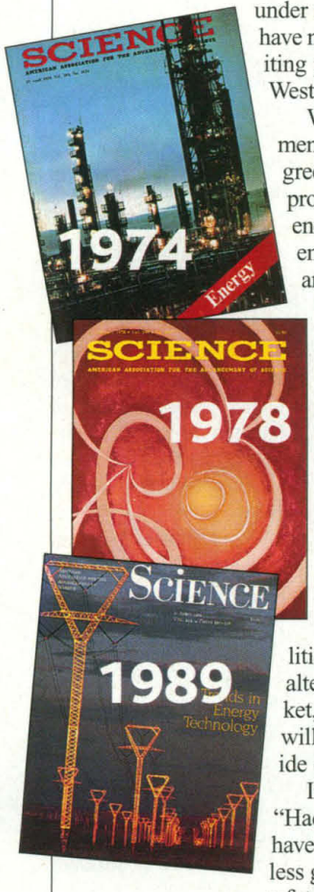
Powering the Next Century

Twenty-five years ago, *Science* devoted an entire issue to what then was perceived as a major threat to Western society: the energy crisis. Some authors presciently wrote of conservation and improved fossil fuel recovery, while others missed the mark by heralding new eras of nuclear and alternative energy. For a deeper understanding of that turning point between energy naïveté and energy realism, see articles from that and subsequent issues posted at our Web site (www.sciencemag.org).



Unexpectedly cheap oil prices in the United States, impossible to foresee in the immediate aftermath of the crisis, are rooted in both economics and politics. Greater oil resources are now available thanks to new reserves and enhanced recovery technologies. [The extent of existing oil resources is under debate (*Science,* 21 August 1998, p. 1128).] Oil-exporting nations have not maintained the political resolve to keep oil prices inflated by limiting production, and the Persian Gulf War demonstrated the resolve of Western nations to use force to protect oil resources in the Middle East.

Western policy-makers are now debating how to rein in the environmental costs of oil use, such as oil spills and rising concentrations of greenhouse gases. To meet the pollution reduction challenges, energy producers are blazing trails in energy efficiency and reviving alternative energy sources. This special issue explores the science and policy of emerging technologies. Most are works in progress. Fuel cells, for example, are limited largely by ion transfer rates across fragile membranes, whereas the efficiency of heat engines is limited in part by the operating temperatures of metals; ceramics are being explored as hardier alternatives. Improving thermoelectric devices for refrigeration requires finding materials with high electronic conductivity but low thermal conductivity, properties that normally tend to increase or decrease together.

Alternative fuels are also being developed, but they face their own hurdles. Using hydrogen in fuel cell vehicles, for example, would require billions of dollars to create the infrastructure to deliver the gas. Meanwhile, the present infrastructure could become vastly more energy efficient—a shortcoming the young field of industrial ecology is trying to address. Many resources that could be recycled, such as waste water or flare gas, often are not. Where political will translates into legislation, such as California's demand for alternatively fueled vehicles and the deregulation of its electricity market, investments in new technologies have happened. Where political will has faltered, such as not establishing firm targets for carbon dioxide emissions, developments have been slow.

In his editorial in that 1974 issue of *Science*, Phil Abelson noted, "Had we been driving smaller, less gas-consuming cars, there would have been no energy crisis. Some other forms of transportation consume less gasoline, and their use should be encouraged." The logic remains irrefutable a quarter of a century later. Advances in energy technology will likely need to be assisted, however, by changes in our own habits of energy use, willingly or not.

–RICHARD STONE AND PHIL SZUROMI

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