Repeatedly we read such phrases as "PhD required . . ."
"Good lecturing ability . . ."
"Strong commitment to teaching undergraduate courses . . ."
"Commitment to research . . ."
"The candidate will be measured by his ability to teach at all levels—lower and upper, undergraduate and graduate—while carrying on effective research . . ."
and all of these things in the one "pitch."

I ask you: Do such men now exist? I have not seen one for years! A young PhD knows that his salvation lies in his doing research. In the *big schools* this is a *must. And no one looks at his teaching.* In the small schools they are also mutually exclusive and there is little or no provision for doing research. Ask the undergraduates what they think of their courses and the teaching they suffer! And ask the graduate students what they think *of all of it*! There was—once-upon-a-time in my own younger years—another atmosphere where the *spirit of physics* prevailed. I think it is now all gone.

JULIUS SUMNER MILLER
5/22/80 *Torrance, California*

Efficient funding

Your editorial for May (page 36) states that "economists have good evidence that advance in fundamental knowledge has been the single biggest source of economic growth in the past, making possible the high-technology products that enable us to compete in the world market," and you commend budget increases for science.

But if we consider the evidence in the accompanying graph from John Ziman's "The Force of Knowledge" (Cambridge University Press, 1976), it is clear that the cost/effectiveness of our R&D is far below that of Germany or Japan.

What that graph suggests is that the allocation of resources within the overall R&D program may be far more important than the absolute amounts invested. One can even imagine a pattern of misallocation so inefficient that increases in total expenditure will actually be counterproductive by diverting resources from the more productive to the less productive areas of investment. Might this be the interpretation of the well-advertised "innovation recession"?

Funding for R&D versus rate of economic growth for various countries during 1951-1960.

It is clear that if we are to serve the national interest as well as our own professional interests, we should devote at least as much attention to a critical review of the efficiency of our systems of resource allocation as we do to the size of our gross budgets.

LAWRENCE CRANBERG
6/2/80 *Austin, Texas*

Intractable energy problem

The letter "Action on Energy" by Morton and Judith Tavel (March, page 114) presented questions and frustrations that many have had regarding the failure of our country to realistically develop technical solutions to the energy-supply problem. In the absence of a scientist who today could influence the government to undertake an effective course of action, the Tavels propose that the professional scientific societies select a delegation of unbiased experts to analyze the alternatives, draw conclusions and somehow bring about a directed program that would assure adequate energy availability in the future.

With the stated hope of stimulating response, their letter reiterated the urgency of the energy problem and offered this course of action as a possible path to a solution. I share completely their expressions of concern and despondency about the present national course. In seeking a remedy, however, it should be noted there are two aspects of the situation that make the problem particularly intractable and different from other technical challenges, such as the Manhattan Project and the Apollo Program.

First, the energy sources and the means for conversion into useful forms that will be used on a significant scale in the future will be determined by cost factors. This means that in the final analysis, the engineering aspects of applying the scientific principles will be overriding. History will verify that in the environment of our economic system, the struggle of international competition and the demand for higher standard of living, society will not accept any means for providing basic energy requirements that are appreciably more expensive than the alternatives. The eventual cost of delivered energy from any one of the new approaches being proposed is difficult to estimate, since it will be determined primarily by the success of the final engineering and large scale operational experience. Thus, the best choices for energy sources and energy conversion methods to be developed in the future cannot be quantitatively identified today.

The second aspect of today's situation that makes the problem so intractable is largely a consequence of the first, just described. The difficulty of foreseeing the degree of success eventually attainable in large-scale engineering applications has resulted in a national arena where special interests are being served through claims that cannot be disproven or substantiated. Every conceivable technical approach to future energy supply seems to be accorded a measure of credibility.

The organizations performing research and development in industry, and in the not-for-profit institutions and universities, promote and even misrepresent favorite schemes to secure funding. Environmentalists and organized public groups attack certain approaches and promote others relating to energy supply, often employing statements of questionable validity. Legislators employ similar tactics to best serve their constituency or their particular political objective. And even within the government agencies and other organizations sponsoring research and development there exists a competition among factions assigned to further the different approaches to the energy puzzle. The result has been a continuing clash of claims and counterclaims as to which of the large number of possible methods for energy supply have greatest merit. It is no surprise that clear directions for the national effort have not emerged from this confusion.

Returning to the suggestion by Morton and Judith Tavel that a delegation of experts from the country's scientific organizations analyze the options and recommend a course, essentially even this has been attempted. One example was the "Cornell Workshops on the Major Issues of a National Energy Research and Development Program," whose conclusions were reported in 1973.[1] Another was the "National Research Council's Committee on Nuclear and Alternative Energy Systems," whose report was issued last year.[2] Why do not the recommendations of such competent scientific groups made in the national interest have more influence on the national program?

Two reasons as to why have been discussed in this letter. While the outcome of the technical and engineering competition among different

energy supply methods can be estimated by such a committee, all analyses admit to unforeseen factors that at a later date could alter the conclusions reached. As a result, while priorities are recommended, the door tends to remain open for essentially all approaches. The second reason is that the committee's recommendations are easily lost in the largely self-serving debate that is indiscriminately reported by the media.

It is discouraging to contemplate, but there appears no way to overcome this impasse, given our political system and our business-as-usual attitude. Each year the economy is becoming more vulnerable from foreign dependence on critical energy supplies. It is not unlikely that this could lead to a real crisis, and drawing a parallel to the experience of Pearl Harbor, attitudes would quickly change. Cost and environmental factors relating to energy supply would probably become secondary. In such an eventuality, it is likely government decisions would be made, and actually carried out, to develop and implement certain selected methods for supplying the nation's basic energy requirements. Here our scientific leadership could play an effective role in identifying the technical approaches deserving of a concentrated effort. It is probable that in this hypothetical situation of severe national stress, as was true for the numerous new developments vital to the World War II effort, our scientific leadership would receive and deserve the respect and support of the government and the public in providing the necessary guidance.

References

1. "Report of the Cornell Workshops on the Major Issues of a National Energy Research and Development Program," published by The College of Engineering of Cornell University, 1973.
2. "Energy in Transition: 1985–2010," published by the National Academy of Sciences, 1979.

WILLIAM E. PARKINS
Rockwell International
4/21/80 *Canoga Park, California*

Correction

May 1980, page 82—In the second paragraph of the letter by Lance Kethley entitled "Suppressing amateurs" the sentence reading "Also during the recent meeting of the AAS in San Francisco, we were denied the opportunity of presentation" contained an unfortunate printing error—AAS should read AAAS. Our apologies to the American Astronomical Society for this mistake in identity. □

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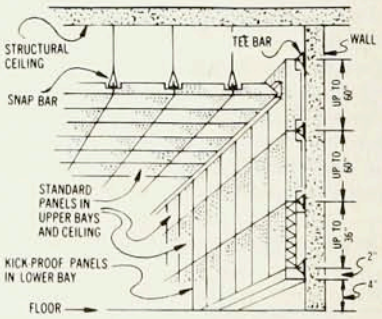

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