to turn windmills. And with these new sources of energy he developed an advanced agricultural society and the beginnings of commerce and industry.

Finally, in the middle of just the last century, the fossil-fuel age began, and the advanced industrial society we know today was made possible.

In hindsight, however, it is clear that from the first man expected, and may still expect, too much of the fossil-fuel epoch. Everyone alive today was born years after this epoch began. We were born into it, as we were born into the constants of rain, sunshine and the tides. Understandably, therefore, we tended to more or less expect it to go on forever.

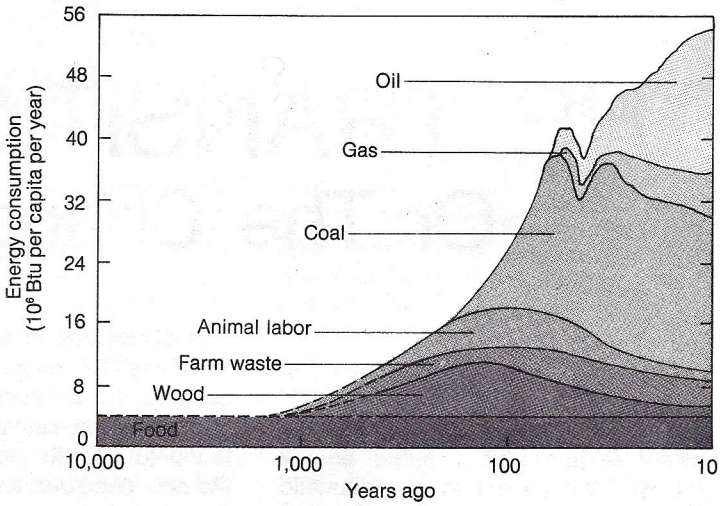
Just how unrealistic these expectations are is indicated by a paper written by Dr. M. K. Hubbert of the U. S. Geological Survey, Department of Interior. "It is difficult," Dr. Hubbert observes, "for people who are living now, and who have become accustomed to the steady, exponential growth in the consumption of energy from fossil fuels, to realize how transitory the fossil-fuel epoch will eventually prove to be when viewed over a significant span of human history."

Dr. Hubbert estimates that in a period of only 1300 years from beginning to end, man will have consumed the world's entire available supply of fossil-fuels. Further, he estimates that 80 percent of that supply—all but the first and last ten percents—will have been consumed in the incredibly short period of only 300 years.

Put another way, if we say that man's adventure on earth began some 400,000 years ago, and if that period is represented by a 12-inch rule, then 80 percent of the fossil-fuel epoch would cover only 1/9000 of an inch on the rule.

Man has already gone through several energy epochs; and the transitions have helped change his lifestyle immeasurably.

CONSUMPTION OF THE WORLD'S ENERGY RESOURCES THROUGH THE AGES



Energy inexhaustible, says thermodynamics

Lest we fall victim, however, to the despairing notion that the world will go out of business when the last barrel of oil is pumped, it is important to keep in mind during this transitional storm that there is a basic difference between an energy crisis and an energy shortage. As Edward Teller puts it, "Thermodynamics teaches us that *unlimited* energy exists. What is missing is the practical way to use this energy efficiently." In other words, the shortage is not of energy or of fuel, but of conversion technology—the "smarts" to convert available fuel into useful energy.

Given the transience of the fossil-fuel epoch and the inexhaustibility of energy itself, the challenge of the moment comes into clearer focus. First, we must do everything possible to stretch the fossil-fuel epoch to its absolute limit—thus lessening the storm's *intensity.* And secondly, we must simultaneously accelerate the development of conversion technologies that will get us into the follow-on epoch as soon as possible—thus shortening the storm's *duration.*

It sounds simple; and theoretically it is. But what is making it more difficult than need be is both a lack of public consensus and the notion promoted by some that there are other options, most particularly that there