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# Chapter One

A NEW BOOK BY STEVE BAER OF ZOMEWORKS

BEING SERIALIZED IN THE TRIBAL MESSENGER...

## ENERGY IN A CAR CRASH

Mechanical energy seems pathetic when it subsides to thermal energy. If you came upon a smashed automobile that had just collided at 60 mph with a concrete retaining wall, all of its kinetic energy would have recently been converted to heat. Yet, neither the car nor the retaining wall would be very hot.

The kinetic energy of an object weighing m lbs. and going v feet per second equals:

$$\frac{mv^2}{2g}$$

The car weighs 2000 lbs., it is travelling 60 miles each hour which is the same rate as 88 ft. each second. Gravity increases the speed of a falling body 32 feet a second each second that it is falling. The kinetic energy then equals:

$$\frac{2000 \text{ lbs } (88 \text{ ft/sec})^2}{(2)\, 32 \text{ ft/sec}^2}$$

242,000 foot pounds    311 BTU's

311 BTU's is very nearly the same amount of energy that falls on a foot square directed at the sun.

The 242,000 foot pounds. We could store this energy by lifting the 2000 lb. car 121 feet in the air.

The 242,000 foot pounds of potential energy then could be cashed in as kinetic energy by dropping the car 121 feet. It would reach a speed of 60 miles an hour just before it hit. When the car hits, the kinetic energy turns into heat.

"Author Drinking Beer"

## DAMS AND HYDROELECTRIC STATIONS

Look at dams and hydroelectric generating stations - they produce enormous amounts of electricity (it amounts to a few percent of the national consumption). Yet, if this energy were returned to heat the river that is passing through the turbines, it would change the temperature very little. The hydroelectric plant or the water fall is the perfect scene to compare thermal energy and mechanical energy.

A British thermal Unit, BTU, is the quantity of heat required to raise the temperature of one pound of water one degree Fahrenheit. The precise definition states that it is the heat required to raise the temperature one degree when water is at its densest, or at a temperature of 39.2 degrees F. Water takes about the same amount of heat for each degree step that it climbs in temperature, and most of our work will be within the comfortable and predictable range between freezing and boiling.

The mechanical equivalent of one BTU is 778 ft. lbs. A weight of 1 lb. lifted 778 ft. in the air has had 1 BTU invested in it as potential energy. Or, to store 1 BTU as mechanical energy we could lift 778 lbs. one foot.

Jacking up a car to change a tire requires increasing the potential energy of the car one or two BTU's. This is not the amount of work you have done - for most jacks have a great deal of friction. But it is all that you have to show at the end, for the warm parts of the jack won't do you any good. Hydraulic jacks are efficient.

After the car is jacked up we have stored perhaps one or two BTU's - lifted 1000 lbs. one foot or so.

Drink a pint of beer, a 16 ounce can. The beer is largely water and therefore will take close to 1 BTU for each one degree F. that it rises in temperature. You drink the beer at 40 degrees F. and it warms in your stomach to 98 degrees F. or 99 degrees F. which takes 58 or 59 BTUs, which is an enormous amount of energy compared to the raised automobile.

One BTU equals 778 ft. lbs. If a pound of water fell 778 feet, when it hit its kinetic energy would be converted to thermal energy and the temperature would rise one degree F. Then a dam 778 ft. high is a one degree fahrenheit dam.

Boulder Dam on the Colorado is 726 ft. high, Grand Coulee is 550 ft. high, Bridal Veil Falls are 620 ft. high. None of them high enough to heat their water one degree F. on impact.

The water going through the turbines of a hydroelectric plant can do two things - it can give its energy to the turbine wheels, then the generators and finally someone's light bulb. (Given the speed of electricity this happens very fast.) Or, if the turbine wheels were stalled, it can just churn and splash and warm up.