

PHYS 2010 LECTURE 23

Power: Rate at which:

— Work is done

— Energy is converted from one form to another:

$$P = \frac{W}{\Delta t} = \frac{\Delta E}{\Delta t}$$

$$\text{Unit} = \frac{\text{J}}{\text{s}} = \text{W (Watt)}$$

⇒ 100 watt lightbulb converts 100 J of electrical energy into heat every second.

Power comes in many forms: any kind of potential energy that can be produced by (converted to) other kinds of energy does so at a rate vs. time.

Electric company sells "power" → no! It sells potential energy. The rate at which you buy it is the power.

Remember your power bill: charges you ~10¢ per kilowatt-hour:

$$1 \text{ kW}\cdot\text{h} = 1000 \text{ W}\cdot\text{hr} = 1000 \frac{\text{J}}{\text{s}} \cdot 3600 \text{ s} = 3.6 \times 10^6 \text{ J} = 3.6 \text{ MJ}$$

kW = power

kWh = energy

Power example: I climb to the 10th floor in 90 sec.
What is the power I generate that goes into my PE grav?

My mass is $\sim 86\text{kg}$ the 10th floor is $\sim 35\text{m}$ high.

$$P = \frac{\Delta PE}{\Delta t} = \frac{mg\Delta h}{\Delta t} = \frac{(86\text{kg})(9.8\frac{\text{m}}{\text{s}^2})(35\text{m})}{90\text{s}} = 330\text{W}.$$

Compare to 1 hp = 746W