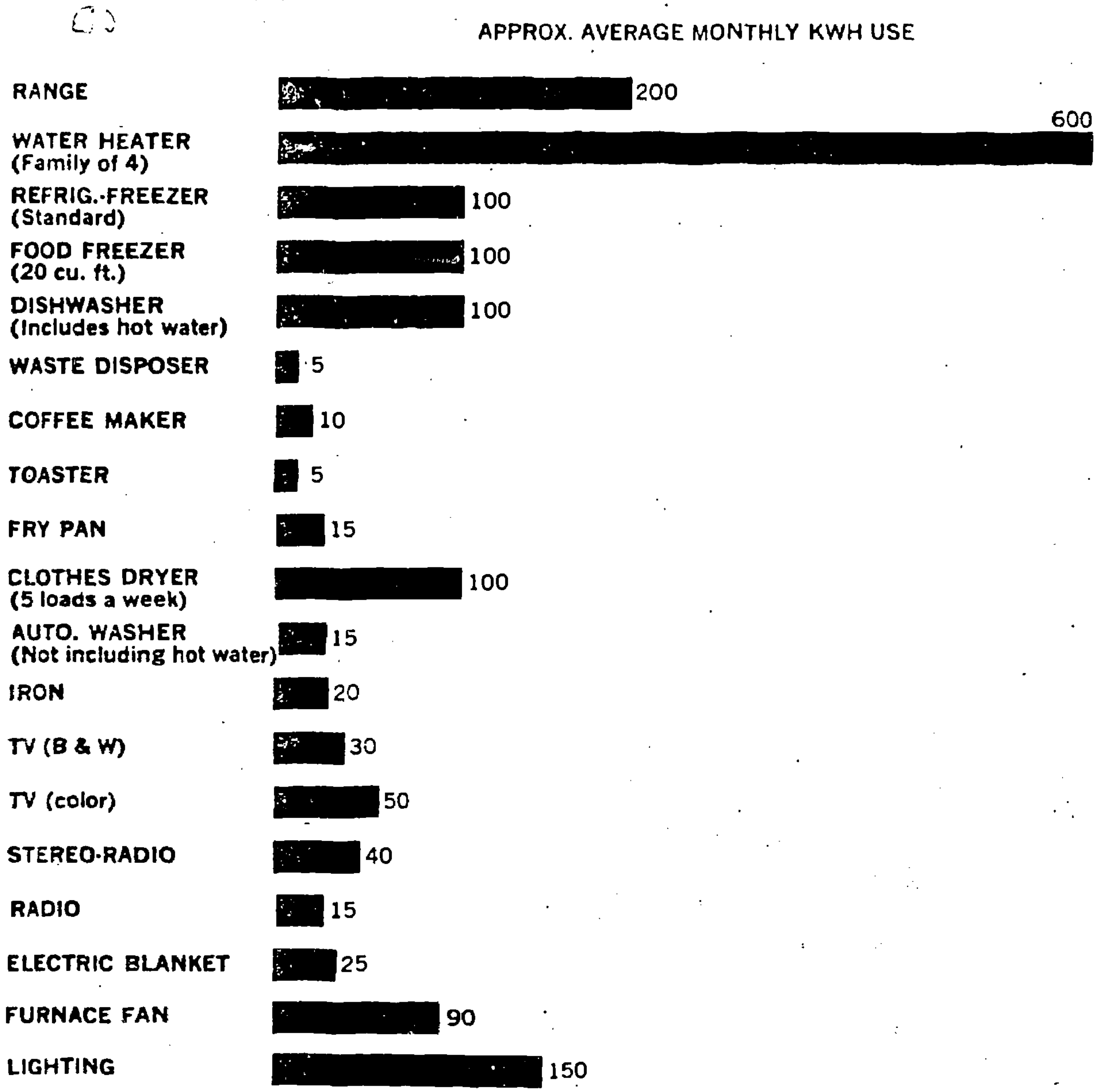
To determine the biggest energy users in the home, rate electric appliances on a scale from one to ten. Make "savings reminder" labels for home appliances. Electrical equipment that requires only nominal kilowatt consumption would, of course, be labeled in the "one" category. Big power-meter accelerators, such as clothes dryers and color TV's, would be rated at 5, 6, 7, or higher on the scale.

MAKE ENERGY ECONOMY A DESIGN PRINCIPLE. When remodeling homes, consider the energy factor in the changes you are making. For instance, most home lighting is incandescent. Fluorescent light is generally twice as efficient as incandescent lighting, and may be used effectively in baths, laundries, kitchens and workshops. Types of insulation will effect home heating efficiency. Develop a list of new equipment which might be wise to consider in home remodeling.

CONCENTRATE ON FUEL SAVINGS WHEN USING FAMILY CARS. The most recent nationwide crisis in energy supply has been the shortage of gasoline. Motorists can improve driving economy by reducing the weight carried in the vehicle (heavy tools and equipment), keeping the vehicle in peak operating condition, maintaining constant speed in city driving, etc. In addition to these specific actions, a general change in *transportation habits* will also improve fuel economy. Develop a list of ways that families can shorten the distance they travel in their cars.

CHART IX

Where the Watts Go



WHAT IS A KWH?

Kwh stands for kilowatt hour. Electric power is measured in watts, like gasoline is measured in gallons. All electric appliances and light bulbs are sized, or rated, in watts. Some time ago, someone took the Greek word "kilo (meaning 1,000) and joined it to "watt." The term kilowatt is simply an easy way to say 1,000 watts. A kilowatt hour, then, is 1,000 watts of power used for one hour. One kilowatt hour will run a 100 watt light bulb for 10 hours.

HOME CHECKLIST FOR ENERGY CONSERVATION

HEATING

____ Set heating thermostat at 68°-70°.

____ Turn thermostat down at least 10° at night.

____ Eliminate use of home air conditioning. If air conditioning must be used, adjust settings so it does not come on below 78-80°.

____ Keep furnace filters clean for more efficient operation.

____ Close fireplace damper when not in use.

____ Open or close drapes to help control indoor temperatures.

____ Do not use oven for heating the kitchen.

____ Insulate homes. An uninsulated home requires twice the energy for space heating.

____ Install weather-stripping around all windows and doors.

____ Use storm windows, or cover windows with plastic during colder months.

____ Move obstructions away from cold air returns or hot air vents.

____ Thermostats should not be placed on cold walls or outside walls.

____ Before leaving on winter vacations, lower thermostats to 55 degrees. During summer, all windows that face the sun directly should be shaded.

____ Keep baseboards and heating surfaces clean and unobstructed by furniture or draperies.

____ Minimize the use of portable electric space heaters.

____ Keep humidity as normal as possible (45% to 50%) by using exhaust fans in high moisture areas.

____ Minimum settings or 55 degrees should be maintained on thermostats when leaving for a period of time; i.e., vacations, moving from the residence, etc.

____ Close foundation vents on the windy side of the house during cold weather.

____ Shut off registers and heat vents in unused rooms (check to be sure there are no items in the room vulnerable to freezing).

____ Cover outside section of wall-mounted air conditioning units with plastic to prevent air leakage.

WATER

GENERAL

____ Reduce water heater thermostats to 140°.

____ Turn electric water heaters off if you plan to be gone from home more than one day.

____ Take showers when possible, instead of baths; make them brief, and turn faucet on to minimum practical water flow.

____ Use less water for tub baths.

____ Drain and flush your hot water tank at least once a year to prevent buildup of sediments.

____ Repair dripping faucets and leaking toilet fixtures.

DISHWASHING

____ Wash only full loads in dishwasher.

____ Use shortest cycle for load being washed.

____ For hand dish washing use a tub of rinse water rather than running water.

LIGHTS AND APPLIANCES

GENERAL

____ Turn off all lights not in use.

____ Reduce bulb wattage where practical.

____ Eliminate yard lights. Turn on porch lights only when expecting visitors. Eliminate exterior Christmas lighting.

____ Turn off all unused television, radio, stereo, etc.

___ If you have a choice between color and black-and-white television, use the black-and-white set.

___ Use sunlamps, hairdryers, electric haircurlers, etc., only when essential.

LAUNDRY

___ Cut down on use of clothes dryers. Hang clothes outside when possible.

___ Dry full loads, but avoid overloading.

___ Set drying temperature for fabric.

___ Clean lint trap in dryer after every load.

___ Use full loads in washer.

___ Set water level controls to load size.

___ Set water temperature for fabric.

___ Use cold water when appropriate.

COOKING AND REFRIGERATING FOODS

___ Pre-heat oven only when necessary.

___ Choose pans to fit units and cook with covers.

___ Keep oven door closed until food is done.

___ Clean kitchen exhaust fan and run only when necessary.

___ Use pressure cookers.

___ Plan menus requiring less cooking.

___ Use self-cleaning ovens as little as possible.

___ Don't use ovens to heat kitchens.

___ Set refrigerator temperature to maintain 35°-40°.

___ Defrost refrigerator when frost is 1/4" thick.

___ Be sure doors seal on refrigerator and freezer.

___ Clean condensor coil regularly.

___ Cool foods before refrigerating or freezing.

___ Don't overload refrigerator or freezer.

___ Limit opening and closing of refrigerator and freezer.

___ Keep refrigerator away from heating equipment and direct sunlight.

DRIVING HINTS

___ Maintain speed at less than 55 miles per hour.

___ Avoid use of auto air conditioner and other power accessories except as safety requires.

___ Keep car engine tuned.

___ Use proper air pressure in tires.

___ Use radial tires on vehicles to increase gas mileage.

___ Use mass transit, or organize car pools; when driving to and from work, avoid one-person use of cars.

___ Plan shopping to reduce the number of trips. One fifty-mile trip is more efficient than five ten-mile trips because of engine warm-up.

___ Allow engine to warm up while driving at moderate speeds, rather than while idling.

___ Accelerate slowly and smoothly from a stop, rather than making "jack rabbit" starts.

___ Maintain a steady highway speed in harmony with traffic conditions.

___ Carry no unnecessary weight in car.

___ Walk or ride a bicycle as an alternative to driving.

CONSERVATION AND SAFETY MEASURES FOR MOBILE HOME RESIDENTS

WATER

___ Check all outside connections leading to the mobile home for leaks. These could be underground connections, faucets, lead-in hoses/pipes/tubing, and actual connections to the mobile home.

___ Check the hot water heater for any leaks which might have occurred while the mobile home was in transit. If it is an electric water heater, revent and close off all vents leading to outside air. *CAUTION: if you have a gas water heater, do not close off any vents.* With either type of water heater, seal off entry door to avoid air leakage into the water heater closet.

___ Check all faucets and pipes when practical for leaks which might have occurred during transit or from worn out faucet parts. One drop of water per second could add up to 1,200 gallons of water consumption per month, which shows up on your bill! Wrap all exposed pipes with insulation. Use heat tapes only if absolutely necessary.

HEAT

___ If you are just moving the mobile home to its new location, try to place it on the down-wind side of trees, bushes, cut-ground bank, or hill.

___ Place a layer of gravel (preferably small size; i.e., 1/4" crush or "buckshot") under the mobile home and cover with heavy plastic sheets or other vapor proof barrier.

___ Wrap all heat and cold air return ducts with insulation. Seal all joints or cracks to prevent outside air from being drawn into the heating system.

___ Seal all cracks or fiberboard breaks on the bottom of the trailer to prevent cold air seepage into the home. Seal the anchor/support beams and the subsequent crack where the two halves of a double wide mobile home are joined. Check all seals around "expansion" or "tip-out" rooms.

___ Skirting around a mobile home is a must. The skirting should be vented to prevent mildew, but close off all vents on windward sides of your mobile home during the cold weather season.

GAS HEATERS AND APPLIANCES

___ Check all lead-in pipes and pipes to the heater and appliances for leaks. This will not only prevent costly consumption of gas, but is a sound safety measure.

___ Check the heater and all appliances for gas leaks, and make sure that pilot controls are functioning correctly.

___ Check all electrical portions of the heater to be sure that the blower and thermostat are operating correctly.

A LESSON IN READING ELECTRIC METERS

On some wall of your home—basement, garage or most often outside—you'll find an intricate glass-enclosed device. If you're like most people, you seldom pay any attention to it. Nor do you need to, for modern electric meters perform their job so accurately and reliably that you need never be troubled.

But, every month or so a man from your electric utility company comes to see it, and later you are billed for the exact amount of electricity used.

METERS MEASURE ELECTRICITY. Through your meter's glass enclosure, you can see a revolving aluminum disk and a series of dials and pointers, or digital numbers. Without explanation, they don't make much sense. But, it's really quite simple.

The amount of electricity you use determines the speed at which the disk moves. The more electricity you use, the faster it turns. Each revolution measures a precise amount of electric energy called watthours. This watthour measurement is transferred from the disk through a series of gears to the digital numbers or pointers on the dials.

JUST WHAT IS A WATTHOUR? Every hour a 100-watt light bulb burns, it uses 100 watthours of electric energy. Since a watthour is such a small unit of energy, your electric utility company uses a unit equal to 1000 watthours—a kilowatt hour—to measure the amount of electricity you use.

WHAT MAKES YOUR METER DISK TURN? There are two sets of connections which tell your meter what it needs to know: (1) the amount of current flowing into your house, and (2) the pressure or voltage at which the current is flowing.

Electric current is like water flowing through a pipe. The rate of flow of electrons through your line is measured in amperes. Pressure is the force that pushes electric current through your lines, measured in volts. To determine the watts of electricity you use, your meter multiplies ampheres of current by volts of pressure. Total watts then give you the figure in watthours on which your electric bill is based.

CLOCK-LIKE METER ACCURACY. Friction inside the meter is all but eliminated with the use of a magnetic-suspension system which uses a magnetic field to float the disk and its shaft in air. And to help maintain accuracy provided by magnetic suspension and other design features, the meter is sealed with filters which keep its interior free of dust and other contaminants that can cause inaccurate meter registration.

YOUR METER—A SMALL MOTOR. Your meter is basically a small induction motor run by magnetic forces created by electricity in a set of coils. The voltage coil is a winding of wire connected to the power supply lines. The current coil is a winding of wire connected with your household wiring. When current passes through these coils, the disk is forced to turn at a speed exactly proportional to the number of watts (amps x volts) of electrical power you are using.

HOW FAST DOES THE DISK MOVE? Today, most meters are nameplate-rated 30 amperes at 240 volts—7200 watts of power. At rated power, the disk rotates 1000 revolutions per hour—or 16 2/3rpm, just half the speed of a long-playing record. As the disk spins 1000 times, the gears attached to its shaft move the pointers forward 7.2 kilowatt-hours. One kilowatt-hour is added to your meter for every 138 8/9 revolutions of the disk.

METER PROGRESS TO MEET YOUR NEEDS. Meters have changed a great deal in the last 20 years. They've had to. Television, electric heating, more lights, freezers, air-conditioners, water heaters and other new appliances have more than quadrupled the average family's consumption of electric power. Twenty years ago a meter rated at 600 watts was enough to meet your requirements. Today's meters are capable of handling up to 48,000 watts.

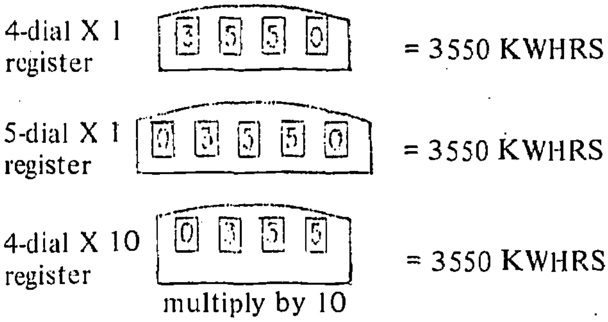
HOW TO READ YOUR KILOWATT HOUR METER

The kilowatt-hour meter is an instrument used to measure electrical energy consumed by a customer during a month's billing cycle.

Two types of meters used by the power companies are the digital and dial type meters. The digital is read directly, from left to right, as shown in Figure 1. This type of meter is often used by Consumers Power Company, Corvallis, Douglas County Co-op, Roseburg, and Benton County REA near Yakima.

Fig. 1

DIGITAL KILOWATT-HOUR METER



Most meters have four or five dials. The figures above each of the dials indicate the number of kilowatt-hours (kwh) that have passed through the meter during the time that the hand on that dial made one complete revolution.

So, when the hand on the right-hand dial has passed from one figure to the next, one-tenth of 10 kwh, or one kwh, has passed through the meter

Be sure to read the meter "backwards"—from right to left—and remember to read the smaller of the two numbers between which the pointer on the dial is standing. *This is very important.*

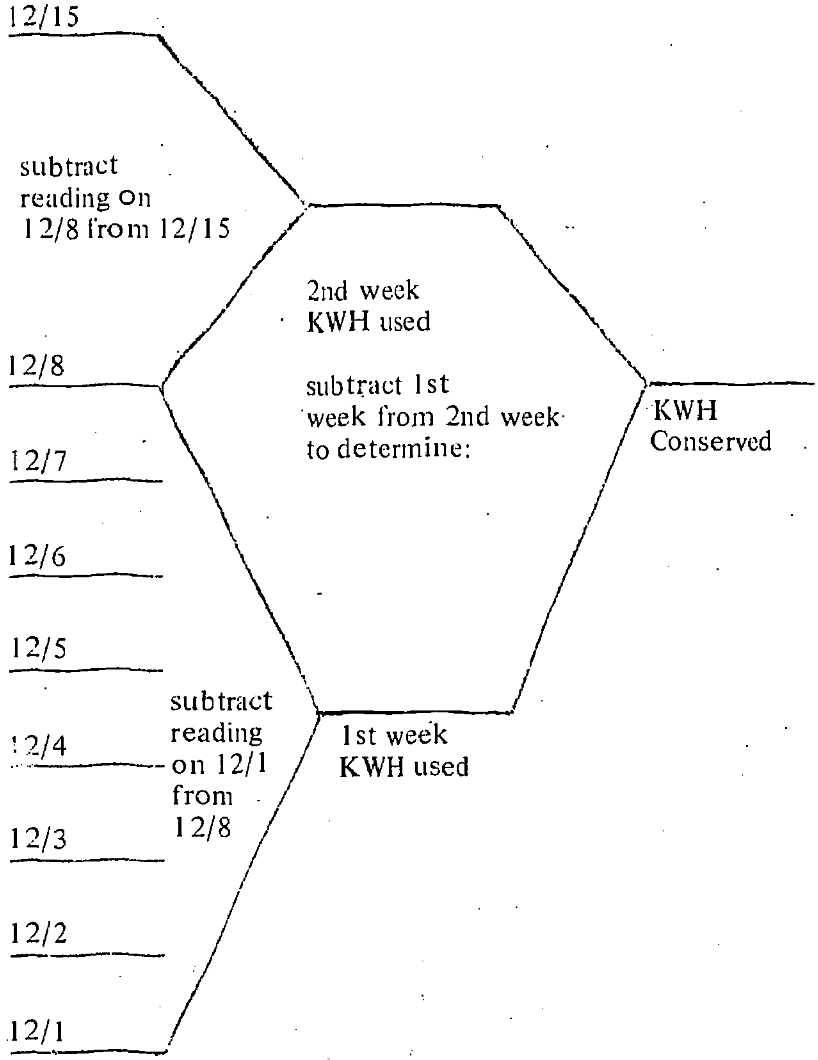
Note that the pointers of the 10, 1,000 and 100,000 dials rotate clockwise, and on the 100 and 10,000 counter-clockwise.

During the time that the pointer on any one dial is making a complete revolution from 0 to 0, the pointer on the next dial to the left will pass from one figure to the next. Therefore, although a pointer on one dial may appear to have arrived on a given figure, that figure should not be read unless the pointer on the dial to the right has reached or passed 0. (See Fig. 1)

For example, in Fig. 2, the pointer on the 1,000 dial looks as if it is on the 5, but you should read that dial "4" because the pointer on the 100 dial, to the right, has not made a complete revolution to 0. The correct reading is shown under the dials.

KILOWATT-HOUR RECORD SHEET

My meter reading time is p.m./a.m. on each date which is listed below:

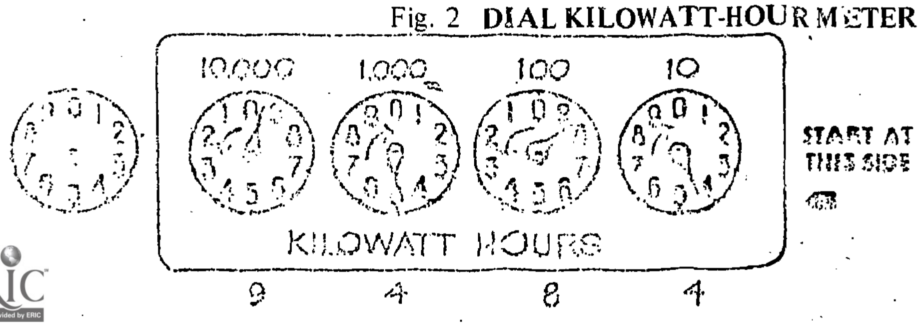


Name ____________

School ____________

Class ____________

Fig. 2 **DIAL KILOWATT-HOUR METER**



APPENDICES

GLOSSARY OF TERMS

Acre-foot: A volume of water one foot in depth covering an area of one acre.

Ampere: Unit of electric current approximately equivalent to flow of 6×10^{18} electrons per second.

Ampere-Hour: The amount of electricity flowing per hour through a conductor when current in it is one ampere.

British Thermal Unit: Amount of heat required to raise the temperature of 1 pound of water 1 degree Fahrenheit.

Calorie: Unit of quantity of heat. The amount of heat required to raise the temperature of 1 gram of water through 1 degree Centigrade.

Circuit: The complete path traversed by an electric current.

Combustion: Burning.

Conduction, Thermal: The transmission of heat through a substance from places of higher to places of lower temperature.

Conductor, Electrical: Body capable of carrying an electrical current.

Conserve: Save.

Diesel Oil: The oil left after petrol and kerosene have been distilled from crude petroleum.

Electric Current, Heating Effect: When an electric current flows through a conductor of finite resistance, heat energy is continuously generated at the expense of electrical energy.

Electric Power: The rate of doing work. Measured in watts.

Electrical Energy: The energy associated with electric charges and their movements. Measured in watt hours or kilowatt hours. One watt-hour equals 860 calories.

Electrometer: Instrument for measuring voltage 'ifferences.

Energy: Capacity for doing work. Forms: potential, kinetic, electrical, heat, chemical, nuclear and radiant.

Fahrenheit Degree: 1/180 of the difference between the temperature of melting ice and that of water boiling under standard (760mm.) atmospheric pressure.

Fuel: A substance used to produce heat energy, chemical energy by combustion or nuclear energy by nuclear fission.

Gas Turbine: An engine which converts chemical energy of liquid fuel into mechanical energy by combustion. Gases resulting are expanded through a turbine.

Gasoline: Petrol. Mixture of hydrocarbons obtained from petroleum.

Generator: A machine for producing electrical energy from mechanical energy.

Geothermal: As applied to power generation, the use of heat energy obtained through the medium of hot water or steam coming from beneath the earth's surface.

Heat: Energy possessed by a substance in the form of kinetic energy, usually measured in calories—in space heating by the British Thermal Unit. Heat is transmitted by conduction, convection or radiation.

Heat Pump: A machine for extracting heat from a fluid which is at a slightly higher temperature than its surroundings.

High Tension: High voltage.

Horse-Power: British unit of power. 1 H.P. = 746 watts.

Hydro-: Prefix denoting water.

Hydroelectric: Electricity production by water-powered turbine generator.

Illumination of a surface: The amount of light falling per second on unit area of the surface. Measured in lumens per unit area.

Internal-combustion Engine: Energy is supplied by a burning fuel which is directly transformed into mechanical energy by controlled combustion.

Kilowatt: Unit of 1,000 watts of power.

Kilowatt-hour: Work done at the rate of 1,000 watts for 1 hour.

Load: The power and energy requirements on the electric power system in a designated area.

Megawatt: One million watts.

Megawatt Month: A unit of energy equal to one megawatt of power flowing continuously for an average month of 30.4 days or 730 hours.

Nuclear Energy: Atomic energy, released during a nuclear reaction.

Nuclear Power: Electric power produced from a power plant obtaining energy from nuclear reaction.

Output: The amount of power and energy delivered from a generating station or stations during a specified period.

Petroleum: Mineral oil. Fractional distillation yields gasoline, diesel, lubricating oil and other products.

Power: The rate of doing work, measured in watts or horse power.

Power Pool: A group of electric power suppliers whose transmission lines are interconnected.

Propane: Inflammable gas obtained from petroleum.

Reservoir: Water storage lake behind a dam.

Reservoir Capacity: The usable volume of a reservoir available for the storage and release of water for power generation.

Run-off Season: The period of the year when natural flows in streams are supplemented by accelerated snow and ice melt from mountain packs.

Snowpack: The winter accumulation of snow in mountain areas which will melt and run off into streams and rivers.

Solar Cell: An electric cell which converts radiant energy from the sun into electrical energy.

Spill: The discharge of water through gates, spillways, or conduits which bypass the hydroplant's turbines.

Steam Engine: A machine which is powered by steam. It can be either turbine or reciprocating.

Stream Flow: The rate of water flow past a given point.

Thermostat: An instrument for the purpose of maintaining a constant temperature.

Transmission Lines: Wires or cables through which electric power is moved from point to point.

Turbine: A motor, the shaft of which is rotated by a stream of water, steam, air, or fluid from a nozzle and forced against blades of a wheel.

Turbogenerator: An electric generator powered by steam turbine engine. The steam created by heat from combustible materials (coal, oil, natural gas or other) or from a heat source beneath the earth's surface (geothermal).

Volt: Unit of electromotive force moving electrical energy through a conductor.

Voltage: The amount of electromotive force of a quantity of electricity, measured in volts.

Voltmeter: The instrument for measuring electromotive force. The unit of measurement is volts.

Watt: The unit of measure for electric power. Wattage of electric power operated equipment or devices is determined by multiplying required volts by required amperes (volts x amps).

Watt Hour: Work done at the rate of 1 watt for 1 hour.

Watt-Meter: The instrument for measuring electric power. Measurement is in watts.

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