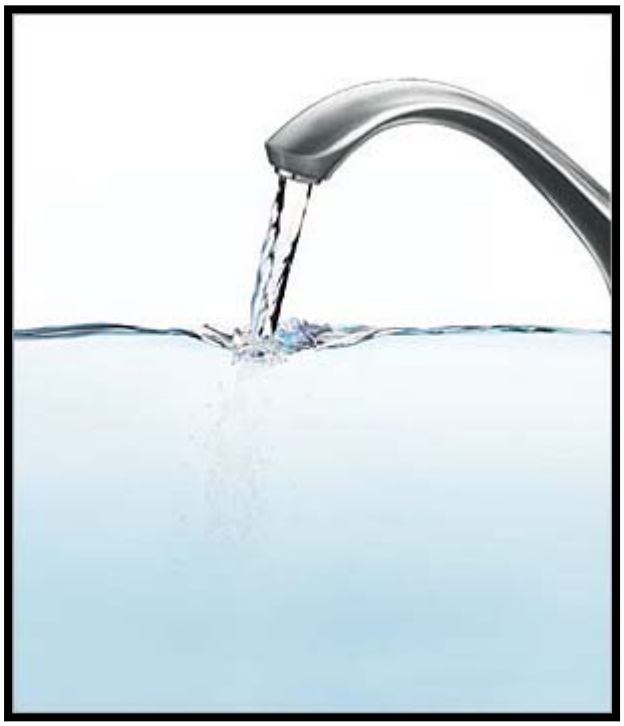
## WATER



Savings are possible by reducing water use. If you have not done so already, review the water bills for your school. Check for evidence of leaks and billing errors. Review how water is being used to identify any opportunities for savings. It also takes more energy to heat water that is coming out of the tap. Further energy savings are possible by reducing hot water use and improving the efficiency of its delivery.

It is important to look at the **system efficiency.** At some schools during warm weather, a boiler is operated simply to supply hot water. Sometimes savings can be obtained by installing a smaller, hot-water heater for use when space heating is not required. In some schools, the hot water heater is distant from the point of use. In these situations it may be possible to save by installing a second water heater close to the point of use. Heating needs can be reduced by insulating hot water pipes where they are accessible.

Another consideration to look at is the cost of different forms or **fuel sources** of energy at your school. Sometimes significant savings can be generated by switching to a less expensive fuel. For some applications it may be possible to use the sun or take advantage of heat being exhausted from the buildings or kitchen to heat or pre-heat the water.

One of the things you will be looking at when doing the water audit on the school is calculating the cost of meeting the hot water needs at your school using a gas hot water heater and an electric water heater. You will also state your assumptions regarding water heater efficiency, system efficiency, and rates.

Think about it

2.5 GPM is a magic number when it comes to showerheads. When flow rates in excess of 2.5 GPM are found, energy can be saved by changing the shower heads. Care must be taken however to be careful to use types that perform acceptably. If not satisfied, users tend to damage or remove the showerheads resulting in more energy and water use.

## BUILDING AUDIT CHALLENGE – MEASURING WATER FLOW RATES (STEP 6)

By determining how much water the school uses and the temperature of the water, you can come up with an estimate how much more it costs to use hot water, verses cold.

### Equipment and Information Needed:

1. One gallon container
2. Stopwatch
3. Thermometer
4. Water bills from the school

Find a sink somewhere in the school where you can easily place the gallon container. The water rate is going to be how fast the water is coming out of the faucet. With the **COLD** water fully on, note the time on your watch (with a second hand) and fill up the one gallon bucket, noting how much time it takes to fill in seconds.

### Outcome Required:

**1. Number of seconds to fill one gallon of COLD water: _____ seconds**

**2. Cold Water Temperature: _____ °F**

**3. Take the reciprocal** *(so if you recorded 58 seconds, the reciprocal would be 1/58)* **of the above number of seconds** (#1) **you just recorded, and multiply it by 60 to convert it to GPM = _____ GPM (Gallons Per Minute) for COLD water**

Now, you want to work with some HOT water. With the HOT water fully on, record how long (in seconds) you have to let the water run until it actually feels HOT. (Not sort of warm, but HOT).

**4. Number of seconds the water has to run to feel HOT: _____ seconds**

Once, the water is running HOT, fill up the 1 gallon bucket with HOT water, and time how long it takes to fill.

**5. Number of seconds to fill one gallon of HOT water: _____ seconds**

**6. Hot Water Temperature: _____ °F**

**7. Take the reciprocal** *(so if you recorded 58 seconds, the reciprocal would be 1/58)* **of the above number of seconds** (#5) **you just recorded, and multiply it by 60 to convert it to GPM = _____ GPM (Gallons Per Minute) for HOT water**

**When you wanted some HOT water, you had to let it run first, before it got HOT. How much water was literally "wasted down the drain" before it was the HOT temperature you were looking for?**

Again how long did you have to let the water run for before it got hot *(refer to #4)?* **_____ Seconds**

**8. Therefore, how much water was literally "wasted down the drain" before it was the HOT temperature that you were looking for?**

**( _____seconds water ran for** *(#4)* **/ 60) X _____ GPM for hot water** *(#7)* **= _____ Gallons Wasted!**

Calculate the amount of energy used to heat water at your school.
You will need to convert the temperatures you recorded in Fahrenheit into Centigrade using the formula below.

**( _____°F – 32 ) x (5/9) = _____°C** (Celsius)

**9. Temperature of cold water = _____°C**

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**10. Temperature of hot water = _____°C**

**11. Difference cold vs. hot = _____°C**

It takes 1 calorie to raise 1 gram of water 1°C and,
1,000 grams of water = 1 liter so,
It takes 1,000 calories *(or 1kcal)* to heat 1 liter of water up 1°C

If there is 2.78 liter per gallon, how many calories does it take to raise 1 gallon of water, 1°C?

2.78 liters per gallon x 1,000 calories, per liter = 2,780 calories to heat up 1 gallon of water 1°C.

**So to find out how many calories it took to raise the one gallon of water from the cold water temperature to the hot water temperature.**

**12. _____ (Difference cold vs. hot in °C***(#11)***) X 2,780 calories = _____ calories to raise 1 gallon of cold water to the hot water temperature.**

It can be estimated that about 1/3 of the total water usage in a school is heated.

**13. How many gallons of water did the school use for the total year? _____ Gallons.**
(b) **Therefore, _____ Gallons are assumed to have been heated** ***(#13 X .333)*** **.**

**14. How many total calories were required to heat all the HOT water used in the building for the year?**
**_____ Assumed Heated Water** *(#13b)* **X _____ Calories to raise 1 gallon of cold water to the hot water temperature***(#12)* **= _____ Total Calories Used For Heating Water**

**15. Convert the Calories used to heat the Assumed Hot Water into BTU's, Therms' and Kwh.**
1 BTU= 252.5 calories
1 Therm= 25,210,420.6 calories
1kWh = 860,420.6 calories

**_____ Total Calories Used For Heating Water** ***(#14)*** **/ 252.5 = _____ BTU's**
**_____ Total Calories Used For Heating Water** ***(#14)*** **/ 25,210,420.6 = _____ Therms**
***(1 Therm= .9765625 CCF)***
**_____ Total Calories Used For Heating Water** ***(#14)*** **/ 860,420.6 = _____ kWh**

**16. Depending on your results from #15, and the cost of gas, verses electricity, which would be the cheaper way to heat the water up? _____**