Science & Technology

MHD research: slowing here, speeding up abroad

by Marsha Freeman

For the past three years, the magnetohydrodynamics (MHD) energy research and development effort in the United States has been fighting for its life. Budget balancers in the Reagan administration have zeroed the program out of three successive budgets, but Congress has refused to let it die.

MHD promises to increase the efficiency of generating electricity from the 34 percent that is the industry average, to double that when the technology is fully developed. MHD direct conversion can be used with coal, oil, or gas-fueled power plants, or with nuclear fission reactors. In the future, it will be joined with the super-hot nuclear fusion process to produce electric power.

MHD conversion needs no moving parts. The motion of a hot, ionized gas flowing at supersonic speeds past a stationary magnetic field produces electricity directly. The days of huge rotating steam turbines will be gone forever when MHD reaches it potential.

At the 21st conference on Engineering Aspects of MHD, held June 27-29 at Argonne National Laboratory outside Chicago, it was clear that though the U.S. MHD effort has been reduced by two thirds in terms of its funding, other nations recognize the present and future necessity of increasing the productivity in the crucial electric power sector, and are going ahead with significant MHD programs.

Is MHD ready for commercialization?

This was the title of the keynote address at the conference, delivered by MHD pioneer Dr. Richard Rosa. The speaker stated from the outset that he had thought the answer to that question has been yes since 1959, when the Mark I MHD generator built at the Avco Everett Research Lab produced its first kilowatts of electric power.

Rosa reviewed in brief the accomplishments of the MHD program since then, in the hopes of countering policy proposals and position papers recently circulated to Congress by the Department of Energy, which funds the MHD programs. These documents dispute that any significant steps toward commercial development have been attained, and assert that MHD is too complicated; that it will not be ready until nuclear fusion is achieved, so it is not really necessary; and that the program should be reduced from its current paltry $30 million to $10 million per year to do only basic research.

It was quite apparent at the conference that though the United States has been slowing down its MHD effort, which had reached a peak funding level of $78 million before the Reagan administration came to Washington, government and private interests in other countries were moving ahead with ambitious MHD programs.

France and Israel push ahead

For the first time since 1970, a paper was presented at the conference on the MHD effort in France. Though technical problems in the late 1960s discouraged the French utility industry from continuing large-scale research in MHD, a second look is being taken at the present time.

In France, MHD is being considered for two potential applications. One is for export; it involves using a liquid metal for a closed-cycle MHD system which would use solar energy to provide small amounts of electrical power in rural parts of developing countries. French developers are looking to the Sahel region of Africa as a potential market for this technology, where individual systems could bring at least the basics of industrial life to a widely dispered population which will not have large baseload utility power plants to service it for some time.

Private interests in Israel are looking toward the Middle East as a market for similar small-scale liquid metal MHD units. By the end of this year, Israeli researchers plan to build a 5-10kw pilot plant to demonstrate the feasibility of the technology. The SOLMECS Corporation in Jerusalem plans to develop and market the units.

A number of developing nations, with large geographic expanses and isolated, thinly-populated rural areas, such as India, have made good use of solar-powered units which, up until this time, has been primarily developed by NASA for space applications. Over the past decade, NASA has built units that deliver a few kilowatts of electrical power and run on solar energy. These units, which can be small enough for one household to use, radically alter the standard of living of these currently backward peoples. One unit can power a light bulb, so people can read at night; a small refrigerator to preserve food; a radio to bring people into contact with the outside world; and perhaps one other small appliance.

These units will provide a bridge to the future by bringing rural people into touch with the rest of the world until large power plants are constructed and thousands of miles of electrical wires are strung. One of the original purposes of the small units NASA designed for the developing sector was to refrigerate medicines at hospitals.

MHD in space

The French MHD effort is also getting a small amount of funding from the CNES, the NASA of France. CNES is looking into the use of MHD conversion with a liquid metal fast breeder reactor in space, for on-board electrical power and also possibly electric propulsion.