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## Learning About Energy the Hard Way

For more than a decade it has been obvious that the United States is destined to face enormous adjustments in its use of energy. The difficulties and costs of finding new oil and natural gas have been climbing rapidly and it is clear that potential discoveries are limited. The embargo of 1973–1974 should have led to vigorous action, but it was quickly ignored.

By mid-March the acute stage of the current energy shortage will have passed. Because supplies of foreign petroleum are available, a major disaster has been avoided. A huge shortfall has been in part made good by record imports of oil. The United States is fortunate in another aspect. Although generating equipment was taxed to the utmost, the electrical utilities were able to avoid massive power shutdowns.

And so, although domestic sources of oil and gas continue to decline, the United States will luck through another energy crisis. But other crises will come, and will probably be more severe, for even with action now, many years must elapse before the gap between domestic production and consumption of energy can be made to decrease substantially.

In principle, conservation is the solution, with a goal of reducing energy consumption to half its present level. However, the record of the past 3 years provides little basis for hope that energy consumption can easily be cut. Industry has already made most of the simple moves such as fixing steam leaks. Those homeowners who are willing to turn down the thermostat have already done so. To achieve really substantial economies will require investment of as much as a thousand billion dollars or more. Even were major changes to begin now, a decade or more would have to pass before their effects would be largely felt. Still a beginning must be made, but that will evidently require more incentives than have hitherto been supplied. The people must come to understand and believe that the various forms of energy—especially those based on oil and natural gas—are going to become steadily more scarce and much more expensive. Examples of incentives would be huge taxes on gasoline and heavy autos. Conversations with people in industry indicate that new energy-saving installations would be built if funds were available at low interest rates. Such construction would employ many workers.

Much of the energy that is consumed by industry is utilized for process heat. In principle coal rather than oil or natural gas could be used, and this substitution could be the fastest means for freeing supplies of natural gas and oil. However, in general, capital expenditures would be involved, and again financial incentives would speed the process.

Overall, the amount of energy moved in gas pipelines is about three times that transmitted electrically. For home heating there is no easy domestic substitute for natural gas. To replace methane by electricity in homes alone would require an investment in generating plants and heat pumps amounting to several hundreds of billions of dollars. Solar heating would also involve enormous investment.

Domestic supplies of both oil and gas could be increased. For example, additional amounts of methane might be obtained from fermentation of biomass, from disposal of organic matter in sanitary landfills, from gases associated with coal, from brown shales of the Appalachian Basin and elsewhere, from the low-porosity rocks of the Uinta and other western basins, from the geopressed zones of the Gulf Coast, and from Alaska. At some time in the future there will be synthetic methane from coal. Probably most practical is natural gas to be discovered by conventional drilling. Methane from all of these sources will be expensive.

The United States apparently learned nothing from the 1973–1974 embargo. Perhaps a second lesson will be more effective. If not, other lessons will come and they will be more harsh.—PHILIP H. ABELSON