The Nuclear Energy Solution (Light Element Fusion)

by Robert W. Bussard, June 24, 1986, Financial World

It is a shame that our highly technical societies have developed nuclear energy so poorly. What saddens me especially is the historical indifference to an alternative that is potentially inexpensive and nearly inexhaustible, a source of power that promises low cost and inherent safety if developed and used properly. I speak not of the heavy-element fission of uranium and plutonium, whose pitfalls continue to be made plain by each update of the catastrophe at Chernobyl, but of light-element fusion.

Energy generated through fission powers all of mankind's unclear plants. Unhappily, the fission process results in highly radioactive by-products. These will produce energy uncontrollably (though predictably) long after their original fission process has been turned off. After all fission had stopped in the Chernobyl reactor, for example, "decay heat' continued to melt through its core and superheat its graphite matrix, causing the giant fires that spewed lethal radioactivity into the surrounding area and atmosphere.

Fission reactors have this one basic flaw: Once lit, they cannot be fully turned off; their fission products never go away. That is the nub of the problem. Nuclear criticality and the fission process itself can be contained by control rods, nuclear poisons and mechanical disassembly. And with some intelligent designing, we can build reactors so that no runaway nuclear-bomb syndrome can ever happen. But radioactive decay heat cannot be stopped.

All of this is why so many people — quite legitimately, I believe — express fears about nuclear energy. In the final analysis, what is frightening is our inability to guarantee fail-safe human operator management.

Make no mistake about this: It is a desperate prospect; the Chernobyl disaster is of enormous proportions. Current estimates are that many hundreds of people will die from radiation in the near term and a thousand times that many over the next several decades. Hundreds of square miles must be abandoned and sealed off for hundreds of years — just because one reactor system failed. Indeed, more people are killed each year in auto accidents, but the potential for continent-wide death and contamination does not reside in one automobile. It does reside in a fission reactor, and no matter how clever we are, there is always the problem of "the maximum credible' accident — and of the accident attributable to human error, which we didn't think of until too late.

Helium Balloons

Yet, as already noted, there is a safe nuclear solution to the need for cheap and controllable energy for man's works. It is the energy of nuclear fusion. Some fusion reactions yield only helium — that stuff used to fill children's balloons — and no radioactivity at all. Others also yield neutrons, whose radiation-inducing properties can be fully determined by design. No fusion process yields any radioactive products that create a decay-heat problem, and no meltdown is possible in any decently designed fusion power plant. So why don't we get on with it?

Well, if you ask the government, we are getting on with it — at a cost of about half a billion dollars a year. To date, in 30 years of research, over $10 billion has been spent, nearly all on designs that require a power plant of several

thousand megawatts and a construction cost of several billion dollars. Utilities said long ago that they didn't want, couldn't afford and wouldn't use these hypothetical giant plants.

Until recently (before Gramm-Rudman-Hollings), the federal government's plan had been targeted at spending another 20-plus billion dollars over another 25-plus years before reaching a useful power-producing result. This mentality completely misses the "think small' approach needed for any practical development. Yet a variety of concepts exist for small-scale fusion devices that, if successful, would offer dramatic new, safe and cheap ways to generate power. All of these concepts can be realized in less than a decade at costs, in some cases, of less than $10 million (not billion).

The government will not pursue these ideas because of the threat they pose to the huge federally funded fusion-research constituencies and to the bureaucratic agencies governing them. Real life suggests that this situation is not likely to change. But the small-scale R&D that I propose here is ripe for private support. It is the right size for industrial development, and it offers huge benefits (safe, cheap and radiation-free energy).

Yes, there is a nuclear energy solution — clean, quick and small-scale fusion. Let us get on with it — and turn away from fission's hazards — before more Chernobyls smite the world.