COMMENTARY

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REDEPLOYMENT OF THE NATIONAL LABORATORIES

There has been discussion, both in the United States and abroad, about the redeployment of the Atomic Energy Commission's National Laboratories around problems of national importance that have no direct connection with nuclear energy. Desalination, both in its nuclear and nonnuclear aspects, is one of the new jobs around which several of the world's atomic energy laboratories have already mobilized. We at Oak Ridge have moved into civil defense and chemical co-carcinogenesis as well, and Chairman Chet Holifield of the Joint Committee on Atomic Energy has urged that the Atomic Energy Commission help devise ways of reducing pollution.

As one of many who have argued that the problem of nuclear energy, though vast, is nevertheless finite, and that the world shall some day have to redeploy its magnificent nuclear energy research institutions around newer and more pressing problems, I view the current redeployment both as in the national interest and as inevitable. Ever since the February 1960 report of the AEC to the JCAE on "The Future Role of the Atomic Energy Commission Laboratories," the possibility of redirecting some of the laboratories' energies to other problems of national significance has been contemplated. I have often felt that our government needs "government," as well as "government agency," laboratories; and I think the current exercises in redeployment will teach us how a laboratory can cross agency lines, and at the same time retain its strength and vitality.

Yet I have certain reservations. The first has to do with the present state of the nuclear energy art. To be sure, nuclear power now seems to be a giddy success. But, just because it has suddenly become so successful, the burden on the nuclear development community is immensely increased. We now must make absolutely *certain* that nothing has been overlooked in the present generation of reactors. Thus we shall have to devote continuing and sustained effort to such things as engineered safeguards, long-term radiation effects on pressure vessels, earthquake-proofing of reactors, and some aspects of waste disposal.

But perhaps more important, the primary goal of nuclear energy—the *economical* breeder—has yet to be reached. Until a reliable, *economical* breeder has been achieved, the essential job of the nuclear energy community remains undone and any redeployment that diverts us from that goal is premature.

By "economical" I mean a breeder that achieves fuel cycle costs, even with fissile material bringing only, say, \$3/g, of around 0.3 mill/kWh and capital costs of around \$100/kW. Some very advanced fast breeders, and the molten salt thermal breeder, appear to me to have the possibility of achieving such costs. But their development will be expensive. In view of their extraordinary long-term significance, I can only say that I am chagrined at the relatively low priority being given, even now, to breeder-reactor development, as compared with other projects sponsored by our government that have incomparably less long-term significance for mankind.

For the implication of really cheap and abundant energy is now beginning to be appreciated. We first saw it in R. P. Hammond's views on desalination. Desalting appears tractable as soon as one has sufficiently cheap energy. What about other massive industrial uses of very cheap energy, uses that will really make a difference to humanity?

I think several such uses can be discerned even now. The first is water from the sea at agricultural prices—that is, at not more than 10¢/1000 gal. Though this goal is very difficult, it is very important. The thermodynamic minimum of work required to desalt 1000 gal of sea water is around 3 kWh; if the economical breeder is achieved, and is financed publicly as is customary with water plants, the minimum energy cost for desalting would be around 0.5¢/1000 gal. Thus there is a margin of about 9¢/1000 gal to work on. Many of those who have looked seriously at the question of agricultural water from the sea do not view it as impossible by any means. I think it should be made a very important part of our future nuclear energy agenda.

And there are other industrial uses that become feasible with power from a reactor having a 0.3-mil fuel cycle cost. To mention only one, electrolytic hydrogen might be manufactured at a cost of 20¢/MSCF (with a \$4/ton oxygen credit), and from this would come relatively competitive ammonia for fertilizer, and possibly liquid fuel from coal.

I do not pretend that these large-scale industrial uses of extremely cheap nuclear energy are clearly feasible. And yet one is tantalized by the following circumstance: process industries have never had available to them, close to their sources of raw material, energy as cheap as we can expect from the economical breeder. I should think that once this fact is realized, a new industrial revolution may be set in motion. And inasmuch as this new industrial revolution would be based on the utilization of nuclear energy, I should think that its shape, and its onset, should be very much the business of the nuclear energy community.

In a sense, concern for the utilization of cheap nuclear energy itself represents a sort of redeployment away from the nuclear energy community's original task of *production* of cheap nuclear energy. Yet, such a redeployment strikes me as being very natural, possibly more natural than some other avenues that have been suggested. I only repeat, however, my original concern: that before the nuclear energy research community allows itself to become so dispersed that it cannot reintegrate around big projects, it must address itself, much more vigorously than it now has, to the ultimate problem of nuclear energy—the achievement of the economical breeder that, to paraphrase H. G. Wells, will "Set the World Free."

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