Tags
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17 little froggies

Energy!
Chapter 17 in the Frog book has a nice intro to energy, some of it old, some new, all of it totally frog-like.
Let's dive in:

Energy=the ability to do work
Heat=lowest form of energy-can only move molecules around
Primitive societies: fire from wood
Wood is scarce, hard to carry, and hard to light when wet or green, so...
Coal!
What is coal?
Millions of years ago, living things decomposed, some around oxygen, some without oxygen.
If a living thing is made of C H and O, and the water leaves, what is left?
Carbon (coal)
This enabled the industrial revolution to happen: burn coal, make steam, make stuff move around.
Up to this point, you had to be near a river to have a mill. With coal, you could do this anywhere you could drag a humongous pile of coal with you...
Steam can also move fans, or special fans called turbines, so you can make electric generators move (you can also do this with moving water, which is what hydroelectric power is all about).
Back to Energy.
It is measured in some pretty inventive names: Joules ("jowles" if you are British), ergs, calories (like in chemistry, or food, where 1000 cal = 1 Cal), or kWh (this one is really goofy).
Now, what is the difference between energy (the ability to do work) and power?
Power is how FAST you can do the same work.
Imagine two students climbing a ladder to the roof of the elab, 10 meters high. Both have mass 100 kg (big folks, around 220 lbs.).
One climbs up and does this in 10 seconds.
The second one takes his time, taking 100 seconds.

Here is how a physicist would calculate this:
Work = energy = mgh = 100 kg x 9.8m/ss x 10 meters = 9800 joules (same work for both)
Power is work/time, so one does it with 9800/10 or 980 Watts (this is over 1 hp, 1 hp = 747 Watts)
The second does it in ten times the time (say that fast), or 98 Watts, about enough to keep a fan running...
Check this out:
https://www.youtube.com/watch?v=S4O5voOCqAQ

Your turn: measure the time it takes to boil some water in the hot water makers. Note the Watts for each, as well as the time it takes to do this work.

What you are measuring is Watts, convert them to kiloWatts by dividing by 1000.
If you have a 1200 W heater this is 1.2 kW.
Now for the time. You have to convert it into hours, so divide seconds by 60, then again by 60 to get hours, or you can divide seconds by 3600, which is the same thing.
Multiply kiloWatts x hours to get kWh, or kiloWatt-hours.

This unit is a goofy one, created so we could measure electrical energy consumption.
Quick: which one is power and which one is energy? Watts or kWh?

Here is something interesting to ponder:
HELCO (Hawaii Electric Light Company) charges us about $0.35 per kWh.
You can estimate this as about 50 cents for most uses, since this is often the value.

So, if your roommate leaves her 1000W curling iron on 24 hours a day for 180 days of school here, how much would this cost the school? (yes, this really happened).

Back to power:
This we know is measured in Watts (named after some dead British dude).
It can also be measured in horsepower, where about 747 Watts = one horsepower (yes, that means equivalent to the power of one horse, so our climber was stronger than a horse).

The electric company, natural gas company, gasoline company and water company don't care how FAST you use their stuff (electricity, gas, gasoline or water), they just care how MUCH you used, so:
Electricity = kWh
Gas = liters or gallons
Gasoline or diesel = liters or gallons
Water = gallons
BUT
If you have a really powerful car (lots of horsepower) you will likely use your gallons of gasoline faster.
Make sense?

Our goal in conservation is to use as few joules, calories or kWh as we can.
How?
Next: Conservation.