ENERGY CONSERVATION

Calculating Kilowatts, Cost and CO_2

> **Electricity is measured in kilowatt hours (kWh)**
>
> **1 kilowatt = 1000 watts**
>
> **kWh = kilowatts x hours the lights are on**

Let's work through an example scenario.

The Eco-Action team audited 20 classrooms at Johns Middle School. The average length of time classroom lights were left on was 7 hours per day. Watt Watchers also found that each audited room had 16 light fixtures and each fixture had 3 bulbs. According to Mrs. Ranger, the custodian, each tube is a 17 watt tube.

1. **17 watts is equivalent to how many kilowatts?** Using the conversion factor in box 1, divide 17 by 1000.

   17 watts = .017 kilowatts

2. **What are the kilowatt hours (kWh) used per room in a day?**

   .017 kilowatts x 7 hours per day - .119 kWh/day

3. **How many kilowatts hours (kWh) are used by the 20 audited classrooms in a day?**

   .119 kilowatts x 20 classrooms = 2.38 kWh/day

4. **How many kWh are used by the 20 audited classrooms in a school week (5 days) and a school month (average 21 days)?**

   2.38 kWh/day x 5 days = 11.9 kWh in a 5 day school week
   2.38 kWh/day x 21 days = 49.98 kWh in a school month

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Let's find out the cost for the kWh used by the 20 audited classrooms at Johns Middle School.

1. Go to EIA.gov. https://www.eia.gov/electricity/state/
2. Hover over your state, where a box will pop up. For this calculation, you will use the *Average retail price (cents/kWh)*.
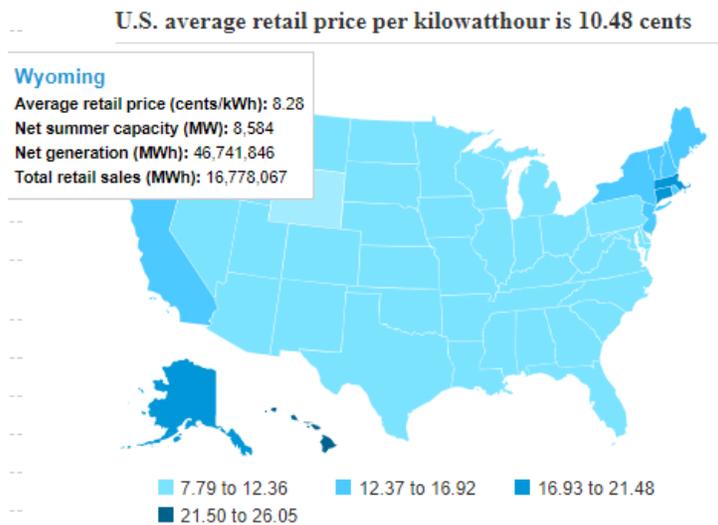
3. **To calculate the cost per room in a day, use the following equation. Refer back to page 1, number 2, if needed.**

    8.28 cents/kWh x .119 kWh = .99 cents/day.

4. **What is the total cost for all 20 rooms?**

    8.28 cents/kWh x 2.38 kWh = $19.71/day

5. **What is the total cost for all 20 rooms per school week (5 days) and school month (average 21 days)?**

    $19.71 a day x 5 days = $98.55/ 5 day school week
    $19.71 x 21 days = $413.91/21 day school month

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ENERGY CONSERVATION

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Let's calculate how many pounds of CO_2 are emitted via classroom lighting at Johns Middle School.

> **Pounds (lbs.) of CO_2 emissions = conversion factor x kWh**

1. Go to EIA.gov, https://www.eia.gov/electricity/state/ and choose your state. I chose Florida for this example.

2. Find *Carbon Dioxide* under the *Emissions* section in Table 1.

Emissions		
Sulfur dioxide (short tons)	59,864	11
Nitrogen oxide (short tons)	76,754	4
Carbon dioxide (thousand metric tons)	107,438	2
Sulfur dioxide (lbs/MWh)	0.5	31
Nitrogen oxide (lbs/MWh)	0.6	31
Carbon dioxide (lbs/MWh)	991	25

3. **First you must convert pounds per megawatt hour (lbs/MWh) to pounds per kilowatt hours (lbs/kWh).**

$$991 \div 1000 = .991 \text{ lbs/kWh}$$

4. The lbs/kWh is your state's conversion factor. Now using the formula above, the Eco-Action team can calculate the average pounds of CO_2 emissions.

$$.991 \text{ lbs/kwh x } 2.38 \text{ kWh/day for the 20 audited classrooms} = 2.36 \text{ pounds of } CO_2$$

What does a pound of carbon look like?

Actual volume of one pound of carbon dioxide gas
At standard pressure and 15 °C (59 °F) the density of carbon dioxide gas is 1.87 kg/m3 (0.1167 lb/ft3). One pound (454 grams) of carbon dioxide gas occupies 0.2426 m3 (8.566 ft3, 64 US gallons, 243 liters). It would fill a cube 62.4 cm high (24.6") or a sphere 77.4 cm across (30.5").

1 lb CO_2 gas (actual volume)