"replacement" levels in 50 years would mean halving the lowest population increase achieved anywhere in recent years; (*c*) if fertility decreases to replacement level by 2025, while higher mortality rates in the poorer, hungier countries gradually cut average world life expectancy from 55 years in 1975 to 45 in 2025, world population will stabilize for the following 50 years, while mortality slowly decreases and life expectancy rises to 63. This last projection suggests a stable world population of about 6 billion by 2075 but, says Echols, the price will be "terrible suffering for the less developed Southern Hemisphere."

Conserving Energy: A Blunt Instrument

"Save Energy, Save a Soul" by Eugene Bardach, in *Commentary* (May 1976), 165 E. 56th St., New York, N.Y. 10022.

"Energy conservation is a solution in search of a problem," writes Professor Eugene Bardach, of Berkeley's Graduate School of Public Policy. The alleged benefits of energy conservation include reducing America's vulnerability to oil embargoes, saving the environment, and protecting the welfare of future generations. But none of these worthy goals, Bardach argues, is best achieved by reducing energy consumption.

The appropriate U.S. response to the threat of another Arab oil embargo consists of an oil stockpile, import quotas (which can automatically reduce fuel consumption if Washington permits prices to rise), and the counter-threat of military intervention. Environmental degradation can best be prevented by regulation and pollution taxes—not by invoking conservation measures with environmental protection as a side-benefit. Assuring energy for future generations, says Bardach, requires a "technological solution" that will be found through an effort spurred by rising energy prices. The solution will not be found simply by agreeing with those conservationists who reject all energy proposals that appear to fail their "net-energy-yield" standard (which specifies that energy sources should be developed only if they will yield more energy than is consumed in their development).

E = Time + $

"Some Thoughts on New Energy Sources" by Bertram Wolfe, in *Nuclear News* (May 1976), 244 E. Ogden Ave., Hinsdale, Ill. 60521.

Recent public debate on America's energy problems has tended to focus on issues of safety with little concern over whether advanced technology can actually produce a new energy system (nuclear, solar, or whatever) in time to avoid serious economic and social dislocations. Wolfe, a General Electric nuclear power specialist, examines a number of energy proposals and finds that none avoid significant economic and technical problems (e.g., possible seismic effects in geothermal power; the accident potential in solar power transmitted from space).

Wolfe argues that conditions existing in the 1950s and '60s no longer prevail—that the size and cost of central power stations and the time required to build them have since increased (from $50 million to $500 million, and from 2 or 3 years to 7 to 10). Now, several decades must elapse before there is any impact from development—from "base technology" through the experimental and demonstration stages—of a new power system. This time frame exceeds the normal professional lifetime of engineers, scientists, and perhaps even of industrial and governmental organizations set up to implement such programs. Other hurdles are current public antipathy to new technology and the dearth of established financing institutions to underwrite the high costs. Wolfe urges frank discussion of the difficulties, costs, and dangers of proceeding with the most promising new energy system (nuclear breeder reactors), as well as "the dangers of not proceeding."

The Solar Potential

"Solar Energy Is Here, but It's Not Yet Utopia" by Edmund Faltermayer, in *Fortune* (Feb. 1976), Time & Life Building, New York, N.Y. 10020.

Solar energy might seem to be the perfect solution to our energy problems—it is "everlastingly abundant" and completely benign to the environment. But sunpower has inherent limitations, Faltermayer says. It cannot be stored for long or transported far (unless converted to electricity). More serious is "the high cost of gathering the sun's free energy." Equipping a house to use it is an investment few can afford: it requires bulky "collectors" (which absorb solar energy and transfer it to air or water circulating inside them) and energy storage equipment and an alternate energy back-up unit to use when the sun is not out. "Solar energy generally turns out to be more expensive than conventional fuels . . . in some cases ten times as expensive." But with fossil fuels becoming more costly, solar energy is today economically viable in a few specific situations, most notably in heating and cooling buildings and heating water. Sunpower might grow into "the biggest economic development since the automobile revolution," but first equipment prices must come down and equipment efficiency must go up.

Another promising application of solar energy is the generation of electricity, still restricted by the high cost of the system's basic component, the photovoltaic cell (current price—$17 per watt). Noting that solar energy already has a "small and valid commercial role," the author calls on the federal government to drop the billion-dollar subsidies and tax breaks for the industry now being discussed in Washington. The proper federal role is limited research and enforcement of industrial standards, while state and local governments amend zoning laws and grant tax incentives.