Classroom Comfort and School Lighting Audit

Objective:

Students will calculate energy use and costs based on real world data.

National Energy Foundation

Materials and Curriculum Correlations

Introduction

In this activity, students will conduct a lighting survey of their school and estimate the amount of money that could be saved by turning lights off for an extra 30 minutes a day. As students will need to leave the classroom to do parts of this activity, you may need to alert your building administration.

Procedure

1. Speak to your school custodian to find out the wattages of the various bulbs used in your school. You may want to have a custodian bring some bulbs and show them to students before they begin the audit so that they can identify the bulbs when they see them throughout the building.
2. Instruct students on how to read a light meter, thermometer and hygrometer.
3. Produce the student sheets. You may also want to provide copies of a map of the school to students. Decide which locations in the school you will allow students to visit. Decide if the entire class will stay together or if you will break students into teams. If using teams, consider whether you need additional adult supervision.
4. Provide students with copies of "School Lighting Audit" and allow time to complete the building audit.
5. Assist students as needed in their calculations.

To Know and Do More

6. Find out how much electricity your school used last month. Calculate your school's primary carbon footprint. Multiply the number of kilowatt-hours times .81 to get the approximate greenhouse gas emissions caused by the electricity used by your school.
7. Write an action plan for your school to reduce your electricity consumption and shrink your carbon footprint.

Materials Needed:

- Calculator
- Student sheet
- Hygrometer
- Light meter
- Thermometer

Curriculum Correlations

4-PS3 - 2
4-PS3 - 4
5-PS1 - 3
5-PS1.B
5-ESS3 - 1

MS-PS2 - 3
MS-ESS3 - 3
MS-ESS3.A
HS-PS1 - 3
HS-PS3.B

HS-ESS3 - 1
HS-ESS3 - 2
HS-ESS3.A
HS-ESS3.C

▶ Student Sheet

School Lighting Audit

National Energy Foundation

In this activity, you will conduct a lighting survey of your school and estimate the amount of money that could be saved by turning lights off for an extra 30 minutes a day.

Step One: Collect Data

Record temperature, humidity and light levels for each room in your school that you audit. Record in the spaces provided.

To calculate how much electricity your school uses to run the lights, you need to know the type of lights and wattages. Fill in the chart below to collect this data. Your school may not have all of these places, so just fill in the chart for those that you have. Blank spaces are provided for additional areas of your school not listed. Some spaces may have more than one type/wattage of light, so multiple lines are provided for you.

Area of the School	Room Comfort	Bulb Type	Number	Wattage	Total Wattage
Classrooms (Survey one classroom and use it as an estimate for all the classrooms in the school.)	Temperature	Incandescent			
	Humidity	Fluorescent			
	Light level	Other (halogen, CFL, LED, etc.)			
Total Number of Classrooms		Multiply by Classroom Wattage		Total Classroom Wattage	
Hallways	Temperature	Incandescent			
	Humidity	Fluorescent			
	Light level	Other (halogen, CFL, LED, etc.)			
Library/Media Center	Temperature	Incandescent			
	Humidity	Fluorescent			
	Light level	Other (halogen, CFL, LED, etc.)			
Cafeteria	Temperature	Incandescent			
	Humidity	Fluorescent			
	Light level	Other (halogen, CFL, LED, etc.)			

Area of the School	Room Comfort	Bulb Type	Number	Wattage	Total Wattage
Office	Temperature	Incandescent			
	Humidity	Fluorescent			
	Light level	Other (halogen, CFL, LED, etc.)			
Gymnasium	Temperature	Incandescent			
	Humidity	Fluorescent			
	Light level	Other (halogen, CFL, LED, etc.)			
Auditorium	Temperature	Incandescent			
	Humidity	Fluorescent			
	Light level	Other (halogen, CFL, LED, etc.)			
Additional Spaces to Audit					
	Temperature	Incandescent			
	Humidity	Fluorescent			
	Light level	Other (halogen, CFL, LED, etc.)			
	Temperature	Incandescent			
	Humidity	Fluorescent			
	Light level	Other (halogen, CFL, LED, etc.)			

Step Two: Calculate

Electrical energy is measured in kilowatt-hours. Follow the procedure below to calculate the energy used by the lights in your data table. Use a separate sheet of paper or a spreadsheet on the computer.

1. For each fluorescent tube (not CFLs), add 5 Watts to the wattage you recorded in your data table. This represents the additional electricity used by the ballast. Different types of fixtures have ballasts that use different amounts of electricity but this is a good average.
2. Multiply the number of lights times the wattage of each light for each line of your data table to get the total wattage. Record this information. Add the incandescents, fluorescents, CFLs, LEDs and other lights' wattages together to get a total wattage for the classroom you surveyed. Record this number.
3. Multiply the total wattage for your sample classroom by the number of classrooms in your school. Record this number as the total classroom wattage in the data table.
4. Repeat step 3 for the other areas of your school: hallways, cafeteria and so on. Record these numbers in the data table.
5. Add the total wattages for all of the areas you surveyed. This will be a BIG number.

6. Now it is time to convert to kilowatt-hours. First, we need to convert from Watts to kilowatts (1 kilowatt = 1000 Watts).
7. Talk to your school's custodian or make your best guess of how many hours lights are on in your school each day. Multiply the kilowatts you calculated above by the number of hours your school's lights are on. Now you have kilowatt-hours!
8. Find the cost of 1 kilowatt-hour of electricity in your area. Your school may not pay the same rate for electricity as you do at home. Ask your school district's facilities group for the rate your school pays or just make your best estimate.
9. Multiply the rate per kilowatt-hour times the number of kilowatt-hours your school uses in a day. Take the number from step 8 times the number from step 9.

Questions:

1. If your school runs its lights for 180 days (the number of days in a typical school year), how much does it cost to run the lights in your school?

2. If you reduced the hours your school's lights were running by half an hour a day, how much could you save per school year?

3. This survey produces an estimate of the electricity used for lighting your school. What are some sources of error in your data? What could be done to increase the accuracy of your estimate?

4. List other things in your school that use electricity.

5. What other ways can your school reduce the amount of electricity it uses?

6. Review the temperature, humidity and light levels of various classroom, hallways and other areas of your school. Discuss with a teacher or custodian if these readings or levels are within guidelines for a comfortable educational setting?

7. Discuss variables that affect each type of reading (e.g. season, time of day, entryways open to outside, interior entryway, etc.).

8. Graph the temperature and humidity levels in classrooms.