Persepolis and Miami Beach

Alvin M. Weinberg, of the Institute for Energy Analysis at Oak Ridge, Tennessee, comments on the evils of energy from fossil fuels and nuclear fission.

MIAMI Beach and ancient Persepolis must have as little in common as any two places in the whole world. Yet in the past three months each was the site of a scientific meeting that in an unsuspected way impinged on each other and possibly on our whole future. At Miami Beach 80 climatologists, ecologists, oceanographers, energy soothsayers, and scientific administrators met to discuss carbon dioxide in the atmosphere. At Persepolis, 500 nuclear people met to discuss transfer of nuclear technology. I attended both meetings.

Miami Beach marked the first time that most of the United States workers on the CO_2 problem, plus a sprinkling of European experts, gathered to decide what might be done about the great uncontrolled experiment—the effect of the accumulation of CO_2 in the atmosphere on climate. The atmosphere contains about 700×10^9 tons of carbon as CO_2; its present concentration is 330 parts per million (ppm). The concentration has been increasing at about 1 ppm per year during the 20 years that Professor Keeling of the Scripps Institute of Oceanography has been monitoring it. This increase corresponds to about one-half the total CO_2 thrown into the atmosphere by the burning of fossil fuels.

How much of the increase in CO_2 really comes from burning fossil fuel, how much from clearing of the world's forests? The oceanographers were adamant: there was no room in the oceans to accommodate a contribution from forest clearing that was a significant fraction of the contribution from fossil fuel. The ecologists were less adamant: from what we know about forest cutting, we cannot say whether the biosphere is a net source or a net sink of CO_2. More experiments and observations are needed.

If one assumes the CO_2 increase is caused by the burning of fossil fuel, what is the likely ultimate level of atmospheric CO_2? Since removal of CO_2 to the deep ocean requires 500–1,000 years, the concentration of CO_2 would double in about 300 years, even at the present rate of burning fossil fuel. But if the world's use of fossil energy increases—say sixfold by 2050—then the CO_2 concentration might double in 75 years.

The climatologists, largely basing their conclusions on the Global Circulation Model of Manabe and Wetherald, came close to predicting that a doubling of CO_2 concentration would cause an unprecedented warming of the climate: about 2 °C average, 8–10 °C at the poles. Moreover, the usually invoked stabilisers, especially clouds, did not seem to change these estimates significantly.

What, if anything, can one do about CO_2? Schemes ranging from dumping the CO_2 directly into the deep ocean (a suggestion of C. Marchetti) to planting a trillion trees (F. Dyson) were described. But mostly there was an air of helplessness. If CO_2 is as big a problem as many now suspect, we simply may have to limit our use of coal and other fossil fuels or live with whatever consequences may arise. Prudence dictates that in any case we keep open the world's energy options—solar, fission, fusion, conservation.

Which brings me to Persepolis. The most important paper discussed there was not even on the agenda: it was President Carter's nuclear policy, which was announced on the eve of Persepolis, and which completely dominated the proceedings. How could it be otherwise? Persepolis aimed at facilitating transfer of nuclear technology; President Carter's policy, though domestic, was largely aimed at minimising proliferation and therefore at limiting the transfer of certain nuclear technologies. No wonder most of Persepolis reacted as though mortally wounded.

Did Persepolis react too strongly? I think it is too early to say. After all, President Carter's proscription of plutonium recycling in light water reactors (LWRs) is simply a continuation of President Ford's policy. It goes beyond the Ford policy in deferring the Liquid Metal Fast Breeder Reactor (LMFBR). Now plutonium recycling in LWRs is only marginally economic in the US; and although it is unclear how the nuclear enterprise will permanently dispose of its wastes unless some reprocessing is allowed, I don't think it was the continued US proscription of plutonium recycling in LWRs that mainly bothered Persepolis.

Nor did President Carter's call for investigation of breeders other than the LMFBR bother me. I have long believed that the entire world locked itself into the LMFBR before it really investigated the alternatives. The real question to my mind is whether the President's policy represents a firm commitment to develop *some* breeder or was only the first step in soft-pedalling all breeder development.

The basic concern at Persepolis was that the new policy may betray an underlying inclination to have done with nuclear energy: let LWRs run their course, and because of the danger of proliferation, do nothing serious about the breeder. And if the breeder is not developed, nuclear energy will wither as our low-cost uranium is used up.

But what then of the necessity of keeping options open, a necessity made urgent at Miami Beach? At Miami Beach the alarm-sayers sense the end of fossil fuels because of CO_2. At Persepolis the alarm-sayers sense the end of nuclear energy, crucified on a cross called proliferation.

I would like to believe that both alarm-sayers are overreacting: that President Carter's policy will really lead to the timely development of several breeders, and that CO_2 somehow isn't the Sword of Damocles pictured at Miami Beach. But these are hopes, not necessary realities.

To weigh proliferation against climatic change is surely beyond human wisdom. Yet there is an asymmetry in these catastrophes, assuming they really exist, that suggests a proper course. The CO_2 catastrophe, if it indeed exists, will occur even if the fossil fuel system works *properly*: it can hardly be avoided short of drastically reducing our use of fossil fuels. Proliferation, by contrast, could be, though not necessarily, a consequence of an *improperly* operating breeder system, that is, one in which technical and institutional barriers to proliferation have failed.

Proliferation stemming from breeders can in principle be forestalled by proper design, both technical and institutional; a CO_2 catastrophe (assuming it exists) hardly can be forestalled except by changing to a non-fossil energy system. It therefore seems clear to me that we turn away from serious development of breeders at great peril. I hope my concerns are without merit, and that the President's policy will lead to greater, not lesser, emphasis on the practical achievement of proliferation-resistant breeder systems. □

Barnaby's

Plant a tree and save the world?