more sparingly—and the poor made a disproportionate share of such sacrifices. A 1979 U.S. Energy Department study revealed that no energy-saving measures at all had been adopted by 10 percent of those surveyed. Sixty percent of the households queried had *invested* nothing in conservation. As for the rest, the average outlay per household was only $266; those most likely to invest were young and relatively affluent.

The lesson: Higher energy prices spur less affluent families to reduce their living standards, while only those who can easily afford it make lasting improvements. Renters, one-third of U.S. families, have little reason to spend anything on conservation. And during 1978 and 1979, some 600,000 households simply converted from oil to gas heat, say the authors, a step that "saved money without saving energy."

Conservation at home will never yield the big energy savings its most fervent advocates envisioned during the 1970s, the authors assert. But without active promotion by Washington—heftier financial incentives, better technical advice, improvements in notoriously inaccurate home energy "audits"—it will produce next to nothing in terms of greater U.S. "energy independence."

Natural Gas

"A Nearly Perfect Fuel" by Barry Commoner, in *The New Yorker* (May 2, 1983), 25 West 43rd St., New York, N.Y. 10036.

A chaotic system of production and distribution is depriving the United States of the full benefits of "a nearly perfect fuel."

Methane, the principle constituent of natural gas, is clean, plentiful, easily transportable. But Commoner, a Queens College biologist and third-party presidential candidate in 1980, asserts that U.S. natural gas supplies have been consistently mismanaged. More than half the nation's reserves are in the hands of oil companies, which are more interested in selling oil. Congress complicated matters in 1978 by voting to deregulate gradually natural gas prices within seven years. For the interim, it created 28 different categories of gas, each with its own price. The result: In 1981, some gas could be had for 19.7 cents per thousand cubic feet and some for more than $6.

Consumers, meanwhile, have reaped few benefits because pipeline companies are locked into contracts that prevent them from buying the cheapest gas.

Congress has erred before. Based on alarmingly low estimates of remaining U.S. natural gas reserves, it passed a law in 1978 requiring many large factories and utilities using gas to switch to coal. Today, gas is so plentiful that wells are being capped.

A rock-bottom estimate of current reserves is nine hundred trillion cubic feet—a 45-year supply. But when natural gas from such unconventional sources as deep wells (beyond 15,000 feet), "geopressured" methane trapped in brine far below ground, and gas locked in densely

packed rock formations is counted, enough supplies exist for 160 years. Methane is also a renewable resource, produced when bacteria break down sewage and garbage. Several trillion cubic feet of such renewable methane could be produced by this method every year.

Congressional blunders and the narrow interests of some producers and pipeline companies have kept natural gas prices high. With intelligent regulation, methane could be the answer to what Commoner sees as the real energy crisis: the high cost of energy, not its scarcity. And, eventually, methane could serve as a bridge to a society completely powered by renewable solar energy sources.

Solar Power's Uncertain Future

"Solar Technology: A Whether Report" by Kevin Finneran, in *Technology Review* (April 1983), Room 10-140, Massachusetts Institute of Technology, Cambridge, Mass. 02139.

Solar energy research no longers grabs the headlines it did during America's energy-obsessed 1970s. But engineers have developed a surprising array of promising new technologies and are quietly eliminating more and more technical barriers.

Photovoltaic electricity, writes Finneran, editor of the Solar Lobby's *Sun Times*, remains the "great soft hope" of nuclear power's foes. It is not competitive with conventional power today, but if costs drop to $4 per peak watt by 1986, as some specialists predict, it would be economical. The total output of all the photovoltaic cells manufactured last year was only six megawatts; a single coal-fired plant can generate 1,000 megawatts.

Standard photovoltaic technology relies on ingots of silicon crystals painstakingly grown in vats and sliced into thin, round cells. Sunlight striking the cells frees electrons and generates electric current. Such cells are both inefficient, converting only six to nine percent of the available sunlight (when linked together on a panel of some 40 cells), and, at $15 to $20 per peak watt, costly.

Researchers today are developing other ways to use silicon. Several companies, including IBM, synthesize ribbons of crystallized silicon and cut them into squares, which waste less space than circular units when mounted on panels. The ribbons are up to twice as efficient as standard cells, but are currently far more expensive.

Another option is to sacrifice efficiency for economy by relying on silicon that is not formed into a regular crystalline structure. "Amorphous" silicon cells now on the market capture only four percent of the energy available, but cost only $6 per peak watt. RCA recently claimed it had achieved 10 percent efficiency with such a cell. But amorphous cells are plagued by poor durability.

Texas Instruments is working on a unique system that combines crystallized silicon and chemical processes to produce electricity and heat. Washington recently cut off funding for the research, but the com-