Letters

Nuclear Energy

Alvin M. Weinberg (7 July, p. 27) states with penetrating clarity the nature of the Faustian bargain that nuclear energy offers to mankind. We are to receive an almost unlimited supply of energy, which, he says, "when properly handled is almost nonpolluting." In return we must maintain incessant vigilance to guard against leaks and accidents; and we must maintain "longevity of our social institutions" to a degree that is probably unparalleled in history. Weinberg concludes that the bargain is well worth the price. From his admirable presentation I draw the opposite conclusion: The Faustian bargain may indeed be a pact with the Devil, and we should reject it.

Weinberg calls for a vigilant, dedicated priesthood to tend the power plants in perpetuity and keep them efficient and nonpolluting. This lays a burden of responsibility on our descendents that they will be stuck with, willing or unwilling, for generations to come. Other relatively nonpolluting sources of energy, such as nuclear fusion or solar energy, may within a generation or two render nuclear fission plants obsolete; yet the priesthood guarding the latter would still need, long after that, to enlist new and dedicated recruits, to save mankind from the potentially disastrous consequences of an accident to these (by then) obsolete structures, or to the containers of the fission products to which they give rise. Even devoted priests are human; they grow weary, they grow careless; they make mistakes, and in this instance the mistakes could lead to unprecedented disasters.

Weinberg's requirement for longevity of social institutions, which seems even less likely of fulfillment, requires a kind of social stability that has not existed in the past, does not exist now, and offers no promise of existing in the near future. In our time we have seen two world wars and vast revolutionary unheavals. With the increasing social tensions that are bound to accompany the growth of populations, the depletion of natural resources, and the present widening economic gap between the rich and the poor nations, it would seem prudent to assume that such upheavals may be even more intense in the coming years. Nuclear fission plants will be enormously attractive objects for sabotage and blackmail. A well-placed charge of explosives, in the midst of one of these huge concentrations of radioactive material, could blow into the air enough radioactivity to be carried by the winds over thousands of square miles, and perhaps render large areas uninhabitable for decades. The twisted minds, and the savage emotions, that could lead to such acts, seem utterly alien to most of us; but only a tiny minority of such people need exist to imperil all the rest of us. I agree with the view recently expressed by Hannes Alfvén, in a most thoughtful article, that ". . . fission energy does not represent an acceptable solution to the energy problem. It would place an unendurable burden on the safety and health of future generations" (*1*).

What then should we do? I would make several suggestions, none original, but several still unheeded.

1) Stick to fossil fuels for the present, with drastically improved antipollution equipment, as our major energy source for some years to come.

2) Slow down the rate of growth of electric power; emphasize economy in use of power, and work to the utmost to improve efficiency. Set a sliding scale of costs, with rates charged for use of power *increasing* as use increases; this would promote both efficiency and economy.

3) Discourage manufacture of products that require large amounts of electrical energy (for example, aluminum cans) if satisfactory alternatives that require less electricity exist.

4) Greatly intensify research to develop sources of energy that are nearly pollution-free, notably nuclear fusion and solar energy.

5) Create a national energy commission to formulate and promote national policy on the total energy problem, and, as Alfvén (*1*) has suggested, create also an international energy commission, to deal with such problems in global terms.

Some of these proposals will be unpopular and will encounter strong resistance, but the troubles they would cause are trivial by comparison with the immense hazards of a large-scale system of nuclear fission plants.

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References

1. H. Alfvén, *Bull. At. Sci.* **28** (No. 5), 5 (1972).

In focusing so sharply on the negative side of the Faustian bargain implied in nuclear energy, Edsall all but ignores the primary and positive aspects of the bargain. The simple fact is that mankind can avoid the catastrophe predicted by the Club of Rome (*1*) only if an essentially inexhaustible energy source is developed. Of the possibilities that are visualized, only one, the nuclear breeder, now appears to be technologically and economically realistic. That this route to the inexhaustible energy source carries with it certain risks is unfortunate; but the Club of Rome catastrophe that will befall man if he cannot find such an energy source is a risk of much greater magnitude.

Edsall proposes, among other things, that we intensify research on fusion and on solar energy. I agree; yet suppose, as is quite possible, that neither of these sources is found to be feasible, either for technical or for economic reasons. The two generations we would thereby lose could make our energy-environment crisis much graver than it now is.

On the other hand, if fusion or solar energy becomes practical, the problem of safely dismantling the fission technology is nowhere near as serious as Edsall suggests. The only surveillance that would then be required would be the rather minimal guarding of a few burial grounds for radioactive wastes. As I explained in my article, I do not consider this degree of surveillance to be at all unreasonable, especially since, even without surveillance, the likelihood of widespread contamination from wastes buried in salt is extremely small.

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References

1. D. H. Meadows, D. L. Meadows, J. Randers, W. W. Behrens III, *The Limits to Growth* (Potomac Associates–Universe Books, New York, 1972).

Nature's Highways

R. G. Lynch (Letters, 6 Oct., p. 11) hopes that "biologists can describe the needs of mammalian offspring generally, and the needs of *man's* [italics mine] offspring specifically." Is it one of "the highways nature intended" that the "love, discipline, and care" he and I agree are among those needs be provided exclusively or even predominantly by a woman? Lynch answers this question, which he never asks, with an unequivocal "yes." My children, my wife, and I disagree.

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It is difficult to argue in a logical way with the letter from R. G. Lynch. It contains many of the clichés frequently used to suppress women and members of minority groups. Appealing to "nature's laws" is a time-honored and traditional way of preventing change. As a reproductive biologist, I recognize that natural laws exist. Those which are relevant to the issue at hand, namely, the equality of opportunity for women, are rather small in number. They include the fact that women, not men, become pregnant; that women, not men, carry children until birth; and that if it is desired by the parents that the child suckle, it is the woman who plays this role. I do not know of any other natural laws which are relevant to the issue. No one has described how many hours a day for how many months a given woman needs to be with a given child. Furthermore, there is another "law" which Lynch does not recognize. Every child has two parents, the mother and the father. This is a biological as well as a sociological fact. There is no natural law that says that child care must be only the responsibility of the mother. Therefore, the question of extended maternity leave should be an individual decision of the parents of a child, perhaps in consultation with experts.

Lynch says that "Women certainly deserve fair and enlightened treatment." The women in our country, both professional and nonprofessional, have learned a simple truth; in order to get fair and enlightened treatment, we must act together and get it for ourselves. We are very pleased that the American Association for the Advancement of Science has recognized at its meetings and in the columns of *Science* that the women's movement, specifically as it is related to science, is here to stay. We are pleased that there are an increasing number of stories about the movement. There may be times when individual women may disagree with individual stories, or, indeed, when an entire women's professional association may disagree. Nevertheless, we think this is a problem which is important not only to women, but to men, and that it needs to be looked at openly. We hope that the AAAS will continue to increase its interest and not permit letters such as those from Lynch to deter them from this exceedingly important issue.

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More Parts per Million

With reference to the letter "One part per million" by William W. Porter II (11 Aug., p. 477), I should like to quote from the fourth edition of *Toxicology of Drugs and Chemicals* (*1*). The following appears in the front of the volume on page VI:

Parts Per Million

1 ppm is equal to 1 inch in 16 miles,
1 ppm is 1 minute in 2 years,
1 ppm is a 1-gram needle in a ton of hay,
1 ppm is 1 penny in $10,000.00,
1 ppm is 1 ounce (30 gm) of salt in 62,500 pounds (28,375 kg) of sugar,
1 ppm is 1 large mouthful of food when compared with the food a person will eat in a lifetime,
1 ppm is the theoretical concentration that 1 teaspoon of DDT will impart to the hay when spread on 5 acres of alfalfa,
1 ppm is 1 drop in 16 gallons, or in 80 "fifths," a very dry martini indeed!

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References

1. W. B. Deichmann and H. W. Gerarde, *Toxicology of Drugs and Chemicals* (Academic Press, New York, ed. 4, 1969).