



# ENERGY CONSERVATION

## Calculating Kilowatts, Cost and CO<sub>2</sub>

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.

$$17 \text{ watts} = .017 \text{ kilowatts}$$

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

$$.017 \text{ kilowatts} \times 7 \text{ hours per day} = .119 \text{ kWh/day}$$

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

$$.119 \text{ kilowatts} \times 20 \text{ classrooms} = 2.38 \text{ kWh/day}$$

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

$$2.38 \text{ kWh/day} \times 5 \text{ days} = 11.9 \text{ kWh in a 5 day school week}$$

$$2.38 \text{ kWh/day} \times 21 \text{ days} = 49.98 \text{ kWh in a school month}$$

Go to the next page.



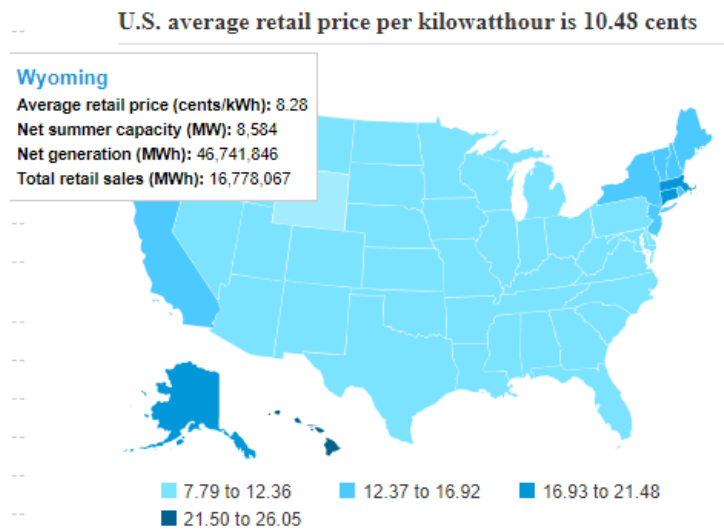
# ENERGY CONSERVATION

Calculating Kilowatts, Cost and CO<sub>2</sub>



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.

$$8.28 \text{ cents/kWh} \times .119 \text{ kWh} = .99 \text{ cents/day.}$$

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

$$8.28 \text{ cents/kWh} \times 2.38 \text{ kWh} = \$19.71/\text{day}$$

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

$$\begin{aligned} \$19.71 \text{ a day} \times 5 \text{ days} &= \$98.55 / 5 \text{ day school week} \\ \$19.71 \times 21 \text{ days} &= \$413.91 / 21 \text{ day school month} \end{aligned}$$

Go to the next page.



# ENERGY CONSERVATION

Calculating Kilowatts, Cost and CO<sub>2</sub>



## OPTIONAL

Let's calculate how many pounds of CO<sub>2</sub> are emitted via classroom lighting at Johns Middle School.

**Pounds (lbs.) of CO<sub>2</sub> emissions = conversion factor x kWh**

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

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

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

- 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<sub>2</sub> emissions.

$$.991 \text{ lbs/kwh} \times 2.38 \text{ kWh/day for the 20 audited classrooms} = 2.36 \text{ pounds of CO}_2$$

## 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/m<sup>3</sup> (0.1167 lb/ft<sup>3</sup>). One pound (454 grams) of carbon dioxide gas occupies 0.2426 m<sup>3</sup> (8.566 ft<sup>3</sup>, 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").

