

With a solar hot water heater he takes long hot showers when it is sunny and feels fine about it - when it is cloudy he takes a short shower or if it continues cloudy for several days he doesn't shower at all.

Science, engineering, technology can be wonderful arts. Often they are practiced very sloppily. Much of this has to do with poor handling of equations and equivalences.

After a thousand simple equations have been employed in manufacturing and designing things they gain a kind of momentum and those involved in the design and use are reluctant to give up a good thing, namely, the simple equations, and deal with how they feel. Instead, the people feel obliged to try and become the way that the contraption or machine was designed to have them be.

ROBOTS IN COMMAND

If you doubt this notice what happens the next time you are in a store and the telephone rings. The customer who has walked in with his head and body is left standing while the business of the person who has called on the telephone is taken

care of. The hierarchy in a drive-up liquor store is usually car, telephone, human.

The equation with its balancing equals sign is a forceful invitation to our minds to jump from one side to the other. Sometimes we later find that a balance existed between relatively tiny aspects of what we believed stood on one side and the other. A story and a wordy explanation are much more trustworthy.

We hold enormous animals in fields with thin wires and relatively weak posts - later we gather them and kill them. They never understand what the wire is for - they don't break through it. The cattle won't move through our flimsy fences. We are just the opposite, we won't stop from leaping each time we see an equals sign.

P.W. Bridgeman, the American physicist and philosopher, filled his books with lengthy descriptions and explanations and very few equations. I quote a passage from his book, Dimensional Analysis:

"...we have treated the dimensional formula as if it expressed operations actually performed on physical entities, as if we took a certain number of feet and divided them by a certain number of seconds. Of course, we actually do nothing of the sort. It is meaningless to talk of dividing a length by a time; what we actually do is to operate with numbers which are the measure of these quantities. We may, however, use this shorthand method of statement, if we like, with great advantage in treating problems of this sort, but we must not think that we are actually operating with the physical things in any other than a symbolical way."

EVAPORATING WATER

It takes 1 BTU to raise 1 pound of water 1 degree Fahrenheit.

It takes about 1000 BTUs to boil away or evaporate 1 pound of water.

A quart of gasoline gives off about 30,000 BTUs when burned. Burning a quart of gasoline could boil away about 4 gallons of water. It could also boil away about 12 gallons of alcohol and about 25 gallons of gasoline. Water is very reluctant to evaporate. When water condenses it gives back the 1000 BTUs used in evaporating it. Clouds, which are made up of condensed droplets, are gigantic heat dumps. As clouds grow, heat is released.

If the oceans were gasoline we could expect to have much more gasoline rain than we now have water rain. Gasoline evaporates and condenses so much more easily.

BURNING A QUART OF MILK

The calorie content of 1 quart of milk is about 660 kilocalories or 2640 BTUs. About 1/10 the calorie value of 1 quart of gasoline.

BOOKS

Dimensional Analysis
P.W. Bridgeman
Yale Press, 1922

Energy and Society
Fred Cottrell
McGraw Hill, 1955

End of Chapter