Energy in the Home

Every month, we get the Bad News from our local electrical company. A bill comes in the mail saying that you used 900 Kilowatt Hours (kWh) of electricity last month, and that will cost you $100.00! *What is this all about?*

Definition: 1 kiloWatt hour is a unit of energy determined by multiplying the electrical power, in kilowatts, by the number of hours of use.

Example: A 100-watt lamp is left on all day. E = 0.1 kilowatts x 24-hours = 2.4 kWh. Note: At 11-cents per kWh, this costs you 2.4 x 11 = 26 cents!

Problem 1 – You and your sister fired-up your two computers at 3:00 PM, and finished your homework at 9:00 PM, but you forgot to turn them off before going to bed. At 7:00 AM, they were finally shut off after being on all night. If this happened each school day in the month (25 days):

A) How many kilowatt hours did it cost to run the computers this way for 25 days?

B) How many kilowatt hours were wasted?

C) If each computer runs at 350 watts, and if electricity costs 11-cents per kilowatt hour, how much did this waste cost each month?

D) How many additional songs can you buy with iTunes for the wasted money each month?

Problem 2 – The Tevatron 'atom smasher' at Fermilab in Batavia, Illinois collides particles together at nearly the speed of light to explore the innermost structure of matter. When operating, the accelerator requires 70 megaWatts of electricity – about the same as the power consumption of the entire town of Batavia (population: 27,000). If an experiment, from start to finish, lasts 24 hours:

A) What is the Tevatron's electricity consumption in kilowatt hours?

B) At $0.11 per kilowatt hour, how much does one experiment cost to run?

Problem 1 – You and your sister fired-up your two computers at 3:00 PM, and finished your homework at 9:00 PM, but you forgot to turn them off before going to bed. At 7:00 AM, they were finally shut off after being on all night. If this happened each school day in the month (25 days) A) How many kilowatt hours did it cost to run the computers this way for 25 days? Answer: The computers were turned off between 7:00 AM and 3:00 PM which is 8-hours, so the total time they stayed on each day is 24 – 8 = 16 hours. Over 25 days, this comes to 25 x 16 = 400 hours for each computer, or 800 hours for both. B) How many kilowatt hours were wasted? Answer: The computers were used between 3:00 PM and 9:00 PM so this is 6-hours out of the 16, so the wasted time was 10 hours each day per computer, or 2 x 10 x 25 = 500-hours of wasted 'ON' time. C) If each computer runs at 350 watts, and if electricity costs 11-cents per kilowatt hour, how much did this waste cost each month? Answer: The wasted time = 500 hours, and the total wattage of the two computers is 700 watts, so the number of kilowatt hours is 0.7 kilowatts x 500 hours = 350 kilowatt hours. At $.11 per kilowatt hours, this becomes 350 x 0.11 = $38.50. D) How many additional songs can you buy with iTunes for the wasted money each month? Answer: At $0.99 per song, you can buy $38.50/.99 = 38 songs!

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Below is a picture of Fermilab's Tevatron accelerator. The ring has a diameter of 2 kilometers.