9

The new technology may be closer than we realize

It is sometimes alarming to observe the activities of the United States federal government in attempting to address the energy problem. Whether or not there truly is a problem is no longer an issue worth debate. The only question remaining is whether the people of the United States will learn to cope with the realities of energy economics. Failure to do so will almost surely lead to declines in our influence on the state of the world and eventually in our way of life.

The distressing thing is that our leadership appears to have its collective head in the sand—unable to face the realities of the situation.

A headline in a leading Midwest newspaper recently proclaimed: "Energy Plan: Re-Invent Car or Fuel." The news story, not too unlike many in recent days, included a report of the United States Department of Transportation secretary's description of a campaign "to reinvent the car" that will likely cost American taxpayers $500 million a year!

The fact is that the odds are very slim that throwing money at the energy problem, in the hope of uncovering a "new technology," will prove fruitful in time to prevent the first manifestations of the ultimate collapse. Realistically, the United States must start immediately on the long road to reduced energy consumption. Further, the only way to do this is to curtail use while putting our emphasis on applying *known* technology to increase the effectiveness of utilization.

There have been few if any breakthroughs in the fundamentals of energy conversion, except for nuclear conversion, since the nineteenth century. We have simply pushed the various thermodynamic cycles to the brink with respect to materials and safety; the same physical laws govern. Huge sums of money earmarked for new technology have been spent on the reincarnation of age-old concepts without thorough study of why the concepts failed to provide our energy needs during any of their earlier lives. Examples of these rediscovered "new technologies" include solar energy utilization, the heat pump, and integrated energy cycles (power and heat)—and a move to a newly discovered savior referred to as "second law concepts."

The fact is that the "breakthrough" or "new technology" may be much closer than one would think. Further, the opportunities at conservation may be so significant that they could have a serious detrimental impact on our major energy-producing industries. If this is so, this is the area in which the government should be looking to solve a serious economic problem.

Energy conversion falls short

Using the second law as we have always used it, together with the Carnot analyses of efficiencies and *COPs*, it is immediately evident that today's articles of commence fall far short of achieving the ideal effectiveness in energy conversion. If efforts are concentrated here, trying to get closer to the ideal, the first effective steps will have been taken. This requires no new technologies, simply redirected efforts at heat transfer, fluids, and system parasitic analyses. In a building system, except for lighting, the end result of the entire energy system is to heat and cool. Heating is virtually a total degradation of useful energy to entropy. Entropy, in turn, is

the end of the line in the conversion of energy resources to a useful form; this is the reason for the current trend toward heating with energy that has previously been used for a higher order form.

But to accomplish heat transfer in real machinery requires a finite temperature differential. Therefore, in considering cycles and machines that lend themselves to combined cycle application (power and *useful* heat), machines should be sought that deliver shaft energy efficiently while providing useful quantities of heat at elevated temperature. Such a device is *not* the external combustion Rankine cycle but rather the internal combustion Otto or Diesel cycle. Hardware is currently available that can be readily used in such applications; in fact, many such systems have been in operation for many years!

Consider the building system parasites. The purpose of the system is to convey heat into or out of a building. The major energy consuming devices in many buildings, however, are the fans and pumps that move fluids around—not the boilers or refrigeration compressors. To address this problem simply requires properly directed attention, not a new technology.

Consider thermal storage system

Current activity in solar research and application has produced almost an entire generation of "specialists" in so-called solar technology. It must be recognized, however, that the collection of the heat is simply one small component of a necessarily complex system. In any thermal fluid system, when the need is not coincident with the availability, a complex system of storage is required. Efforts at advancing developments in the mundane concepts of hydronics would produce immediately beneficial results that could accelerate the feasibility of active solar systems. An example of lack of attention to "simple" technologies is the hydronic expansion tank. To obtain maximum benefit per investment dollar from a thermal storage system, the temperature range of the stored fluid must be maximized. This, along with the relatively large volumes of storage, requires the use of enormously large expansion tanks. Although there are methods available for coping with this problem at more reasonable costs, the current literature used by the vast majority of designers still contains the tank sizing procedures developed for systems of a different type.

Thus, the new energy technology is closer at hand than is normally recognized. It is in the less romantic areas of complex engineering technology, in controls, hydraulics, heat transfer, and fundamental thermodynamics. The problem is simply that these opportunities have been almost totally ignored in our efforts to find a solution that can be utilized with less need for basic understanding.