increase efficiency tremendously, but often it adds little or nothing to total production.

We must also realize that soil, like any other resource, must be used within limits or it is destroyed. If it is used properly, it is a provider of a renewable natural resource (annual agricultural crops). However, if it is destroyed, it takes centuries to restore it. With our present rate of population growth, such restoration would be impossible.

It is true that the United States is now the breadbasket of the world, but looking to agricultural research to solve the problems of the future is keeping our heads buried in the sand. We in agricultural research should give full recognition and increased support to our co-workers in population control, because eventually our success depends wholly upon theirs.

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I agree completely with Rothschild that a program of nutrition education, coupled with wide dissemination of understanding about the best uses of America's agricultural productivity, could be very helpful as one part of the solution to the problem of world hunger.

Blackwelder and Peterson both emphasize the urgency of reducing rates of population growth. This can be humanely accomplished only by lowering human fertility, and we are beginning to learn some of the necessary conditions. There is growing evidence that the needed reduction of birth rates in the less developed countries depends, at least in part, on improving the conditions of life of the poorest 60 percent of the people and on giving them realistic hopes for the future. Most of these people depend on agriculture for a livelihood, and a large increase in agricultural production would be a major step in the right direction. Rapid population growth in many poor countries seem to be as much a consequence as a cause of human poverty and misery.

In reply to Peterson's comments about agricultural mechanization, it should be pointed out that some kinds of mechanization will increase both food production and employment. For example, irrigation water from mechanically or electrically powered wells and cultivating equipment which will allow rapid seedbed preparation often make it possible to grow a second or third crop during the year. Other kinds of mechanization do tend to reduce direct employment on farm fields, but insofar as they help to increase agricultural production and farmers' incomes, they are likely to result in more total employment in rural areas. Exactly this seems to have happened in some of the "green revolution" areas of the Punjab in India, where, by the way, the age of marriage of women rose by about 4 years, and birth rates declined by at least 20 percent during the past decade.

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Thermal Energy Units

It appears that the pressure to convert to the use of the metric system in the United States has mounted to the point where adoption is inevitable in a very few years. Many of the more vigorous proponents of conversion may not be aware of all the complexities involved. Presumably the basic reason is to provide for international interchangeability of nuts and bolts. It is inferred that the metric system is good because it is logical. That is not the case. It is good because it is decimal and because unity conversion factors exist between sundry simple units of length, volume, and weight (or mass).

It is assumed that conversion to the metric system will require that we abandon all of the more complex terms of the English system, including the important units, the horsepower and the Btu (British thermal unit). The horsepower can conveniently be supplanted by the kilowatt, and simple and obvious conversion factors to basic units such as the watt and the joule can be retained. The unit of thermal energy involves a much more complicated issue, since it is arbitrarily defined in *both* the English and the metric system and in a manner such that conversion factors are difficult to remember.

In the light of the energy crisis of today, it might be well to examine the confusion of terms which are currently employed in discussions of energy problems. The petroleum expert thinks in terms of barrels of crude oil or millions of cubic feet of natural gas. The electrical engineer thinks in terms of kilowatt-hours. The heating experts think in terms of Btu's. Scientific expressions for energy involve a bewildering array of numerical conversion factors, even within the metric system. For example, the joule equals 0.239 gram calorie, and 1 kilowatt-hour equals 860 kilogram calories (and frequently the kind of calorie is not specified). Interrelation with the English system adds more confusion: 1 kilowatt-hour equals 3413 Btu's, 1 Btu equals 251.98 gram calories, and 1 Btu equals 1054.8 joules. It is rare to find even a technically oriented person who can instantly recall these conversion factors.

If we are to change our measurement system, I suggest that we consider changing the definition of the unit of heat, the villain in the above confusion. Adoption of the meter-kilogram-second system in place of the classical centimeter-gram-second (cgs) system resulted in a one-to-one relation between the expression for energy in scientific and practical units, that is, 1 newton-meter equals 1 watt-second. A one-to-one relation between the basic units of energy in the mechanical and electrical energy systems was thereby established. It would be most convenient if the basic unit of the thermal energy system had a one-to-one relation with the basic units of other energy systems.

I propose a new unit called the "herg," which would be an amount of energy equal to 1 joule, 1 newton-meter, or 1 watt-second. A herg would be equal to the quantity of heat required to raise the temperature of 1 gram of water 0.2388°C (or whatever string of significant numbers could be agreed upon). The kiloherg would be equal to approximately 0.95 Btu, and therefore the commercial unit of heat might well become the megaherg, perhaps contracted to mherg or mhg—an energy unit equal to 0.278 kilowatt-hour.

The name herg is proposed for obvious reasons. The cgs unit of work—the erg—has been, in effect, abandoned. Since it was presumably merely a contraction of the world energy, a revival with the prefix letter "h" might be highly appropriate. It might even be more in keeping with past practice in assigning names to units of physical measure to name the new unit the Carnot, honoring one of the most eminent figures in thermal theory.

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