used with a 3 percent per annum inflation factor, which may be a reasonable long-term rate, the results would be much the same as those obtained by the Atomic Energy Commission (AEC). Depending on the frame of reference, even a 7 percent discount rate might be based on some inflation. The present electrical utility discount rate is between 7 and 8 percent; this includes some inflation effects.

The estimate used by the AEC of the demand for electricity of 10,000 billion kilowatt-hours in the year 2000 is not out of line with other estimates. A recent report by the National Academy of Engineering (*2*) contains the projection of 10,000 billion kilowatt-hours for the year 2000.

According to Hammond's report, Cochran believes that technical problems and safety considerations are likely to result in LMFBR plant designs which have poorer technical performance and higher costs than those used by the AEC in its cost-benefit study. Before commenting, I would like to repeat what every *Science* reader knows—the results of research and development are uncertain. Analyses of LMFBR plant benefits have been made at the Argonne National Laboratory with different assumptions and with somewhat different objectives from those made by the AEC. A number of parameters were examined in the Argonne analyses, which centered about a reference LMFBR plant that had lower performance in terms of required plutonium inventory, a higher initial capital cost differential (even higher than Cochran's), and a longer cooling-off period for fuel than those of the AEC's plants. Cost escalation rates of 1.5 to 4 percent with a 7 percent discount rate were used in various components of the study. The main interest was only for the year 2000, although some results were carried through the year 2020. For a fixed nuclear penetration, the LMFBR benefits do start, but not until about the year 2000. Also, the advent of the HTGR (high temperature gas reactor) delays those benefits. The study convinces me of the probability of benefits from the LMFBR R & D effort.

The article also states that there is a crash program to build the breeder. Those who have been involved with the development of the breeder will attest that there is no crash program; the first experimental breeder began operation in 1951. Subsequent and ever increasing breeder developments in the United States and abroad are well documented. John Kenneth Galbraith (*3*) points out that the time span from the beginning to completion of any task increases as more sophisticated technology is involved and that the commitments of time and money for the task tend to become inflexible. We are seeing this with the development of the breeder. With the present level of effort, some electric utility companies may decide in the 1980's that commercial LMFBR plants starting operation in the 1990's are their lowest cost alternative.

The cost of available uranium reserves as a function of tonnage was a prime variable in the Argonne study, which indicated that following the LMFBR path may require from 3 to 4 million tons of uranium oxide. The study also showed that, with no increase in the uranium oxide real cost with tonnage, the breeder has no net benefits. Should we delay the breeder until we prove the cost and availability of uranium oxide within the United States and examine other alternatives? Considering the present energy situation and the future energy needs, I say no. We can analyze alternatives without halting the breeder.

K. A. HUB

Special Reactor Studies Group, Argonne National Laboratory, Argonne, Illinois 60439

References

1. T. B. Cochran, "An Economic and Environmental Analysis of an Early U.S. Commitment to the Liquid Metal Fast Breeder Reactor," to be published.
2. Committee on Power Plant Siting, *Engineering for the Resolution of the Energy-Environment Dilemma* (National Academy of Engineering, Washington, D.C., 1972).
3. J. K. Galbraith, *The New Industrial State* (Houghton Mifflin, Boston, 1967).

Technology Assessment

Robert Gillette's commentary (News and Comment, 6 Oct., p. 41) on the bill establishing the Office of Technology Assessment opened with the observation that this was a proposal which "languished in congressional backrooms for the better part of a decade. . . ." The technology assessment concept was some years in the making. The bill to establish the Office of Technology Assessment was first introduced in April 1970.

PHILIP B. YEAGER

Committee on Science and Astronautics, House of Representatives, Washington, D.C. 20515