Teaching Guide

Electric Bill

Stephen Bannasch
Ted Hall
Adeline Naiman

Acknowledgements

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A Microcomputer Program for the

Apple and TRS-80 Model III and Model IV Computers

Foreword

Electric Bill is one of a series of programs developed during the summer of 1981 in
a project coordinated by the National Science Teachers Association, Project for an
Energy Enriched Curriculum (PEEC) and Technical Education Research Centers (TERC),
with funding from the U.S. Department of Energy. The project involved teachers and
student programmers. The goal of the project was to develop sophisticated software
dealing with various topics in energy studies. The pilot programs were widely tested
in schools across the country and revised in the spring of 1983. This software is designed
to be used in school curricula in a variety of applications. Some of the programs
are best used in the classroom, while others may be used in resource rooms, computer
rooms, and possibly in the home. These materials are particularly appropriate for
grades 9 through 12, though they may be used with older and younger students. The
activities can last for a number of weeks or class periods depending on the teacher.

Other programs in this series are these:

Temperature Grapher	This program utilizes two temperature probes connected to the Apple computer game-paddle input. It is an excellent addition to a science laboratory.
Home Energy Savings	This is a game that illustrates the economics of various energy-conserving home improvements.
Power Grid	This is a game in which the student has responsibility for the operation of a mix of power-generating facilities. The object is to meet consumer demand as efficiently as possible.
Energy Conversions	This program shows how to make conversions from one energy unit to many other types of energy units.
Personal Energy Inventory	This program allows for a wide range of data analysis of students' personal energy use.

All programs are available for Apple* and TRS-80* Model III and Model IV computers
with the exception of Temperature Grapher, which is available only for the Apple.

* Apple and TRS-80 are registered trademarks, respectively, of Apple Computer Co.
and Tandy Corp.

Summary of Electric Bill

This program allows students to learn about the calculation of electric bills by different utilities. Students are presented with a menu and encouraged to follow through on all of the choices in the program. First, they learn about the parts of an electric bill, including a description of a sample rate structure. Once they have learned the basic information about an electric bill, they are encouraged to try to figure out a sample bill. The next option is for students to test themselves with questions about bill calculation. Finally, they may input their own rate structures and check their individual electric bills. By using several different rate structures, students can compare the cost of electricity either from different user categories or from different utilities.

Objectives of Electric Bill

Upon completion of this program, students should be able to—

1. List and explain all the parts of an electric bill.

2. Calculate the sample electric bills in the program.

3. Answer the questions in the "test yourself" option.

4. Calculate their own electric bills correctly.

5. Demonstrate an understanding of the rate structures used by utilities.

Background Information

Electricity is a major portion of our energy use in the United States. Some of the energy we use comes to us at fairly constant rates, such as gasoline and heating oil at a certain price per gallon. Other forms of energy are sold according to rate schedules that depend on the amount of energy we use (in particular, gas and electricity). For most consumers, the rate structure on the electric bill is sufficiently complex to be ignored. With the use of this program, students (and consumers) can understand the computation of the electric bill, both in a general sense and specifically for their own electric bills.

Using the Program

The program offers the following options in order for the student to learn more about electric bill computation:

1. HELP - this option gives the objectives of the program. It also explains what each of the other options does and generally directs the student through the program.

2. TUTORIAL - this option guides the user through all of the sections of a sample electric bill. The student's attention is directed toward the billing period, previous reading, present reading, kilowatt-hours (kwh) used, and amount to be paid. The student is also shown a sample rate structure that includes the fixed block amount, as well as the steps in the rate schedule.

3. TRY AN EXERCISE YOURSELF - this option gives students an opportunity to check their ability to figure out the electric bill. Opportunities are given to submit answers. If the answer submitted is incorrect, the student will be asked to check the arithmetic and/or the logic needed at the time. Paper, pencil, and if possible, calculators are required fo this option.

4. TEST YOURSELF - this option presents the student with five situations. For each situation, the student is asked to determine the kwh usage and the total amount to be paid. Since there two questions for each situation, the student will be graded on the basis of ten questions. Paper, pencil, and if possible, calculators are required for this option.

5. CHECK YOUR OWN ELECTRIC BILL - this option allows students to type in the necessary data from their own electric bills or any other rate structure for the purpose of checking their electric bills or comparing them with the same kwh usage under the rate structure of another utility.

6. END THE PROGRAM - this option allows the student to stop working on the program.

Teaching Strategies

Electric Bill can be used in a number of teaching situations. In a math class, the program can be used as either an in-class exercise, or more likely, as an independent project for students. There are many computations within the program that will reinforce basic math skills. In science classes, Electric Bill is useful in teaching about the rate structure of different energy commodities. Students will learn specifically about electric rates, but this can be extended to include other utility rate structures, such as those used in billing for natural gas and water. You may want to discuss the differences among various rate structures, including the possibility of flat rates for electricity.

Time Required

Students can complete all the parts of the program in one or two 45-minute periods. Additional time should be allowed for follow-up questions and discussion.

Extending the Lesson

1. Have the students research the rate structures of the local gas utility or water utility for comparison with the electric billing structure.

2. Several differential rate structures have been proposed in order to reduce demand during hours of peak use of electricity. Have students research these new rate proposals and present the ideas to the class.

3. Have the students call the local electric utility to obtain all of the rate structures (industrial, commercial, and residential). Calculate the cost per kwh for quantities as low as 100 kwh and as high as 6000 kwh for each of the rate structures.

Follow-up Questions

1. Using the calculation of your own electric bill, answer the following:
   a) Approximately what percent of your bill is the "fuel adjustment charge"?
   b) What is the average cost per kwh?
   c) If you had used another 300 kwh of electricity for your household, how would this affect the cost per kwh?
   d) If you cut your electric use in half, what is the total bill?
   e) What is the cost per kwh in (d)?

2. Explain the advantages of using a rate structure like the rate structure now used by utilities. Explain the disadvantages.

3. How would a "flat rate" structure affect the average bill of the following:

   a) a small consumer (a single individual living in a low energy-use dwelling)?

   b) a large household consumer (a big family with many appliances and electric heat and hot water)?

   c) a large industrial consumer?

4. Suppose that the utility changed its rate structure so that electricity used during peak hours (8 a.m. to 10 a.m.; 3 p.m. to 6 p.m.) was five times more expensive than electricity used during other times of the day. How would this change--

   a) your own personal habits?

   b) the use of electricity by your family?

   c) the use of electricity by commercial and industrial users?

Sources of Information

The public relations or education department of your local electrical utility can provide a great deal of information about electricity.

Starting the Program

This program is available for use with Apple II, II+, IIe, and Radio Shack TRS-80 Model III and Model IV computers. Write HRM Software regarding availability of the TRS-80 Model I version. Be sure that you have the correct version of the program for the computer you are using. Follow the directions below to begin the program.

For all Apple II computers

1. Insert the disk into the disk drive. If you have two drives, use Drive 1.

2. Turn on the video screen and the computer.

3. Wait for the program to load, and as soon as directions appear on the screen, start the program as directed.

4. If you have any problems starting the program, check with a qualified person.

For TRS-80 Model III and Model IV computers

1. Insert the disk into the lower disk drive, close the drive door, and turn on the computer.

2. Wait for the program to load, and as soon as directions appear on the screen, start the program as directed.

3. If you have any problems starting the program, check with a qualified person.