SECTION III

Energy economics

The topical discussion for the preceding section introduced the concept of an energy revolution. That concept is addressed in a constructive manner in this section wherein energy economics is suggested as a tool for molding the direction in which the energy revolution takes us. The first two chapters in this section present the proposal that a science of energy economics, apart from but intimately related to monetary economics, be developed. This sudden need for a "new science" should be considered in perspective.

In the early days of the industrial revolution, the physical laws relating to the engineering sciences were not nearly as well understood as they are today. Furthermore, the physical properties of materials were little understood and good quality control for processing these materials did not exist. This lack of knowledge did not prevent the development of the early mechanisms and machines. The designers and inventors developed the designs much by trial and error. Starting with an idea, a device would be constructed. If it worked, that was fine; if it failed, the cause of failure would be sought and another attempt made. It was through this series of experiments that the physical sciences and knowledge of materials that exist today were developed. The important point is that the early need for knowledge was recognized by the scientific leaders of the time, and they set about a course of developing the science.

An example might be the fascinating development of thermodynamics in the nineteenth century, i.e., a system of laws and principles that were developed and pieced together in such a way that we now have a thoroughly organized science that is universally taught to engineering students, who learn and accept the complex laws almost as a second nature.

Energy, although an essential ingredient in the development of machines and societies, was never considered to relate to the overall problem in as complex a form as the laws of thermodynamics. It was an ingredient that was more or less taken for granted—either it was available or it was not. In the Alpine areas, electricity made from hydroelectric plants is the primary energy form. In central Europe and northern England the primary energy form is coal. As the use-rate curve becomes steeper, and mankind starts to realize the finite nature of the current source, it becomes evident that the only way the future can be secured is through some efforts at planning. In a radio address in 1932, Franklin D. Roosevelt said, "These . . . times call for the building of plans. . . ." The time for disorganized trial and error in the depletion of energy resources must come to an end or our present social systems will certainly collapse. Although we may lack many of the answers, as the engineers of the latter eighteenth century lacked knowledge of thermodynamic laws and materials, we can at least

initiate the organization of the science. If such a proposed science can germinate, there is little doubt that the knowledge will follow.

The alternative is that the present situation will continue. This situation is one of total polarization between the disciplines knowledgeable in the energy situation. As examples, physicists are in diametric disagreement on the issue of the present wisdom of and future place of nuclear energy; the solar utilization concept has developed into camps of proponents and opponents in which the scientific facts are little discussed; the United States federal government attempts to get the public to reduce consumption while the industries that produce and sell energy continually attempt to encourage more use. The economists insist that energy is merely another commodity to be thrown into the hopper with whatever else happens to appear on the commodity market while the engineers are torn between the logic of designing machines for most effective utilization of energy and the pressures to give paramount consideration to manipulated monetary structures.

The chapters in this section, then, are intended to explore the need for such a proposed science of energy economics, recognize some of the essential elements in such a science, and reveal some of the challenges to be addressed by the science. There is little doubt that the engineering community properly motivated can contribute significantly to the overall solution of the energy problem. An example of energy waste resulting from the failure to consider energy apart from its monetary value is developed in some detail in the chapter on the "Case History Study" and the affect of a misdirection in engineering philosophy is revealed in the chapter "Infinite Sink!" The discussion of second law concepts reveals some of the challenges which the engineering community may address. Indeed, "these times call for the building of plans!"