# Forms of Energy & Power

Two types of mechanical energy (Kinetic and Potential) can be converted to each other.
In addition, mechanical energy can be converted into other forms, and back

- Heat (example: friction or inelastic collision, steam engine)
- Electric energy (power plants)
- Chemical and Biochemical Energy (nutrition, burning)

SI unit of Energy is Joule (J):

$$1J = 1N \cdot m = 1\frac{kg \cdot m^2}{s^2}$$

Also commonly used units are calories. One small calorie (cal) is the heat energy needed to change temperature of 1 g of water by 1°C (degree Celsius). Big Calorie (Cal) is the same but for 1 kg of water, so 1Cal is actually 1kilocalorie (1Cal-=1kcal). Those big Calories are used to describe energy content in food. 1000 Calorie diet is actually 1 mln cal. The relationship between calorie and Joule is,

$$1cal = 4.184J$$

**Power** is the rate with which energy is transformed from one form to another. For instance, it can be the work by an engine done per unit time. SI unit of power is Watt (1W=1J/s):

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

# Homework

**Problem 1**

How much energy, in Joules, do you consume with each standard serving of your favorite food (check the nutrition label)? Assuming that you need about 70,000 J to run 1 mile, what distance can you run on one serving?

**Problem 2**

Electricity pioneers Nicola Tesla and George Westinghouse have built the first hydroelectric plant in 1895, on Niagara Falls. Its power was 37 megawatt (could light about a million light bulbs) . How much power they could get, if all energy of Niagara Falls could be converted to electricity? In average on Niagara, 2,000 cubic meters of water fall from the height of 50 m every second.