

Total Energy vs Total Cost

Energy Revealed
Grab & Go Activity
Grade Level 7-12



Main Objective

Learners will calculate how much energy an identified object expends.

Learning Outcomes

By the end of this activity, learners will:

- Investigate and describe relationships between humans and their environments and identify related issues and scientific questions.
- Analyze personal and public decisions that involve consideration of environmental impacts and identify needs for scientific knowledge that can inform those decisions.

Length of Activity: 2 – 3 hours

Step 1+2: Identify a school space and its devices to measure each device's power consumption in watts.

Step 3-7: Calculate watt hours, kilowatt hours, monthly kilowatt hour usage, monthly cost, and kilograms of GHGs.

Materials Required

- Laptop
- Plug in or Circuit level Energy Metering Technology
- Copies of the Total Energy vs Total Cost Worksheet

Activity

Step 1: Analyzing School Electrical Devices

- Think about an area in the school with electrical devices that you would like your learners to focus on. If you have circuit level energy metering technology an area that is being monitored would be ideal.
- Once you have identified the space ask your learners to make a list of the electrical devices in that chosen area.
- Have learners look at their list and decide which one specific device they would like to focus on.

Step 2: Find the Watts to the Electrical Device

- Have learners determine the number of watts their device uses, this can be done using your circuit level energy meter technology, or by using plug in energy meters. Alternatively, learners can look up the wattage online.

Step 3: Calculate Watt Hours

- Next, calculate the device's **watt hours**. To do this, the learners will want to multiply the unit's wattage by the number of hours they use it. By doing this they will find the watt-hours of energy used each day.
 - E.g., A typical laptop uses 50 watts when in use. If you use it for 5 hours a day the total number of watt hours is 250. (50 watts x 5 hours = 250 watt hours).

Step 4: Calculate Kilowatt Hours

- The next step is to convert the watt hours to kilowatt hours. To do this, simply divide the watt hours by 1000.
 - For our example, that would be $250/1000 = 0.25$ kWh per day.

Step 5: Calculate Monthly Kilowatt Hours Usage

- Now they will want to calculate usage over a month to find out the cost (since electric bills are based on monthly usage). Simply take the kWh per day and multiply them by 20 school days in a month.
 - For our example, that would be 0.25 kWh per day x 20 days = 5 kWh per month

Step 6: Calculate the Cost

- The last step is to figure out the cost. To do this you will need to determine how much the school is being charged a kWh. This will depend on your energy provider, but for this example let's say its 6.414 cents/kWh (based on Enmax's rate for October 2018). To get the cost, you take your total and multiply it by the energy cost.
 - For our example that would be $5\text{kWh} \times \$0.06414 = \0.32

Step 7: Calculate the Kilograms of GHGs

- Calculate the number of kilograms of GHGs produced in one year by using the formula: $a \text{ kWh} \times b \text{ kg CO}_2\text{e/kWh} = c \text{ kg CO}_2\text{e}$.
 - **Note:** b in this case is 0.82 for Alberta. This is known as the emission factor.
- **Note:** You can also use GreenLearning's Electrical Energy Calculator for your province to help calculate the kilowatt hours used in one year, the cost of electricity in one year, and the amount of GHGs produced in one year.

 [GreenLearning's Electrical Energy Calculator](#)