

Activity: How Much Does It Cost to Light Your School?

(Information courtesy of the American Coal Foundation)

Overview:

Students compute the cost of electricity used to light their classroom and their school for various lengths of time. They then compute the amount of coal needed to produce the electricity used for one hour of light in their classroom.

Objectives:

Students will:

- calculate the cost of providing electricity to light their classroom and school,
- compute the amount of coal needed for one hour of light in their classroom, and
- gain an appreciation for how much coal is needed to generate electricity.

Materials:

Paper and pencil

Classroom and school lit by fluorescent bulbs

Discussion Questions:

How is your classroom lit?

Where does the electricity come from to power the lightbulbs in your classroom?

How much do you think it costs to light your classroom for one hour?

Procedure:

Begin by explaining to students that coal is used to produce more than half of the electricity consumed in the United States. Tell the students that they will use their computation skills to gain an appreciation for how much it costs, and how much coal is used, to light their classroom and school.

Tell the students that the electricity needed for the fluorescent tubes used to light most classrooms costs approximately three-tenths of a cent per hour. Write this fact on the blackboard for use in calculating. (The actual costs range from two-tenths of a cent to four and one-half cents per hour, depending on the locale.) Ask the students if they can figure out how to calculate how much it would cost to light their entire classroom for one hour. Explain that they can count the number of fluorescent tubes in the classroom (N) and multiply that number by .003 (or three-tenths of a cent). The answer is the total dollar cost (C) of lighting the classroom for one hour.

$$N \times .003 = C$$

Students can then compute the daily cost (DC) of lighting the classroom by multiplying C by the number of hours per day the classroom is lit (H):

$$C \times H = DC$$

Complete other calculations for lighting the classroom for the week, month, and year. Then have the students compute how much it costs to light the entire school for the day, week, month, and year. (Students will need to find out how many fluorescent tubes are in the school. They can estimate this by multiplying the number in their own classroom by the number of classrooms in the school.)

Explain to students that it takes approximately 1 ton of coal to produce 2,500 kilowatt-hours (kWh) of electricity (or 1 pound of coal to produce 1.25 kilowatt-hours). Write this fact on the blackboard or display it on the overhead projector. Explain that a kilowatt-hour is the unit of electric power used by 1,000 watts of energy for one hour. Tell them that the average fluorescent tube uses 18 watts per hour or .018 kilowatt-hours of power per bulb. Ask them if they can determine how to calculate the amount of coal needed to light their classroom. Remind them that 1 ton of coal can produce 2,500 kilowatt-hours of electricity, and that 1 pound of coal can produce 1.25 kilowatt-hours of electricity. Ask them to figure out how much coal (n) it takes to produce only .018 kilowatt-hour.

$$1 \text{ ton} : 2,500 \text{ kWh} = n \text{ ton} : .018 \text{ kWh}$$

(or 1 ton is to 2,500 kWh as "n" tons is to .018 kWh)

OR

$$1 \text{ lb.} : 1.25 \text{ kWh} = n \text{ lb.} : .018 \text{ kWh}$$

(or 1 pound is to 1.25 kWh as "n" pounds is to .018 kWh)

$$n = .0000072 \text{ ton or } .014 \text{ lb.}$$

This is the amount of coal needed to light one fluorescent tube for one hour. Students can now multiply this number by the number of tubes in the classroom (or school) to figure out how many tons of coal are needed to light the classroom (or school) for one hour.

Conduct a class discussion about the calculations. Were the students surprised by how much it costs to light their classroom or school? Were their findings more or less than they thought they would be? Did they have any idea how much coal was needed to provide electricity for fluorescent tubes? Tell them that regular lightbulbs use significantly more electricity (on average .075 kWh/bulb). Even though fluorescent tubes cost more to purchase, they are more economical in the long run, because the electricity

needed to light them costs so much less. Encourage students to think about how much coal might be needed to provide light for their whole town.

Assessment:

Have the students work in small groups to document their findings. Then have them prepare a letter to the principal. The letter should include their assessment of the costs and the amount of coal needed to light the school, as well as their recommendations for ways the school might lower its lighting costs.

Extension:

Encourage students to look at their family's electric bill. Have them take note of the cost of electricity per kilowatt-hour and compare that to the \$.003 used in these calculations. Do they know whether the electricity they use at home is generated by coal? What other source might it come from? Where is the power plant that generates their local electricity?

Differentiation:

This same activity can be conducted with younger students, in a more visual way. Point to one fluorescent bulb and tell them that in order to keep that one bulb lit for one day (approximately 10 hours, including before and after school hours) it costs approximately three cents. Show them three pennies. Then have them count the number of bulbs in the classroom. Write that number on the board or overhead projector. Then, have them compute or count (depending upon their grade level) how much it would cost to light all of the bulbs in the classroom for one day. For extra credit, have them figure out how much it would cost to light all the bulbs for the entire week.