Letters

Energy Production and Climate

Alvin Weinberg, in his editorial on global effects of man's production of energy (18 Oct., p. 205), identifies a research area of critical importance in energy planning. It is clearly crucial that we understand the potential global climatological impacts of alternative future energy development patterns. In terms of the time scale and seriousness of the problem, his recommendation of an institute or institutes of climatology makes eminent sense. But his proposed institution does not match the geographical scale of the problem.

First, the greatest potential for major climatological effects may occur at a time when a large number of countries are contributing to global pollutant loadings. At that time, the increase in pollutant emissions may well be due mainly to an increase in energy production in countries other than those which are now highly industrialized. International action may thus be required to deal with the problem, say by curtailing the burning of fossil fuel. Second, the prediction of global effects will continue to be highly complex and controversial. Third, a nation is more apt to base its planning on information that its own scientists have had a part in developing.

My conclusion is that this global problem requires scientific attention that is not only long-term, but also international. I thus propose that one of the institutes of climatology suggested by Weinberg be international and include participants from countries with developing energy systems. Consideration should also be given within such an institute to pertinent energy systems analysis and to international problems of a political science nature that would be involved in avoiding global effects.

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Weinberg states that climatic changes from projections of global energy production, while impossible to estimate with certitude, might well be felt in as little as 30 to 50 years. Because of the potential irreversibility of global climatic changes, this could mean that adjustments to world energy planning strategies might have to be made soon, despite the uncertainties inherent in present estimates of the climatic effects of energy production (*1*).

The question of energy production and its potential consequences on the global climate is similar to other question of the impact of human activities on climate, such as the consequences of increases in atmospheric carbon dioxide or freon, changes to the earth's albedo or hydrology from land surface alterations, or the effect of aerosols on cloud nucleation processes or on the earth's radiative balance. The common thread that connects all of these questions is that the magnitudes of their suspected climatic influences are both comparable to each other and to the forces that create natural climatic variability. Thus, the problem of sorting out individual influences from the "soup" of the other processes requires a quantitative theory of climate that can be applied to make estimates of the climatic consequences of energy production.

The "institute of climatology" proposed by Weinberg is likely to guarantee attention to the applications of climate theory and modeling to questions of energy production. Yet, a reasonable distribution of talent (which encourages healthy intellectual competition among many groups) may also be necessary.

An additional strategy might be to establish a central "office of climatology" that would coordinate research directions and communication between workers and institutions and would have the influence to prod collaborative efforts directed at specific applications of general interest. A successful working model of this multiagency approach is the Global Atmospheric Research Program. In this international program each agency takes on specific responsibility, but there is general coordination of the entire program at a central level.

Regardless of institutional strategies, we share Weinberg's concern for the urgency of obtaining estimates of climatic changes and of helping decision-makers assess the utility of such estimates in the near future.

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References

1. W. W. Kellogg and S. H. Schneider, *Science* **186**, 1163 (1974); W. Washington, *J. Appl. Meteorol.* **11**, 768 (1972); S. Schneider and R. Dickinson, *Rev. Geophys. Space Phys.* **12**, 447 (1974).

Agricultural Aid to Indochina

With reference to letters (8 Feb., p. 469; 10 May, p. 609) regarding agricultural research aid to Indochina, the U.S. Agency for International Development (USAID) has supported such programs in South Vietnam since the 1960's with varying degrees of success. Since September 1971, the International Rice Research Institute (IRRI) has assigned two American agronomists to a USAID contract team in South Vietnam. This team is assisting and training the staff of the Vietnamese Institute of Agricultural Research (IAR), Ministry of Agriculture, in the application of research trials. They have screened and tested thousands of experimental lines of improved, high-yielding, disease- and insect-resistant rice from IRRI's breeding program and from programs of other countries.

Cultural practice recommendations have been improved as a result of agronomy experiments, nitrogen-phosphorus-potassium (N-P-K) fertilizer trials, and herbicide and insecticide screening trials. By July 1975, two more scientists will probably be added to the team to assist with the development of (i) rice-based cropping systems intended to help small-scale rice farmers intensify production from limited land, and (ii) improved tall varieties of rice that can be grown in deep water (more than 30 centimeters). Such deep water covers about 1.5 million hectares (35 percent of Vietnam's rice land in the rainy season). Two im-

proved varieties of high-yielding rice developed at IRRI were named and released by the Vietnamese government in November 1973. One more became available in November 1974, and at least two more will be named in April 1975.

The IRRI has also helped the IAR develop research objectives, manpower and facilities requirements, and a training program for a 10-year National Rice Research Program, and we are helping the Ministry of Agriculture find and support a Vietnamese scientist to lead this program.

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Marine Faunal Areas

In his review (13 Dec., p. 1028) of my book *Marine Zoogeography* (*1*), Richard Rosenblatt comments that there is not an explicit statement of criteria to be used in the establishment of regions, provinces, and boundaries, that the chapter on the pelagic realm has a literature list that ends in the 1960's, and that he could not find any mention of the central oceanic gyres. The facts are that the province (the basic zoogeographic unit) is defined in chapter 1 (*1*, p. 16), the chapter on the pelagic realm refers to five works published in 1970 or more recently, and that the latter chapter also includes a discussion of water masses and currents (*1*, pp. 335–338) in which the gyres are mentioned.

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References

1. J. C. Briggs, *Marine Zoogeography* (McGraw-Hill, New York, 1974).

The Big Horn Medicine Wheel

In his article (7 June, p. 1035), John A. Eddy describes the solstitial alignment of the cairns of the Big Horn Medicine Wheel in northern Wyoming and suggests that the heliacal risings of the stars Adebaran, Rigel, and Sirius could have been used as signals of the summer solstice. He also suggests that the 28 irregularly spaced spokes of the Medicine Wheel might