2

CONF-8706111--2



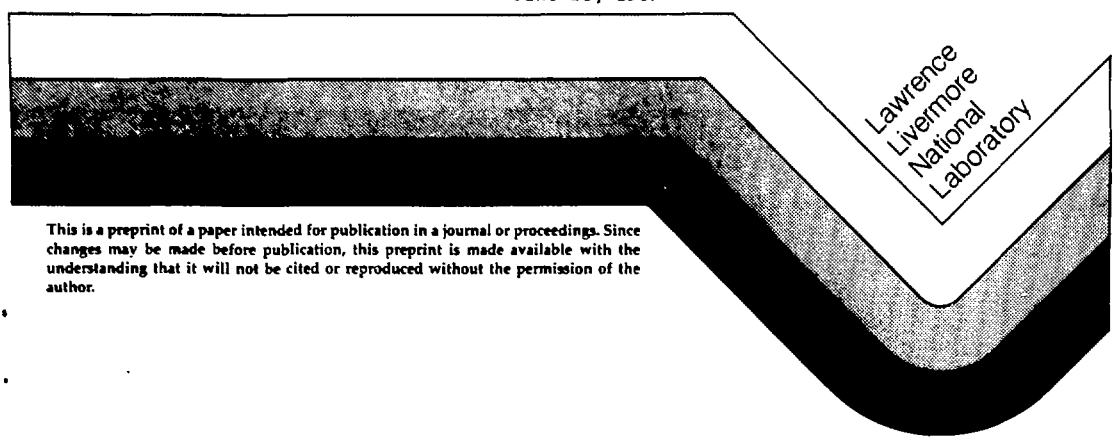
UCRL-96830
PREPRINT

# THE NEED FOR A FUSION TECHNOLOGY INFORMATION PROGRAM

Donald L. Correll, Jr.

This paper was prepared for submittal to
12th Annual Meeting & International
Symposium of the Technology Transfer Society
Washington, D.C., June 23-25, 1987

June 16, 1987



## DISCLAIMER

UCRL--96830

DE87 011886

# THE NEED FOR A FUSION TECHNOLOGY INFORMATION PROGRAM*

Donald L. Correll, Jr.
Lawrence Livermore National Laboratory
Livermore, CA. 94550

In providing an adequate energy technology for the future, which new programs should be considered by the Department of Energy national laboratories to ensure that the U.S. remains in the forefront of international science and technology? This paper suggests that the urgency for energy independence demands an active communication program that would increase awareness of energy as a critical national issue and would present fusion, with its benefits and risks, as one of the long-term alternative energy sources.

Energy independence is a national issue that waxes and wanes with the political and economic status of world oil supplies. Whereas there may be some disagreement about the remaining number of years in which oil and coal can supply the energy needs of the U.S., there is strong agreement that a long-term solution to U.S. energy requirements must be available to take this nation through the 21st century. Each of the three most accepted candidates--fusion, second-generation fission, and solar--should be investigated scientifically and communicated freely. Communication programs based on credible science form the foundation for constructive change that comes from an informed and educated public.



* Work performed under the auspices of the U. S. Department of Energy by the Lawrence Livermore National Laboratory under Contract W-7405-Eng-48.

The next decade is sure to see a growing debate about long-term energy sources: what are the risks, what are the advantages. The average lay person will not master the highly complex issues associated with each potential energy source. Instead, influential leaders from the scientific, industrial, and environmental fields will play a major role in deciding which avenues to pursue. However, the public will be watching closely the decisions and directions these leaders take to create new, environmentally safe, plentiful, and continuing energy sources. Public involvement and support will depend on clear and accurate information with which to gain the necessary perspective, consider various alternatives, and make careful choices. It is important that the scientific community inform the public, present a balanced treatment of the issues, and help to distinguish the real risks from the perceived risks.

Last year, the Technology Transfer Initiatives Program at Lawrence Livermore National Laboratory commissioned the Public Opinion Laboratory (POL), directed by Dr. Jon Miller at Northern Illinois University, to survey current attitudes about energy issues, particularly fusion energy. As part of its charter to initiate technology transfer wherever it has commercial potential, the Tech Transfer office sought data on how science and technology leaders, particularly industrial leaders, get information on issues like fusion and how knowledgeable they are about those issues.

In keeping with current social science theory and its usual survey procedures, the Public Opinion Laboratory selected as their polling sample leaders from four groups: science policy, industry, environment, and the congressional science staff. Current social science theory stresses that policy leaders strongly influence national views about science and technology issues.

Specifically, the POL survey was designed to discover the following information about the leadership groups:

- Their awareness of and knowledge about nuclear power, particularly fusion energy.
- Their expectations, concerns and attitudes about U.S. energy policy.
- Their sources of information about energy.

The complete results from the POL survey are presented in a Lawrence Livermore National Laboratory report, UCRL-15894. The methodology and results of the survey are summarized here.

Methodology

To gain representative samples in each of the four leadership groups, the POL identified leaders through their activities. For example, in the science policy leaders sample, the POL included all persons who were officers of national scientific associations, who had testified before a congressional committee on a scientific topic, who had served on an executive-branch science policy committee, who had published a technical book, and who had other similar roles.

Some individuals fell into these categories more than once, therefore, they were entered into the polling sample more than once. This method generated a sample of thousands of names from which 843 were selected through random sampling. The final survey included interviews with 508 science policy leaders, 89 utility leaders, 150 environmental leaders, and 96 congressional staff members. Of the 508 science policy leaders, 159 were in the

physical sciences, 92 in biological sciences, 72 in social sciences, 119 in engineering, and 66 in related fields.

Interviews lasting about 25 minutes were conducted by phone using a computer-assisted-telephone-interviewing (CATI) system, a process by which branching and logical checks are built into the interview. It is also faster and more accurate than traditional paper and pencil interview forms.

Results

When the POL tallied its results, they found that the respondents were not fully knowledgeable about scientific concepts related to nuclear power, including fusion. Many shared the opinion that fusion would be the solution to the search for a long-term source of energy, but at the same time they revealed that they needed more information about how the actual fusion process works. They were also unclear about a logical time and activity sequence that could lead to usable fusion power.

- **Nuclear power**

The POL survey probed attitudes about energy; it found considerable common ground on most issues--both current and future--among the 843 respondents. Even regarding the hotly debated subject of nuclear power, the leaders and science staff concur on the major issues. (Unless asked to differentiate between the fission and fusion processes, respondents were directed to consider nuclear power as that used in today's fission-based nuclear reactors.)

There was agreement that nuclear power will be a--if not the--primary energy source in 50 years. A majority of science and

utility leaders cite nuclear power as the major source; a third of the environmental leaders and science staff agree. At least 60 percent of all four groups rank nuclear power as one of the two most important future sources.

Of those considering nuclear power the dominant source, most indicate that future technology will be based on the fusion process. Some, however suggest that they did not have enough knowledge of work in this area to make a judgment. In a separate query, over 75 percent of the utility leaders and 60 percent of the science policy leaders indicate that fusion is the best long-term source of electricity. Forty-four percent of the environmental leaders and 45 percent of the science staff see fusion as the answer.

At least 70 percent of the science and utility leaders are confident that the benefits of nuclear power exceed its risks. This view is shared by 77 percent of the science staff. However, environmental leaders are more skeptical--only half feel confident about the long-term benefits.

At the same time that respondents recognize the importance of nuclear power, especially the potential of fusion energy, they suggest not really understanding the process. Overall, only a third say they can provide a clear explanation of the difference between fission and fusion. In a separate question, only 45 percent of the science leaders say they have a clear understanding of the fusion process, compared with 43 percent of the utility leaders, 20 percent of the environmentalists, and 32 percent of the science staff.

- Fossil fuels and energy supply

The survey also explored attitudes about other future energy sources, especially fossil fuels. Over 90 percent of the

respondents agree that planning must begin now to reduce U.S. dependence on fossil fuels in the next 50 years. There is broad recognition of the environmental problems associated with the burning of fossil fuels as well as of their limited supply.

A surprising puzzle was noted in relation to the issue of energy supply. POL pollsters first asked respondents to name the most important science and technology issues facing the U.S. today. To this open-ended question, most listed military preparedness, the level of research and development, science education, and environmental and overpopulation problems. Only 3 percent identified energy supply as the most important issue for the U.S. today. Later in the survey, though, when the leaders and staff were asked to rate five specific issues as major or minor problems, 70 percent considered the long-term supply of energy a major problem--more than any other issue. Following in the ranking are weapons in space, the burning of fossil fuels, nuclear power plant safety, and DNA experiments.

- Sources of Information

When asked in which sources they have "a great deal of confidence," "some confidence" or "very little confidence," respondents indicate that Science and Scientific American as well as publications from the national laboratories are their preferred science and technology news sources. Science earned an 88% confidence rating; Scientific American, 85%; national laboratory publications, 78%, the "Nova" science television series, 44%; the Wall Street Journal, 40%; the New York Times, 39%; and the evening news shows, 4%.

There is a reasonably high level of national-laboratory visibility among leaders and staff. Lawrence Livermore National

Laboratory was mentioned most often (24%), followed by Oak Ridge National Laboratory (13%), and Argonne National Laboratory (12%). Nearly half of the science policy leaders had visited a national laboratory in the last two years.

Although the POL survey showed a considerable consensus among the four groups of respondents, it did point out areas in which more information is needed. Respondents admitted they did not know how fusion works as a future energy source, they were uncertain about the difference between fission and fusion, and they were fuzzy about the severity of the energy supply problem.

It can be concluded that the POL survey points to the need for an information program about long-term energy alternatives, such as fusion technology. During the last few years there has developed an intensive debate over the degree to which the U.S. is in danger of losing its lead in many high technology areas. Advanced energy technology is one particularly important field in which we cannot afford to become a second-rate nation. Although there is no energy crisis today, the warning signs are visible.

The U.S. dependence on foreign oil is slowly rising and petroleum imports are projected to exceed 50% of the demand by 1990. Realistic projections of both U.S. and world population and energy consumption rates clearly show that within the next 25-30 years we must begin our inevitable transition away from fossil fuels if we are to preserve these resources for agricultural, medical and industrial use for future generations. Given that it takes several decades to bring a major new energy production technology from conception to full market penetration, and since there are alternate technologies, it is not justifiable to delay their development until we have no other choice.

If we are to envision a future world where the standard of living currently enjoyed in the industrialized nations will be shared by the majority of the population of planet Earth, we only have three options.

1. Expand the fission nuclear power concept into the realm of breeder reactors--and develop truly effective safeguards.

2. Develop solar conversion plants both in space and on Earth. Potentially, this could supply a significant fraction of our long-term projected energy needs; however, it would require international cooperation on a scale to make all past global efforts seem insignificant.

3. Develop fusion power--the energy source of our sun and all other stars.

Recent scientific and technological advances have shown that fusion is indeed ready for accelerated development. The scientific feasibility of fusion is now certain--a claim that could not have been made a decade ago--and the virtues of fusion energy have withstood the scrutiny of increasingly sophisticated engineering analysis.

Because the challenges associated with fusion research can be met and the rewards are infinite, the Department of Energy national laboratories, which have been recognized for numerous successes in various scientific endeavors, must continue to accept and to communicate the fusion challenge.

Acknowledgments

The author wishes to extend his appreciation to Carol Gerich, Dave Goerz, and Erik Storm for their suggestions and contributions. Any errors are his; the thanks are theirs.

0141P