Editorial

Fusion energy for man's future

With the successful ignition of tritium and deuterium in the Joint European Torus, the reality of fusion as the energy source of the future is no longer deniable. JET proved it could be done, and its performance proceded precisely according to expectation. Although in this first experiment the small amount of tritium used as a fuel precluded scientific breakeven occurring, the energy produced—2 megawatts—was sufficient to light 20,000 hundred-watt bulbs for a period of two seconds. The energy cost was 15 megawatts.

By using this deuterium-tritium fuel combination, the largest amount of power ever produced in a fusion reactor was generated. Previously, in tokamaks using deuterium only as a fuel, only 50 kilowatts of energy was generated. By 1995, the expectation is that energy release will be 80% of breakeven.

This is a clear victory for science; nonetheless, there are several things to be said. The use of tritium fuel by JET was long overdue. The failure to move to an experiment with tritium by 1986—when it was scheduled for the Princeton TFTR tokamak—was reflective of the same kind of budget-cutting mentality which is destroying the space program as well. While things are worst in the United States, the situation is not that much better in Europe, or of course in the former Soviet Union.

One of the results of this budget cutting has been the scrapping of a whole series of promising smaller research fusion machines, such as the plasma focus, the mirror machine, and the reversed field pinch, in favor of the one major project. This is the International Test Experimental Reactor (ITER), which is expected to produce a 1,000 megawatt demonstration tokamak power reactor, and is not planned to go on line until 2040 or thereabouts.

While its designers say that it will cost somewhere in the range of $5-10 billion, a more realistic estimate is $10-30 billion—perhaps even higher. Even so, this is a modest investment in man's future. The major drawback of the ITER is that funds have been cannibalized from other, equally promising, smaller fusion machines—machines in which the physical geometries of plasma reactions were being intensively studied, at great benefit to science. In fact the ITER itself has been planned to leapfrog over several intermediary stages of development to become a large-scale reactor.

A more realistic approach would be to scale back the ITER so that it would become a 10-20 megawatt pilot plant, since this goal might be fully realizable within the 15-year period now set aside merely for completion of the design phase. What is needed now is to attack the problem of developing fusion energy in a multi-faceted way, so that work continues on the smaller alternate concept fusion machines which are now being phased out of existence.

Some scientists today counterpose thermonuclear to cold fusion. This is pure foolishness, or the seeking of petty advantage by a budget-starved science community. We should be devoting major resources to *both* (although at the present time the costs of cold fusion research are minimal in comparison with the thermonuclear budget). From the point of view of basic science, we certainly wish to study fusion plasmas in vacuum conditions (thermonuclear fusion) and fusion processes which take place within metals (cold fusion), and as history has shown, by studying both simultaneously, our understanding of each processes will be immeasurably increased. Undoubtedly such an effort, as it opens up new areas of basic science, will lead to new dimensions in our understanding of astrophysical processes and life processes as well.

There are many problems to be solved before either thermonuclear or cold fusion are realized as technologies. Thermonuclear fusion involves very large configurations, and will produce great amounts of heat and power, while cold fusion cells allow miniaturization and localization of the power source. Cold fusion may also be the desired rocket fuel of the future for interplanetary space travel. Now is the time to move ahead with a vigorous program to bring within man's grasp, the entire spectrum of controlled fusion reactions.