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Energy and the City Person

Curriculum Unit 81.05.08
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INTRODUCTION:

This unit was decided upon because few young people seem to be concerned with energy. They accept it as a "given" in their lives without understanding its relationship with matter, its limitations, and its effects upon their daily lives. The outlook of a young city person is often limited to the here-and-now, eclipsing the lessons of the past and the challenges of the future. The study of energy must be imaginatively taught to bring home to our young city dwellers the reality of energy's influence on their lives now and in the future. Therefore, this unit will attempt to present the essential energy concepts of physics and earth science and to be of personal interest and value to young city students.

The unit is designed for eighth grade students but it may be adapted for physical science or environmental education. It should be accomplished in a six week period. The first segment is unusual in that it is concerned with the energy system of the human body but hopefully this will take advantage of adolescents' interest in their own bodies.

The three sections of the unit are:

YOU AND ENERGY

ENERGY AND THE CITY

ENERGY AND THE FUTURE

OBJECTIVES:

1. To develop awareness of energy systems in their bodies, home and city.
2. To familiarize students with the forms of energy that are available, their limitations, and trade-offs that are necessary with each form.

3. To teach students some simple energy concepts in physics and units of measurements in energy.
4. To develop an understanding that what happened before in the use of energy affects us now, and our choices now will affect us and our children in the future.
5. To develop an awareness of America's position and image in the worldwide energy crisis.
6. To sensitize students to the energy needs of the third, fourth and fifth world nations.

YOU AND ENERGY

The Human Energy System comes in assorted sizes, shapes and types, but they are built of basically the same structural units, the cells. These cells number approximately thirty to one hundred trillion in an adult. The cells differ in structure and function. Most of them are capable of reproducing themselves (renewable) with the exception of those which are highly specialized, such as the brain cells whose number is fixed in the very young, and the heavily minerally deposited bone cells. If we view each cell as a separate living entity (ignoring their inter-reliance) they share those characteristics which we attribute to a typical cell. They are miniature organisms that ingest, digest and excrete food. They have a respiration system that provides oxygen that "burns" the food. Each cell is an energy system that can utilize the simple compounds that are the end products of the body's digestion to burn as fuel to provide energy. If they stop functioning in this way, they die. The turnover, except in those that cannot reproduce themselves, is unending.

The metabolism of a cell is divided into catabolism and anabolism. Catabolism is the process by which large food molecules are broken down to smaller ones and liberate energy. This energy is necessary for all cellular activity. Some of the energy is in the form of heat, and some is used to maintain the mechanical work of the cell, and to activate small molecules are united to form larger ones and in doing so, consume energy. Anabolism utilizes energy to or synthesize cellular products for growth, repair and reproduction. [1]

Input* , *Output* , and *Storage

The three types of food that the cells are capable of accepting and using are:

1. Carbohydrates, in simple (hexose) sugar form.

2. Proteins, in the form of simple amino acids.

3. Fats, in the form of glycerol and fatty acids.

When these units are oxidized directly as in the case of carbohydrate sugars or fats, or indirectly as in the case of proteins that first must be converted to carbohydrates and fats, they produce energy.

Their yield varies:

1 gram of carbohydrate	4.1 calories		
1 gram of fat (after conversion)	9.3 calories	1 gram of protein	4.1 calories [2]

The energy thus produced can take the form of the skin; therefore the surface area of the individual determines the amount of energy (heat) lost. The average man has a total surface area of 1.8 square meters, the average woman, 1.6 square meters. [3] Those excess calories that are not utilized for energy are stored in the body in the form of fat in enlarging fat cells. Weight is gained. Proteins which cannot be stored in the body are either used to form new *protoplasm* for growing or reproducing cells or are converted to fats which may be stored.

Units and Definition

The unit of energy derived from oxidation of food or fuel is the calorie. The calorie is the amount of energy required to raise the temperature of one gram of water one degree, from 15° Celsius to 16° Celsius. A more convenient unit in a body's energy system is the *Kilocalorie* or *Calorie* or the amount of energy required to raise the temperature of one *kilogram* (1,000 grams) of water from 15° Celsius to 16° Celsius.

Physics defines energy as the *ability to do work* . Work, in turn, is defined as *force* X *distance* . When we lift our arm against the force of gravity we do work whether it is lift a bundle or to wave at a friend or to gyrate to music. If a body is sustaining itself as an energy system it maintains cells, provides new materials for growth (anabolism), loses energy as heat through the skin principally, and according to the activity uses additional calories.

Type of Work	Additional Calories/Hours of Work
Light	50 Calories
Moderate	50Ð100 Calories
Hard	100Ð200 Calories
Very Hard	200 Calories or more [4]

Essentials of Diet

Any diet that is sensible for the human organism would seem to require the important foodstuffs, *carbohydrates* , *proteins* , and *fats* . In addition, *vitamins* and *minerals* must be provided to act as catalysts and co-enzymes that enable vital chemical processes to take place in the cells' energy producing structures, the *mitochondria* . *Roughage* adds bulk to the flow of food through the digestive system. *Water* is absolutely necessary since all these processes in the cells can take place only when the materials are in solution and since the body is 65% *water.*

When we discuss diet, especially with the young, we should distinguish between hunger and appetite. *Hunger* is the complex condition that is accompanied by vigorous contractions of the empty stomach, a feeling of emptiness in the abdomen, and a general discomfort that cannot be localized. *Appetite* is the craving for a certain food or drink which can be satisfied quite easily. [5]

Worldwide Diet

With these facts we can now approach modern "diets". The world as a whole has a diet that can be broken down in this way:

Cereals	56%
Roots and tubers	7%
Fruits and vegetables	10%
Sugar	7%
Fats and Oils	9%
Livestock and fish	11% [6]

The average adequate diet in the Far East is 2,300 calories; in North America, 2,700 calories. Climate is a factor. Physiologists give an average figure as 2,400.

Proteins in Particular

In addition, protein intake must be emphasized since it is absolutely necessary for body growth and maintenance. The needs of the body for protein vary with age.

Age	Grams/kg Body Weight (Kg = 2.2 pounds)
3-5 Years	3.0 grams
5-15 Years	2.5 grams
15-17 Years	1.5 grams
Above 21 Years	1.0 grams [7]

These depend on the quality of protein consumed and the requirements of the individual for an active and healthy life higher but " . . . in the early sixties nutritionists in the U.S. recommended (for adults) 60 grams including at least 10 grams of animal protein as the minimum *level of intake.* " [8]

Worldwide Problems* in *Diet

The condition that occurs when a person (especially a child) is deprived of calories, high-quality protein, or both, is called malnutrition. Protein-calorie malnutrition affects from one-half to two thirds of the children under five in poor countries (Eckholm and Record, 1976, Telliffe, 1973) and an estimated ten to twenty million people, mostly children, die from protein-calorie malnutrition and its associated diseases each year. . . .Also, "Severe malnutrition in early childhood can stunt the physical and intellectual development of children that survive past the age of five." [9] One modern problem of nutrition has arisen in the area of infant nutrition. A great concern has been felt recently because breast feeding is on the decline in the poorer countries of the world. Commercial companies have distributed sample formula preparations to introduce them to new mothers. When the mothers use these, the stimulus of nursing is eliminated and lactation ceases. The expense of the commercial preparations is often too high for the young mothers. Also in these areas the water for reconstituting the formula may be contaminated and illness and death sadly follow. Another problem is that nursing mothers ordinarily have longer times between pregnancies, a natural means of lowering population figures, and a benefit that is eliminated by the formula use. A boycott of censure has been instituted against the Nestle's Company, one of the major manufacturers of these formulas. A code restricting this abuse was passed by the U.N. in May, 1981 and voted for by every country in that body except the United States, which voted against it, viewing it as a restriction of trade.

So we see that diet and accompanying energy production in the body is a worldwide concern for this and future generations. Many factors encourage us to re-examine our diets.

1. Expense (especially in an inflationary period).

2. The need to reduce ecological stress caused by increased food production.
3. Health reasons
a. Relationship between fattier meats and coronary heart disease. (This) encourages the use of less beef and pork and more poultry.
4. Economic reasoning that some foods use up many more resources to produce and therefore cost more. [10]

Many scientists believe that we could work out an adequate diet for the entire world population if the major part of the diet were cereals balanced by legumes. The legumes would provide the necessary protein.

This type of diet does not have appetite appeal or cultural acceptance in many areas of the world. In addition, many nations do not even have the means to afford this dietary balance because of their extreme poverty. Ideal distribution of the nutrients would be extremely difficult. If the rate of population growth continues to increase, the output of these nutrients would have to keep doubling. The natural resources necessary to promote that output would lead to environmental degradation.

ENERGY AND THE CITY

History

In some societies today, and in agricultural populations in earlier days, food and other needs of man were provided by nature and the input of energy from the human body. Thus, a primitive person or a farmer might be able to supply his needs by expending 2,000 calories a day. With small populations and arable land that might seem ideal. In some simple farms of today the yield is virtually as high as 20 calories to 1 invested. Complications developed when populations either increased or did not share what could produce crops or support livestock. Always before, when the land could not produce, the population would relocate; but now, the “new” land is no longer available. Seventy percent of the land is unsuited to agriculture. [12]

As man began to relocate he found that by living together he could accomplish many endeavors better. Aggregates developed, clans, tribes, small villages, towns, and finally cities emerged. The city is a recent entity in the time line of man. The Greek city-states flourished only 3,000 years ago. Now we study the social phenomenon of the city in many ways, including environmentally.

Changes In Energy Use

Primitive farmer	2,000	Calories/Day
Add fuel (wood) for cooking, heat 1	2,000	
Add coal, steam engines (1860)	70,000	
U.S. in 1975 using electricity,	235,000	

appliances, private cars and
industry. [13]

Until 1968 we were able to control prices of fuel because the United States was a large producer of our favorite fuel, oil. At that time we announced that we had reached our limits of output. Since then we have had to import oil from countries that do not consider us their friends. OPEC was formed. Even the “Majors”, the great oil producing and processing companies could not deny these oil producing countries their choices to realize greater profits from their natural resources or to control the rate at which those resources would be diminished. The economic pressures made the United States face the Energy Crisis.

Energy And The City

A city can be viewed as an energy “cell”. How does this energy reach the city. By ships, trains, trucks, pipes and wires it flows in to keep the city alive. The city lifestyle demands it and gives off waste products to prove its consumption. What forms of energy are used in city homes, apartments, industries, businesses, restaurants and transportation? What effects does the city dweller’s energy consumption have upon his environment? How can he conserve for economy and health? Does he really have any control?

The Picture In Connecticut Cities

Net energy consumption in Connecticut in 1978 ran up a fuel bill of 2.8 billion dollars, almost 60% for petroleum products, 9% for natural gas, 32% for electricity. Connecticut spent $889 per person compared to $1,013 which is the national average. [14] The electricity portion can be divided into the major fuels for its generation, in units called B.T.U.’s (British Thermal Units). A British Thermal Unit is the amount of heat required to raise the temperature of one pound of water one degree Fahrenheit at 39° F. In 1978 the amounts of each in trillions of B.T.U.’s were:

*One B.T.U. = .252Kcal

Petroleum Products	122.51
Coal	0.00
Hydro	3.61
Natural Gas	0.00
Nuclear141.90 [15]	

Since then, two of the three operating nuclear plants have been inactive frequently, and the percentages of the others have increased. Obviously, Connecticut’s dependence on the dwindling and erratic flow of petroleum products, of which 77.6% originates in OPEC countries, will continue to be a burden to Connecticut’s cities. [16] The effects of the Iranian Hostage Crisis and the wars and unrest in the oil producing countries are accompanied by increased worldwide demand for and export limitations of oil. New discoveries have not kept pace, and the intervention of Saudi Arabia to hold down the price and keep the flow of petroleum products available to the United States is a support subject to many perils. The increased oil prices have been a major factor in the inflation that is plaguing the wage earners of our cities. Oil supplies *propane* , *gasoline* , jet *fuel* , *heating oil* , *motor oil* , and *road tar* as well as many *valuable chemicals.* Connecticut and its cities have no control over this problem. Our nuclear fuel, on the other hand, is mined in Colorado, Wyoming and Louisiana. It is also a non-renewable fuel, uranium. Our Northwest Energy Company has contracts until 1985, so it is a dependable source until then. [17] Natural gas supply has decreased since 1973 but the industry forecasts increases and in 1978 its price was 16% lower than oil. [18]

Closer To Home

We have sited our energy mix figures, but the real effects occur with different impact levels depending on several variables. These include whether the house is owned or rented, if rented, whether the fuel bill is included or separate from the rent. Many city-dwellers live in public housing, and in that case and in some other rent situations, the authority in charge may control the temperature at which heat is delivered by setting a central thermostat.

The average wage level in the city may allow less funds for insulating the city households, less money for the newer cars that represent conservation of fuel, but many families have used their own labor, and subsidies for improving the fuel tradeoffs in their homes, and have increased their use of mass transit, happily available for city people, and many are walking more and driving less.

Household Hints

Householders, landlords, housing authorities of state, city and federal housing alike can benefit from efficient insulation, replacement of broken doors and windows, light walls in the buildings, and using lower limits on the thermostats. We are accustomed to room temperatures above 68° F but except in the aging a lower temperature can be equally healthful. Above all, in the area of space heating, everyone who touches the thermostat should know the limits agreed upon in the home or business, and understand the benefits of energy saving in dollars and cents. Individuals paying electricity bills can turn off unnecessary lights, stop preheating ovens, use cooler water for washing and bathing, use dishwashers and stoves only when filled to capacity, keep refrigerators closed and eliminate frivolous appliances.

City Waste Materials , Whose Responsibility ?

The city is often criticized because of the pollution emitted by its factories and buildings and the rubbish that sometimes litters its streets. The public must remember that the city is the meeting place of humanity, often where it works, carries on commerce and recreates, and many of the polluters and litterers leave the city and return to calmer, safer, and less polluted environments.

Citizen Participation

Many neighborhoods have united to clean up their area, the cities of Connecticut have been carrying on campaigns to boost civic pride. The song and slogan, “Look what we got, here in New Haven” resounds on the television and around town. The city also has the voters to influence the vote of its representatives, and they should use that power in the city and in the state and nation.

ENERGY AND THE FUTURE

History

The United States attempted to implement an energy policy in 1977 under President Carter. America had reached a use of 235,000 calories per person per day. America had summoned seemingly limitless supplies of energy for its needs.

> The American megalopolis of superhighways, hermetically sealed buildings and shopping malls enclosed in artificial climates seems almost designed to squander energy in the unconscious belief that it can never run out.

> But it can. The oil and gas that make up about three-quarters of America's fuel were created in finite supply millions of years ago. At the rate they are being burned, they will begin playing out sometime around the year 2000 give or take a decade or so.

This article in *Time* , April, 1977, forecast closed factories, and cold, dark homes unless our government mastered the problem. It continued:

> Americans will be asked, possibly even ordered to conserve energy by insulating their homes and factories. They will have to pay gradually increasing fuel bills, pay higher-and-higher gasoline taxes, drive smaller cars, perhaps breathe air polluted by coal fumes, take first steps toward using solar energy to heat at least their water and learn to cope with the perils of nuclear power. [19]

Update

In the past four years most of these predictions have come true. However, a real energy policy has not been developed. Some of the suggestions at that time were in the following areas:

1. Conservation—This has been attempted. For example, insulation of homes encouraged by tax credits and money-saving incentives has saved measureably and more can be done.
2. Coal Usage—James Schlesinger, the energy chief at that time was quoted as saying that we had enough coal available for 400 years. Although this may be true problems in converting equipment from oil and gas fuels have deferred its use. Also, coal creates undesirable pollution as a side effect of its use.
3. Auto Efficiency—Cars were ordered to achieve an average of 20 miles per gallon by 1980. This goal has effectively been reached by smaller, lighter, fuel-efficient cars. A goal of 27.5 miles per gallon is set for 1985.
4. Natural Gas—The chief problem was its limited availability and the inequity in prices between the gas producing states and other consuming states. Price decontrol is now being effected in this area.

ENERGY AND THE CITY PERSON STRATEGIES

Even the best laid plans go awry. However, a battery of alternative approaches to a subject and diversified activities are more likely to catch the fancy of the student. According to his talents and philosophy, an individual teacher may use any, all, or none of these strategies. Others are suggested in the books in the teachers' bibliography, and of course every teacher has some that are ideal for his situation. The one criterion that is necessary for success is that the student must be able to see himself as part of the scenario. Learning cannot take place without motivation and if the student sees himself affected, stimulation to learn is more likely to occur.

The people in this country are very weight conscious, for good reason, since the lifestyle and abundance of calories available in all forms are conducive to overweight. Fortunes have been made in fad diets as well as in sensible weight reduction. The Scarsdale, high protein lecithin, water, and no-carbohydrate diets may be suspect to some, but people flock to try them. Diet clinics and behavior modification groups flourish. The youthful figure is the universal goal. Most students are aware of this and are culturally influenced to strive for sliminess, but their home backgrounds and readily available fast foods tip the scale against them. Many of the young have adopted extreme means to curb weight gain. At the same time, the environmental impact of highly processed, expensively packaged and widely distributed foods plus the economic pressure to overproduce is difficult to measure. However, the result is that the United States has a population ten to twenty percent overweight on the average in a world where food is the number one energy shortage. This leads to the first scenario, *YOU AND ENERGY* .

After discussing the human body as an energy system, a model for a system should be established with the divisions of Input, Work, Output (both desirable and undesirable). This model will be used in the second section of the unit *ENERGY AND THE CITY* to analyze the city as a system and other systems used in the city, home and industry.

A review of the history of energy usage and recent attempts to control its use will be examined with the emphasis on the particular problems of non-renewable sources. The newspapers will be monitored for new federal, state and city measures in energy control. At the end of the unit each student will be asked to write a position paper of one page or more on what he would like to see in his energy future. *ENERGY AND THE FUTURE* .

The filmstrip series, *The World of Energy* , from the National Geographic Educational Services will be used as a vehicle for continuity throughout the unit. No more than one strip will be used each week in conjunction with activities relating to the strips.

LESSON PLAN I

THE HUMAN CELL: AN ENERGY SYSTEM

Objectives:

1. To understand the common features of animal cells.

2. To recognize the functions of life common to all cells.

3. To relate these functions to a model of an energy system.

Introduction:

When you feel tired or haven't had food to supply your body's needs you say you feel like you don't have any energy. What do you do to get rid of this feeling? You have to rest and replenish the energy to 30 to 100 trillion cells. 30,000,000,000,000 cells. These cells are complete little systems that work together to make your body go. We will now learn the parts of a cell and their functions (jobs).

Procedure:

The words on the board are some parts of a cell. We will use some of them more than once. Place list on board.

List

A. *Three major parts of all animal cells*

Cell

Cell Membrane

Cytoplasm

E.R. (Endoplasmic Reticulum)

Golgi Body (Apparatus)

Lysosomes

Membrane Proteins

Microtubules

Mitochondria

Nucleus

Proteins

Ribosomes. *Free* and on *E.R* .

Pinocytosis (methods of taking)

Phagocytosis (in materials)

(figure available in print form)

Label: Organelles of the Cell:

(figure available in print form)

Questions

1. Can this cell exists without anything coming in? Why or why not?
2. What would happen if nothing left the cell? If the waste products remained, what would they do to the cell? Is this a form of pollution?
3. What does the cell need to survive? Reproduce? To grow?
4. Could this cell exist without other cells? Why or why not?

5. What do the mitochondria supply that the cell needs to do its work?
6. How can cells get rid of waste materials?
7. How can the body get rid of waste materials?
8. How can the world get rid of waste materials?

THE CELL AS AN ENERGY SYSTEM **:**

Input:	solid _______	Fuel. Potential energy in chemical form.
	gas _______	Unites to "burn" fuel.
	liquid _______	Chemical activity only occurs between materials in solution.
Cell Activity:	_______	Breaking down of complex substances.
	_______	Building up of new substances.
	_______	Combination of the two.
	_______	Necessary to do work.
Output:	_______ Materials produced to be used in other parts of the body.	
	_______ Solid, liquid and gaseous materials that must be disposed of by the body eventually.	

LESSON PLAN

A DAILY DIET

Objectives:

1. To learn to plan a balanced diet for a day appropriate to different individuals.
2. To promote awareness of calorie values of different types of food.
3. To recognize foods that provide different nutrients: carbohydrates, proteins, fats, vitamins, minerals and water.
4. To recognize concept that weight should be lost sensibly.

Motivation:

Displays of various figure types.

Procedure:

1. Students are divided into groups of three.
2. Each group is given a card with a picture of a different type of individual. (Different age, weight, body type, etc.)
3. Each group is to plan a diet for a day from the charts on pages 17, 18, 19 in *Liberty* , *The Support of Life* .

Instructions:

1. Find the number of calories necessary for your individual for a day.
2. Divide the number into number for each meal.
3. Each member of the group should plan one meal.
4. Groups should hand in their one-day menu at end of class.

Follow-Up:

Teacher should mention that in seeking for a good figure people may deprive their bodies of necessary input for their energy systems *and* may endanger their physical and emotional health. Three exceptional examples are the following disorders:

1. *Anorexia Nervosa*— A severe problem with deep psychological roots where the patient never thinks she is thin enough, and eventually cannot force herself to eat. It is very difficult to treat.
2. *Bulimarexia*— A disorder often found in strong-willed, ambitious women and girls who eat large amounts of food and vomit it. (From *bulimia*— craving for large amounts of food.
3. *Ketosis*— Ketones released into blood stream sometimes causing light-headedness and weakness.

LESSON PLAN

DEVELOPMENT OF AN EXPERIMENT

Objectives:

1. To learn the steps of the scientific method in a real situation.

2. To develop powers of observation.

3. To learn the difference between an hypothesis and theory and law.
4. To attempt to construct an experiment to test a possible explanation, eliminating all but one variable.

Teacher Preparation:

Teacher brings in glass enclosed anemometer which has paddles dark on one side and reflective on the other. It should be placed in a sunny spot. She asks the students for any possible explanation of why the paddles move since nothing appears to touch them through the glass. The teacher calls the possible answer a hypothesis. Then she follows this method of development.

1. State the hypothesis.
2. Ask student to devise an experiment to test the hypothesis.
3. List all necessary materials.
4. List steps of procedure.
5. Try the experiment, writing down all observations.
6. Repeat the experiment, noting any variations.
7. Formulate a theory.
8. Teacher explains the universality of this way of dealing with a question *scientifically* . Differentiation between hypothesis, theory, and law can be introduced.

Follow Up:

Ask the students to do a of the experiment so that another student can duplicate it exactly, using the following headings:

1. Purpose

2. Materials

3. Steps of procedure

4. Observations

LESSON PLAN

FORMS OF ENERGY

Objectives:

1. To establish a visual image of potential and kinetic energy to which students can refer. 2. To emphasize that energy changes forms but it is not lost. 3. To learn to recognize specific forms of energy, such as: light, sound, heat, electrical, chemical, etc.

Teacher Demonstration and Motivation:

1. The teacher places a book on a high cupboard and asks, “How much energy does this book have?” The answers may be derisive but it allows the teacher to present an easily remembered visualization of *potential energy* (stored energy or energy of position). The teacher knocks the book down. It hits the floor with a loud bang (explosion of sound). As the book falls the energy of position is changed to kinetic energy (energy of motion), and that energy is greatest as it hits the floor where the energy is lost in an inelastic collision in the form of heat and sound. With a little discussion the students perceive that when energy is lost it usually is really converted to heat (a form of energy).
2. Set up various electrical appliances: iron, radio, television, blender, or beater. Should be examined to ascertain what electrical energy produces. Motors should be checked to see if any heat is also produced. Is the appliance 100Z efficient? What work does the appliance perform for man? How did man do it before the appliance was invented?
3. A group of students should be assigned to research the fuels used for generation of electricity in the *State Energy Advisory Board’s Report* .
4. *Teacher Demonstration of Chemical Energy* . Teacher can show any chemical reaction that exhibits release of energy, e.g. 1/2cm of magnesium ribbon into test tube containing 5cm of diluted hydrochloric acid. KEEP FAR ENOUGH AWAY FROM STUDENTS FOR SAFETY AND CLOSE ENOUGH FOR VISIBILITY.

Interpretations:

What Form of Energy *?*

Teacher shows or mentions:

a. Stretched elastic band
b. Rock dropped into water
c. Candy bar
d. Raised arm
e. Laser beam in science fiction movie
f. Fireworks
g. Waterfall *At top* ?
At bottom?

What About Sunlight ?

What About Nuclear Energy ?

LESSON PLAN

THE CITY ENERGY PICTURE

Objectives:

1. To bring the city's energy picture into the classroom.

2. To teach students to analyze what they see on film.

3. To encourage students to speak their minds about their own environment.

Motivation:

Suppose you were going to make a simple filmstrip on slide show and cassette. First, we'll watch one that is professionally produced, Second, for each slide you will write down a comment about that slide,

Procedure:

1. After watching the strip ask for the students' comments.
2. Ask how they could present the city energy picture by slides photographed around their city.
3. Ask which sites could they suggest to photograph.

Follow-Up:

Pictures should be taken by class "photographer" or teacher (if necessary). Show slides and develop verbal comments of students into paragraphs to accompany slides and make a cassette to be played with the slides by having different students read the paragraphs.

YOU AND ENERGY : ACTIVITIES

Activity I—The Other Worlds

Another *display* should present the picture of starvation in the third, fourth and fifth world, emphasizing the plight of the young. *Short essays* (one page) could be assigned to learn the food situation in various countries of the world, and possible answers to their specific problems.

Activity II—The World Food Picture

Graphs should be prepared from tables of data from writings on the food crisis in the world, the distribution of food in various countries, percentages of various nutrients in regional diets, and comparative population growth.

In association with the graphs an illustration of the dilemma of the imbalance in the world food supply can be utilized. The teacher makes up four different color coupons, each color in a number equal to her number of students. One color represents arable land, one represents food production technology, one represents low population and one represents wealth. She places varying amounts of coupons in sandwich bags (one for each student). Some bags should have only one coupon, several should have three. and at least one should have twenty or more. She then places a box of cookies on the front table and says it represents the entire food supply in the world, and in order to receive any a student must present four coupons of one or more colors. Students should be asked to think of possible solutions to the problem. *EAT THE COOKIES AFTERWARDS.*

Activity III

Growth Game : *The Effect* of *Exponential Growth*— Procedure: Give each student a copy of the checkerboard, some rice from a five pound bag of rice. Direct them to place one grain of rice in the first square, two in the next, four in the next, etc. Ask them to estimate how much rice they will need. Allow them to start the board. They will be quickly faced with the problem of running out of room. Ask them to relate this to the problem of increasing population and increasing food needs. Go through the doubling until they are impressed by the enormous number and explain that if the number of grains were doubled 64 times, they would have to use more grains of rice than exist in the world.

(figure available in print form)

This activity is a variation of Source: Energy and Earth, The Jefferson County Schools. Jefferson County, Colorado, Printed in *Something Special for Teachers* . Seed, Tenneco, Inc. Public Affairs Department, Houston, Texas, 1980.

ENERGY AND THE CITY: ACTIVITIES

I. *Values Clarification Activity*

Of the following, rate five A. Absolutely necessary	A=4
B. Necessary	B=3
C. I hate to give it up, but I can	C=2
D. Easy to give up.	D=1

1. Trip to New York _______
2. Bike riding _______
3. Blowdryer _______
4. Chewing Gum _______
5. Watching T.V. _______
6. Dishwasher _______
7. Deodorants _______
8. Streetlights _______
9. Soda _______
10. Fruit _______
11. Hot Water _______
12. Flush Toilets _______
13. Makeup _______
14. Walking _______
15. Roller skating _______
16. Air Conditioning _______
17. City parks _______
18. Ironed clothes _______
19. Plastic Containers _______
20. Rock Concerts _______

1. Each student should pick an activity.
2. Construct a visual representation of each for number of A's, B's, C's and D's assigned by class.
3. As a group, construct a bar graph for class average value for 1-20.

II. ***FOOD BAG GAME***

This is a game in which foodstuffs are brought in by students and put in a brown paper bag, e.g. vegetables from the garden, fruit from California, tea bags packaged in a metal container, chewing gum. Students are to rate each article from 1-5 in four categories of energy consumption.

Item Distance from Origin Processing Packaging Renewability #

QUESTIONS:

Are any of these foods "junk" foods?

Are any of these stimulants?

Are any of these foods "prestige" foods?

Which ones demand the highest price in energy?

FINISH THE CLASS BY EATING THE FRUIT!

III. HOME QUESTIONNAIRE

DO YOU OWN YOUR HOUSE? ___ RENT YOUR APARTMENT? ___

1. Is your furnace in your house? ____
in another building? ____
2. What kind of fuel do you use?
oil ____
gas ____
electric heat ____
other ____ What kind? _______
3. What kind of stove do you have? oil ____
gas ____
electric ____
wood ____
4. Is your building well insulated? Yes ____ No ____
Do you have storm windows? Yes ____ No ____
5. How old is your furnace? 1-5 ____ years
6-10 ____ years
10-15 ____ years
15-20 ____ years
20+ ____ years
6. About how many square feet of house area do you heat? ____If you don't know, answer next two questions. How many rooms? ____ Large rooms? Yes ____ No ____
7. If you rent, is your heat included in the rent? Yes ____ No ____
8. Have you had a rent increase this year? Yes ____ No ____
9. If you buy your own fuel, how much has it increased in price? For instance, in 1980-81 my oil went from $1.04 a gallon to $1.38 a gallon, down to $1.22 in June.

September March June

_______ _______ _______

10. Do you drive a car? _______

11. Do you have a refrigerator? _______ Toaster? _______ TV _______
Hair dryer? _______ Curling Iron? _______ Washer? _______
Dryer? _______ Other? _______

12. Where do you think you lose the most heat? DOORS? ____ WINDOWS? ____ BADLY BUILT HOUSE? ____ ROOF? ____ OTHER? ____

13. Who controls the heat in your house? One parent? ____ All adults? ____ Everybody in the house changes the thermostat?

V. Car Use *Survey*

This may be done at a toll booth gate on any convenient major traffic avenue at commuter hours. A comparison of the data on how many passengers each car carries within a period of 15 minutes may be converted into a graph.

VI. *Skill Development*

Students learn to read a meter and an electric bill.

VII. *Media Watch*

1. List of commercials on energy on T.V.

2. Cartoons on energy.

3. Articles in paper, particularly on federal program on energy.

ENERGY AND THE FUTURE : ACTIVITIES

I. *Comparative Energy Chart* (Information to be collected from filmstrips)

(figure available in print form)

II. *Time Line*

Make a time line showing approximately when man first used each of the energy sources and when they are expected to run out (if they are).

III. Reports—What Would You Do If?

1. Electricity were off for a week?

2. No oil or gas was available for a week?

3. You were running a temperature?

IV. *Position Papers*

One page on students feelings about the energy picture and what they would like authorities to do about it and what people in general should do.

Notes

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2. Morrison, P. 193.
3. Morrison, p. 195.

4. Morrison, p. 194.
5. Morrison, P. 198.
6. Brown, Lester P., By *Bread Alone* , P. 24.
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8. Brown, *By Bread Alone* , P. 29.
9. Miller, G. Tyler, Jr., *Living In The Environment* , P. 158.
10. Brown, By *Bread Alone* , P. 197.
11. Miller, Pp. 160-161.
12. Brown, P. 77.
13. Stobaugh, Robert and Yergin, Daniel (eds.) *Energy Future* , P.10.
14. Connecticut Energy Outlook, Connecticut Advisory Board,1979.PP 42-44.
15. *Connecticut Energy Outlook* , Table 11, P. 28.
16. *Connecticut Energy Outlook* , Table X, P. 41.
17 *Connecticut Energy Outlook* , P. 19.
18. *Connecticut Energy Outlook* , P. 49.
19. *Superbrain's Superproblem* , *Time* , April 4, 1977, Pp 58-64.

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___. *Something Special for Teachers* , Houston: Schoolhouse Energy Teaching Program, Tenneco, Inc., 1981. Some good lesson plans developed from energy company and teacher resources.

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Tuve, George L., *Energy, Environment, Populations and Food,* New York: John Wiley and Sons, 1976. 40 page appendix of excellent statistical tables on resources and their use for analysis and comparisons.

Filmstrip Series

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Liberty, Gene, *The Support of Life* , Amsco School Publications, Inc., New York: 1975. Chapters 1-4 are high interest, low reading level and activity oriented materials.

Mongillo, John F., et al., *Reading About Science* , Volumes A-F, New York: McGraw-Hill Book Co., 1981. These simple texts are prepared for graduated lower reading levels and include many simple activities and exercises.

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