THE APPLIANCE EXPLOSION

Adapted from the NY Energy Education Project

Overview: Students collect data on the number of appliances owned by students and adults, and construct a bar graph to show changes in appliance use over time.

Objectives:

Students will be able to:

- Conduct a survey
- Collect and record data
- Construct a bar graph
- Interpret results

Student will understand:

- Today's homes have many more appliances than the homes of a generation ago.
- The kinds of appliances used today are different from the kinds used a generation ago.
- One reason for this increase in appliance use was the ready availability of "cheap" energy between 1945 and the early 1970's.
- There are appliances that are essential and others that are nonessential to the well-being of the family.
- Increased use of solar energy can reduce reliance on fossil fuel and electrical energy in the home.

Time:

- One class period to present background information and to give the assignment on the survey and floor plans.
- One class period to tabulate class frequencies, complete the class floor plan, and construct bar graphs.
- One class period to discuss results.

Subjects: Home Economics, Social Studies, Science

Suggested Grade Level: 4–5 or 5-10

Materials: Student sheets (included)

Precautions:

- Some parents may regard this activity as an invasion of privacy. A statement to parents of the activity's purpose, along with permission slips to be signed by parents, is suggested.
- It may be necessary to give students several days to complete the assignment. The survey is long.
- Substitute a different floor plan if the one given is not appropriate for the socio-economic level of your students.

PREPARATION & BACKGROUND

Advance Planning

- Review background information to prepare for class discussion.
- Duplicate survey, floor plans, and Home Appliance Use sheet for distribution to students (each student should receive two floor plans).
- Collect store catalogs for students to use to look up appliances with which they are unfamiliar.
- Collect materials for the Appliances Use Display.

Background

Today the world faces an energy crisis. As of 2007, ninety-three percent of the energy consumed in today's world comes from fossil fuels. But fossil fuel reserves are being used at a tremendous rate and new resources are not being discovered to keep pace. It is estimated that at current rates of use, our known reserves of petroleum will run out in thirty years and natural gas in twenty. Coal may last several hundred years more, but there are serious environmental problems associated with increased use of coal. Even uranium for nuclear fission is in short supply.

As a result, petroleum and natural gas have become much more expensive and people are recognizing the need to conserve, both to save money and to direct valuable resources to other needs. The United States, especially, has much room for conservation; five percent of the world's population consumes twenty-five percent of the world's resource production each year.

Twenty-one percent of the energy used in the United States is consumed in the home. Of this, 47% is for heating, ventilation, and cooling; 24% goes to lighting and appliances; 17% for water heating; and 12% for all other uses of energy. When considered as a nationwide total, residential energy consumption becomes a large factor, and conservation of home energy can lead to substantial reductions in energy use.

Table 1 shows the per capita increase in domestic energy consumption since 1950.

TABLE 1
Domestic Energy Consumption Per Person

Year	Total energy consumed (in millions of BTUs)
1950	229
1960	251
1970	334
1980	346
1990	340
2000	352

Source: Energy Information Administration, *Energy Perspectives: 1949-2002,* http://www.eia.doe.gov/emeu/aer/ep/ep_frame.html

The Appliance Explosion

Residential electrical energy use grew at an average rate of 2% per year from the 1950's to the late 1970's. It is easy to see that the rapid increase in home appliance use found in this activity contributed substantially to this growth rate.

Over the past few years, much research has gone into finding and exploring renewable sources of energy, including solar and wind energy, hydropower, and biomass conversion. The total amount of energy produced by the sun is tremendous, much more than we could possibly use. So the sun is being investigated as a potential source of unlimited, clean, and safe energy.

Table 2 indicates how energy use is distributed in the home. Replacement of the energy used in some of these functions by renewable energy would result in substantial conservation of fossil fuel resources.

The easiest areas in which to utilize renewable energy are space heating, water heating, and air conditioning, which make up a substantial proportion of the total. Solar water heating has been shown to be cost effective even in the northern states. Woodburning stoves can provide an auxiliary means of space heating that is also cost effective at today's oil prices.

Replacement by renewable energy of the fuels used to power electrical appliances and lights is not yet a viable alternative, since photovoltaic cells, which convert solar energy directly to electricity, remain very expensive to produce. However, it is expected that their cost will fall substantially in the next few years with new techniques for manufacturing and mass production.

TABLE 2
Residential Consumption of Energy

Space Heating	47%
Lighting & Appliances	24
Water Heating	17
Other	12

Source: Energy Information Administration
http://www.eia.doe.gov/kids/energyfacts/uses/residence.html

SUGGESTED APPROACH

1. Discuss the background information with the class.

2. Explain how the activity will be carried out.

3. Have students carry out the activity and collect data as a homework assignment. Data will include numbers of appliances owned by students and adults.

4. Have an individual student or committee of students create the Appliance Use Display.

5. If necessary, give students instruction in constructing bar graphs.

6. Discuss the results and implications of the activity as a class.

7. A blackboard can be used to compile class frequencies of appliances. An alternative approach could be to assign different groups to tabulate different appliances. If this method is used, it would lessen confusion if student surveys or floor plans were collected, copied, cut into sections, and then the sections distributed to the various groups for tabulation and construction of graphs. These graphs could then be displayed in the room.

FOR DISCUSSION

1. Which appliances are listed most frequently by both students and adults? Which ones are listed least frequently?

2. What will happen in the future to energy supplies if energy use continues to increase in this way?

3. Use a brainstorming technique to discuss how solar energy can help reduce fossil fuel and electrical energy consumption in the home.

4. Discuss ways in which energy can be saved by judicious appliance use.

TYPICAL RESULTS

- Most students will find that they have at least twice as many appliances in their homes as people did a generation ago.

- Results for class frequencies will vary depending on the appliance and the number of students in the class.

ASSESSMENT

1. Observe students' skill in carrying out the assignment, completing the survey, recording data, compiling statistics, and graphing and interpreting data.

2. Check the quality of students' answers to questions.

3. Ask students to group appliances into essential and nonessential categories. Have them explain the reasons for their choices.

MODIFICATIONS

1. If class time is short, some sections of this activity, such as the floor plan or bar graphs, can be eliminated or completed as homework.

2. Analyze the number of kilowatt-hours used by various electrical appliances.

3. Give students an energy budget of a certain number of kilowatt-hours they can use daily and discuss how they would allot their budget. Refer to transparency A23 for electric appliance energy requirements. Cut the students' daily allotment. Now how would they spend their energy budget?

4. If your students feel uncomfortable about talking about their home appliances, then create a collage of old appliance vs. new appliances or interview a grandparent or older adult and compare appliances of different decades.

RESOURCES

The following websites have information about consumer appliances:

- http://www.ase.org/section/topic/appliances/
- http://www.eere.energy.gov/consumer/your_home/appliances/index.cfm/mytopic=10020

The Appliance Explosion

Approximately twenty percent of the energy used in the United States is consumed in the home. Energy is used in many ways: to heat, cool, and light your rooms; to heat water; to refrigerate and cook your food; to wash and dry your clothes; to entertain you; and to aid in personal care. How many appliances do you have in your home? Can you even guess the number? Do you know where the energy that runs these appliances originates?

Most of this energy comes from fossil fuels, either oil or natural gas, burned in your home by your furnace or hot water heater. The energy consumed in the home may also be produced from oil or coal burned at a power plant to produce electricity. In a few locations, energy may originate from hydropower or nuclear power plants that also produce electricity.

In this activity, you will discover the number and kinds of appliances you have in your home. You will compare this information with the appliances an adult had in his/her home a generation ago. Your results should help you understand the important role that energy plays in your life, and why energy demand has increased so much in the last twenty years.

Objectives

At the completion of this activity, you should be able to:

1. Identify the appliances used in the home today and one generation ago;
2. Explain why the number of appliances used today differs greatly from the number used by adults when they were children;
3. List appliances that could be eliminated from the home in an attempt to conserve energy; and
4. Construct a bar graph to show changes in appliance use over a period of time.

Skills and Knowledge You Need

1. How to conduct a survey
2. How to do basic arithmetic
3. How to construct a bar graph
4. How to set up a display

Materials

- Home appliance Survey
- Typical House Floor Plan sheet or Typical Apartment Floor Plan sheet (two)
- Construction paper and materials for an appliance use display
- Home Appliance Use sheet
- Calculator (optional)

PROCEDURE

1. Scan the list of appliances on the Home Appliance Survey. If you are not familiar with some of the appliances, consult your teacher or look them up in a store catalog.

2. Take the survey and floor plan sheets home. Under Column 1 of the survey, record the number of each kind of appliance you have in your home.

   a. For example:

	1	2
Donut Maker	0	
Radio, Clock	2	

   b. Be sure to check for appliances in each room, in closets, and even areas outside the home, such as the patio or carport.

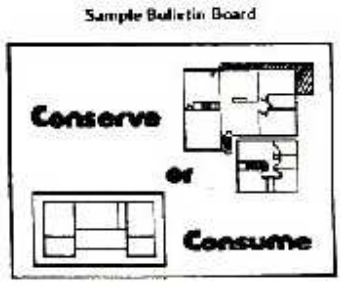
   c. Add any appliances not on the list to the blank spaces that are labeled "Other."

3. Now ask one of your parents or another adult to complete the survey.
   a. The adult should complete the survey in Column 2.
   b. The adult should complete the survey by listing the appliances found in his/her home when he/she was the age you are now.
   c. Record the year that the adult was your age.

4. Total the number of appliances in column 1 and then column 2.

5. Using the first Typical House or Apartment Floor Plan sheet, place the name and number of each appliance you found in your home in the room where it was located. For example, on the floor plan of the kitchen area, write the words "refrigerator—1."

6. Using the second floor plan sheet, ask the same adult to write the name and number of appliances he/she indicated on the survey in the room where the appliance would have been located.



7. Several students in the class should create a bulletin board for the classroom or display area. Some title suggestions are:
   - Appliances of Yesterday and Today.
   - Home Energy Use—Past, Present, and Future?
   - Conserve or Accumulate?

   The bulletin board should have two large floor plans of a house like the smaller floor plans that students and adults have completed. If some students live in houses and some in apartments, you'll have to combine the information from both kinds of homes into one floor plan.

8. On one of the larger floor plans, tally and record the kinds and total numbers of appliances that were found in all students' homes during the survey. Each appliance should be listed in the room where it was located. For example:

   On the kitchen area of the large floor plan, write "Mixer, electric 21" to indicate that 21 students found an electric mixer in their kitchens.

9. Using the second large floor plan, tally and record the total numbers and kinds of appliances listed by the adults who completed the appliance survey.

10. Using the results of Steps 8 and 9, complete the sheet on graphing home appliance use. Select any 10 kinds of appliances to graph.

11. Construct a bar graph that compares the numbers of appliances for class members with the numbers of appliances owned by the adults at a corresponding age.

QUESTIONS

1. How does the total number of appliances you use today differ from the number of appliances used by an adult when he/she was the age you are now?

2. Why do you think the numbers differ so greatly? What kinds of changes have taken place to make this possible?

3. Make a list of the appliances which you simply could not live without and another list of the ones which you could eliminate from your home. Why did you decide the way you did?

4. Which appliances were found in the homes of today which were not in the homes of people one generation ago? How do you feel people managed without these appliances?

5. Solar energy is also a possible energy source. Can you think of some ways solar energy could replace or reduce the fossil fuel energy used by appliances in your home?

LOOKING BACK

Were you surprised by how many appliances your home has? When you compare this number with how many an adult had in his/her home a generation ago, it should help you understand how much the demand for energy has grown. But the United States now faces a continuing "energy shortage." Perhaps you can begin to think of ways to conserve energy at home by reducing or eliminating nonessential appliance use.

EXTENSIONS

1. Trace appliance use back one more generation. Have a grandparent or older adult fill out the survey. Find the total number of appliances used. Compare this to your totals for a younger adult and for your own home. Tabulate class frequencies if data are available.

2. With your family's agreement, plan ways to reduce both the number of appliances and the length of time appliances are used. Then implement this plan from one utility meter reading to the next. Was your family able to reduce the amount of energy consumed?

3. Keep a daily log of the number of ways you use energy from the time you get up until the time you go to class. Can you reduce this energy use? How?

4. Research information on the Energy Guide labeling requirements for major appliances. Visit an appliance store or invite a guest to speak on this topic.

5. Create a floor plan for the home of the future. For each room list the appliances you predict you will own twenty-five years from now. Do you notice any changes?

6. Invite other classes, parents, and friends to view your display and observe the type and numbers of appliances that were used in the homes of the students and adults who completed the survey.

7. Graph the class averages for each item on the Home Appliance Survey. Compare data in Column 1 to data in Column 2.

Home Appliance Survey

DIRECTIONS: In Column 1, write the number of each kind of appliance you have in your home. Then have an adult fill in Column 2 for when he/she was your age. Total the number of appliances listed for each column.

	1	2		1	2
Air Conditioner, Central			Air Conditioner, home Unit(s)		
Automatic Bag Sealer, Electric			Automatic Egg Cooker		
Baby Bottle Warmer			Battery Charger, Electric		
Blanket, Electric			Cell Phone Charger, Electric		
Broiler, Electric, Portable			Blender		
Bun Warmer, Electric			Broom, Electric		
Can Opener, Electric			Calculator with Adapter		
CD player			Coffeemaker, Electric		
MP3 player			Cookie Maker, Electric		
Clock, Electric			Crepe Maker		
Defroster for Refrigerator			Dehumidifier		
Desktop computer			Disposer, Food Waste		
Dishwasher			Laptop Computer		
Door Bell, Electric			Dryer, Clothes (Electric/Gas)		
Drill, Electric			DVD player		
Fan, Electric			Fingernail Buffer, Electric		
Floor Waxer			Fondue Pot, Electric		
Food Dryer, Dehydrator			Food Processor		
Food Slicer, Electric			Food Warmer Tray		
Foot Whirlpool, Electric			Freezer, Independent Unit		
Fryer, Deep Fat, Electric			Frypan, Electric		
Furnace (Electric/Oil/Gas/Wood)			Garage Door, Electric		
Griddle, Electric			Game Boy		
Grill, outdoor (Electric/Gas)			Guitar, Electric		
Hairbrush, Electric			Haircurlers, Electric		
Hair Curling Iron, Electric			Hair Dryer (Standing/Portable/Blower)		
Hamburger Maker, Electric			Heater, Room, Electric		
Heating Pad			Hedge Trimmer, Electric		
Hot Dog Cooker, Electric			Hot Pot, Electric		
Humidifier			Ice Cream Maker, Electric		
Ice Crusher, Electric			Intercom		
Iron, regular or Steam			Kiln, Ceramic, Electric		
Knife, Electric			Knife Sharpener, Electric		
Lamp, Standard			Lamp, Heat		
Lamp, Sun			Night light, electric		

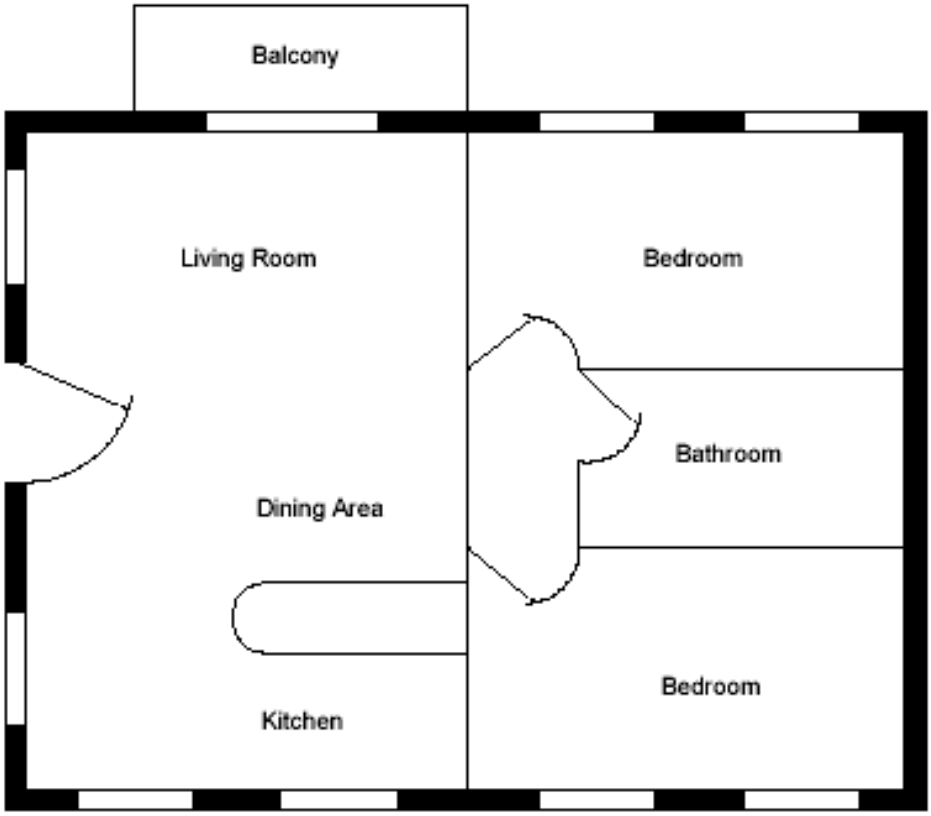
Lawnmower, Electric			Lawn Edger & Trimmer, Electric		
Light, outdoor Lawn			Light, Indoor Night or Ceiling		
Massager Electric			Manicure Set, Electric		
Mirror, Lighted for Make-up			Meat Grinder, Electric		
Organ, Electric			Mixer, Electric		
Oven, Portable			Oven, Dutch, Electric		
Peanut Butter Machine, Electric			Oven Toaster		
Pencil Sharpener, Electric			Peeling Wand, Electric		
Popcorn Popper, Electric			Pizza Maker, Electric		
Projector, Movie			Portable Buffer Ranges, Electric		
Radio, Clock			Projector, Slide		
Range, Kitchen Electric/Gas			Radio, Standard		
Router, Electric (Tool)			Rotisserie		
Sander, Electric			Rug Shampooer		
Scissors, Electric			Saw, Electric		
Shoe Polisher, Electric			Sewing Machine		
Soldering Kit, Electric			Slow Cooker, Electric		
Television			Tape Recorder, Electric		
Toaster			Thermostat (Oil/Gas)		
Train Set, Electric			Toothbrush, Electric		
Vacuum Cleaner			Typewriter, Electric		
VCR			Vaporizer		
Waffle iron			Washing, Clothes		
Water Heater (Electric/Oil/Gas)			Water Pik		
Whirlpool, Electric			Wok, Electric		
Woodburning Set, Electric			Yogurt Maker, Electric		
Other_____			Other_____		
Other_____			Other_____		
Other_____			Other_____		

Year in which the adult was your age: _____

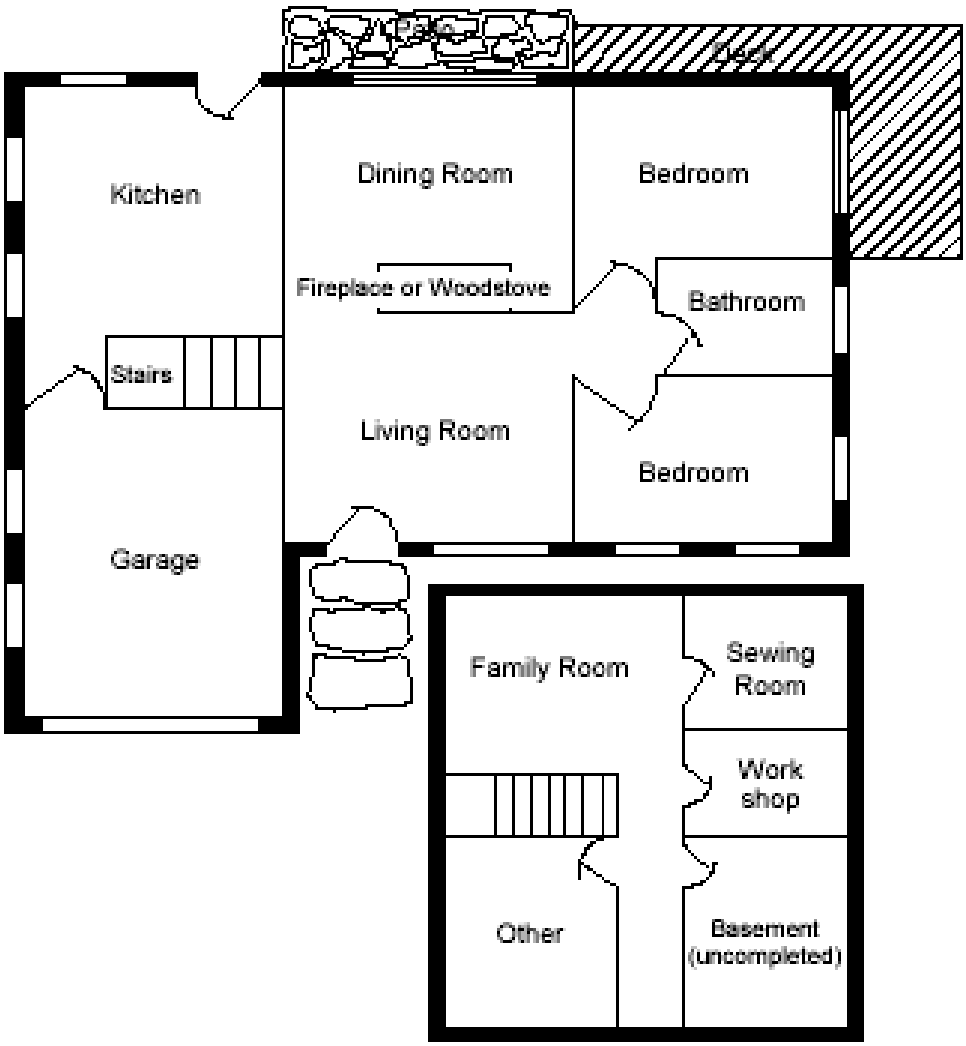
Total of Column 1 _____

Total of Column 2 _____

Floor Plan of a Typical Apartment



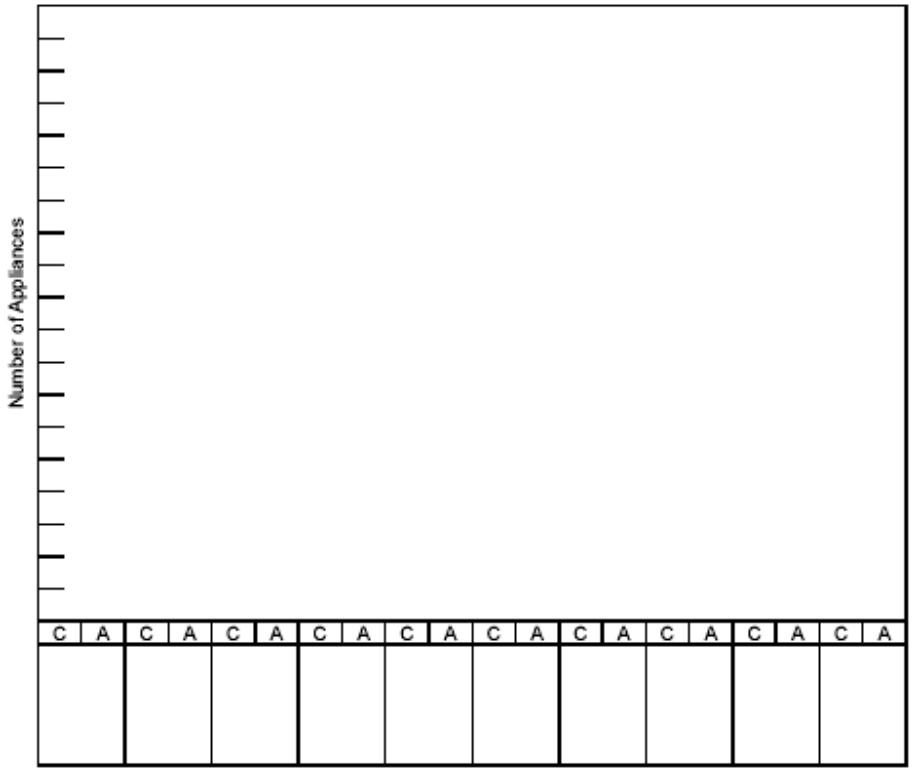
Floor Plan of a Typical House



Home Appliance Use

DIRECTIONS

1. In the ten spaces at the bottom of the graph, write the names of ten different appliances.
2. Using the large floor plans on the class display, observe how many class members and adults owned each of the appliances.
3. Decide on what would be an appropriate number scale for "Number of Appliances" and fill in the numbers to make the scale.
4. Above each of the ten appliances, mark the number owned by class members and the number owned by adults. Draw bars to represent these numbers.
5. You could do this exercise on the computer using spreadsheet software like Excel.



Y axis: Number of appliances

C = Class

A = Adult