energy needs of the next century, we have to start the development of fast breeder reactors now. There is no way, if we look into the future, he said, that we can meet the uranium needs for the number of nuclear plants we'll need in 2050, without breeder reactors. It takes 30 years to find and work out all the design problems in a reactor, Wolfe said. It was a "bad mistake" that the United States gave up our fast breeder reactor program, he concluded. But other nations did not make that mistake.

Russia, for example, has had its BN600 fast reactor operating for 18 years, with a 73% availability, and Russia is ready for the next generation of fast reactors. Four more fast reactors are planned to be on line between 2010 and 2020, two BN800 reactors in both Belarus and South Urals sites. Russian nuclear official Oleg Sarayev—who could not come to present his paper in person because of a lack of funds—said that the construction was expected to take seven years, and that 80% of the budget was to come from the municipalities involved.

France's 1,200 MW Superphénix fast breeder, the world's largest, came on line in the mid-1980s, and was just shut down last year—for political reasons having to do with electoral compromises with the Greens. It should be noted that this commercial-size breeder was completed in eight years—compared to 14 and more years the United States took to put a conventional reactor on line in the 1970s. Work is continuing on the new European Fast Reactor design effort, a collaborative effort of Germany and France, although the funding for this is uncertain.

Japan has proceeded with fast breeder design, moving from the experimental Jojo to the prototype Monju (which is currently shut down because of a sodium coolant leak). Now, Japanese studies are under way for the Demonstration Fast Breeder Reactor, in a 660 MWe plant and a 1,500 MWe plant.

Breeder economics

The economics of different types and sizes of fast breeders have been studied in detail, both for cost per unit of power production and the length of time required to double the initial input of fuel. Japanese nuclear expert Masao Hori argued at the American Nuclear Society meeting in Washington, that these studies and the experimental evidence from breeder operation have to be put together now in a plan for the next century. Hori proposed, therefore, an international collaborative effort, what he called an "international laboratory," to move the technology forward as fast as possible, making use of each nuclear nation's particular strengths and experience in the breeder area (see accompanying interview). The goal would be to have demonstration reactors on line in the 2000s, moving to series construction a decade later, and large commercial plants by the 2030s.

As Hori has emphasized over recent years, such a plan requires a vision of hope for humanity.

Interview: Masao Hori

'International lab' needed to build fast breeder reactors

Masao Hori

Mr. Hori recently retired from the Japanese Power Reactor and Nuclear Fuel Development Corp., where, during the past 30 years, he had served as the General Technical Adviser on Fast Breeder Reactors, Special Assistant to the President, and Executive Director in charge of fast breeder R&D. Hori now is a researcher with Nuclear Systems Association, based in Tokyo. In the early 1990s, Hori headed a special international committee, composed of members from the nuclear societies of 11 countries, to prepare a "Vision Document" on the second 50 years of nuclear energy. He is on the board of directors of the American Nuclear Society and of the Japanese Atomic Energy Society, whose International Committee he chairs.

Hori was interviewed in February by Marjorie Mazel Hecht.

EIR: At the November 1998 meeting of the American Nuclear Society in Washington, D.C., you spoke at the session on fast breeder reactors, and talked about the need to develop these breeder reactors now, so that they will be commercialized and ready for demonstration reactors in the 2000s, with series construction by the 2010s. What is your sense of how this can happen? Will Japan take the lead internationally in bringing this about?

Hori: If we look at the world accomplishment in fast reactors until now, in terms of plant scale, France has built and operated the 1,200 megawatt-electric SuperPhénix. As for operating experience, the Russians have operated the 600 MWe BN-600 plant for 18 years, with a 73% availability factor. In terms of large plant design, the European countries have developed and designed the 1,500 MWe EFR. As for licensing, the Russians licensed the 800 MWe BN-800 in 1997.

Therefore, technically, we are ready to move into the demonstration stage. However, it has now become difficult for these countries to proceed with the demonstration stage for various reasons. The Japanese fast breeder reactor project,

for example, has been delayed several years by the Monju sodium leak.

Because it has become increasingly difficult for any one country to continue the development of its fast reactor project—for political, economic, or social reasons—Japan recently started talks on updating the cooperation on fast reactors with France and Russia. I think it is only under international cooperation among the advanced countries that we can proceed with fast breeder reactor development in the demonstration stage, so that commercial developments could start in due time for the global introduction of fast breeder systems.

EIR: You mentioned the concept of an "international laboratory," operated in partnership. Do you see this as all the nuclear nations working separately on fast reactor designs, but sharing information?

Hori: You know that there are different options pursued by the nuclear countries in fast breeder development. For example, for fuel type there are oxide fuels or metallic fuels; in plant configuration, there are tank-type or loop-type plants; for fuel reprocessing, there is the Purex process, or dry process, and so on. As the fast breeder reactor development tracks and options are different for each country at present, it is important for the "international laboratory" to be operated by what I call a "partnership spirit of flexible interdependence," recognizing diversified tracks and options.

Each country will pursue its own project, while cooperating with other countries as much as possible. There are many facilities on reactor and fuel cycle available for fast breeder reactor R&D in the world. Some of these facilities may be more efficiently utilized by internationally cooperative studies. We have done this up to now, to some extent, but we should increase the breadth and depth of cooperation. As a result, sharing of information would increase, and these experiences could effectively be utilized for the development of commercial reactors.

At first, we envisage a soft, or loose, coupling, rather than a rigid one among the partners. So, the name international laboratory may be symbolic, to show the spirit of partnership. Financial support by each government of advanced countries for its own development organization is the basis. For the management of the international laboratory, there will be periodic joint coordination and review meetings by the representatives from the sponsoring governments, constituent R&D organizations, and utility companies.

In this cooperation scheme, it would be beneficial to all partners for any partner(s) to construct and operate a demonstration plant. Therefore, any joint efforts for a demonstration plant, including technical and/or financial contribution, should be stimulated.

EIR: You have been a leading spokesman internationally on behalf of nuclear energy, and, in particular, for plans to make nuclear energy available to the developing sector, so that these countries can most efficiently provide for their future populations. Meanwhile, the irrational faction in the industrial nations—in Germany especially—is trying to shut off nuclear power. What is your view of this battle? What would you advise the nuclear community to do to prevail over the irrationality?

Hori: First of all, we should recognize that, besides its benefits for the global environment, nuclear power is now economically competitive in many countries, except where energy resources (like coal or natural gas) are abundant and cheap, as in North America.

What the nuclear community should do to prevail over the irrationality is to be clear and outspoken. The nuclear community should speak out on the scientifically and technologically correct facts, and the vision based on these facts, with confidence. The nuclear community should not flatter irrationality. If we do so, it would lead to a great loss for the public and the world.

The choice of energy options should be determined by overall cost/risk/benefit evaluations for all the available energy sources. Environmental costs should be included in assessing the full cost of all energy alternatives. The nuclear community should explain the advantages of nuclear, using relative values to other energy options, as well as quantitative values, especially on such focussed topics as nuclear safety and wastes.

EIR: I think that there is a fallacy in the way cost/benefit analysis is used today. It is too short-sighted to see beyond what it defines as immediate gain. It leaves out the question of human lives that are now being lost by our not investing in the most advanced technologies today—and, of course, it leaves out the future. To put it more starkly: Cost/benefit in accountant's terms means that people will die because the economy that listens to this type of advice will make decisions based on what is assumed to be immediate gain, not decisions based on improving the living standards of people around the world, and seeing the great benefit to mankind of allowing all people to develop their potential fully.

Hori: It is up to the advanced nations to develop energy systems with higher potential, because developing nations will naturally opt for readily available sources of energy. As nuclear energy has the highest potential for the global supply of energy, advanced nations should strive for the development of advanced nuclear power plants.

However, even in the conventional, so-called practical terms in use, nuclear energy makes sense. For example, the ExternE project conducted by the European Commission, gives important results on the external costs, giving the comparative environmental impact of electricity production from various energy sources. The external costs for nuclear energy, given in units of ECUs per kilowatt-hour, are on average one order of magnitude less than those for other energy sources. These are important values to use in explaining energy economics to the public, as well as to policymakers.

I think that the advanced nations should restructure their nuclear research and development program based on the vision that nuclear energy would become the major energy source in the middle of the 21st century. I would highlight some important subjects of research and development for ensuring the continuous supply of nuclear energy for global utilization as follows:

1. R&D on the fast breeder reactor and its recycle technologies, for extracting energy fully from uranium sources.

2. R&D on optional types of reactor and fuel recycling, for making better use of the unique characteristics of nuclear energy.

3. R&D on nuclear safety and the health effects of low-dose radioactivity, for assessing the risk of nuclear energy more quantitatively.

EIR: What is going on in the Japanese nuclear program now? How are plans proceeding with the next-generation nuclear reactors—the fast breeder, in particular?

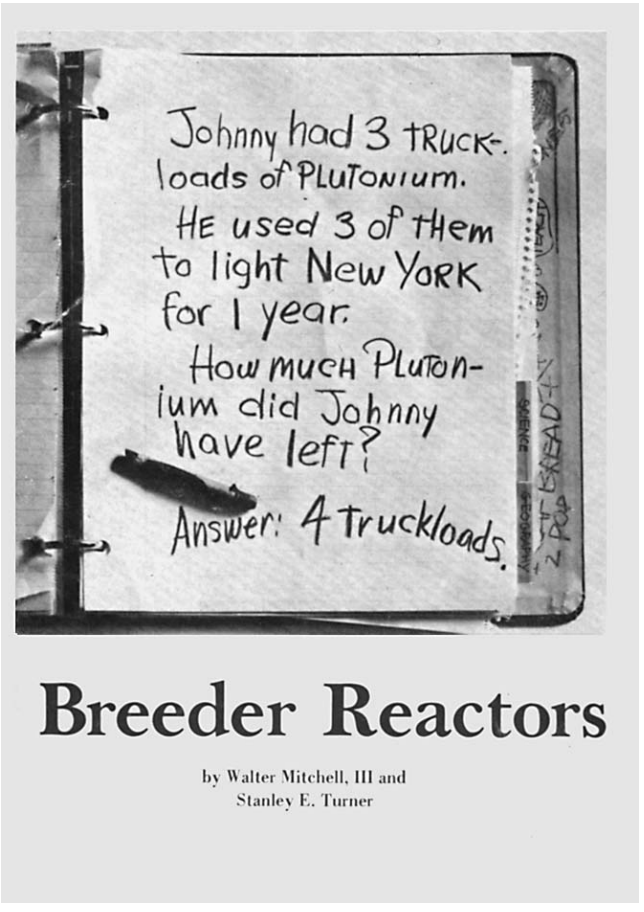
Hori: At present, Japan relies for 36% of its total electric power generation on nuclear energy. Japan has to continue to rely on nuclear as a major energy source in the future because of the scarcity of coal and oil resources, in addition to the Kyoto Protocol fossil fuel restrictions.

Japan has been developing the fast breeder reactor technology for about 30 years, and surely will continue to develop it. Energy security through the fast breeder reactor, with its fuel recycling, is the ultimate goal for Japan, which has no domestic uranium resources. Japan believes that the fast breeder technology will contribute also to the future energy supply worldwide.

EIR: The situation sometimes seems bleak in confronting the irrationality and lies about nuclear energy, which have become commonplace in the Western media. Yet, if you look at countries like China and India, they are committed to an aggressive nuclear-reactor-building program, and understand that it is the most efficient (and cleanest) way to provide enough energy for industrialization and modernization. What are your thoughts on this? How do you see the Eurasian Land-Bridge project as helping your mission to bring nuclear power to its fullest potential?

Hori: There is a growing demand for energy in the developing countries, particularly in Asia. Nuclear power is a proven and practical source of energy available to meet these demands without increased fossil fuel burning. Modern, safe, and efficient nuclear power stations are being planned and built in this region with the collaboration of countries in which nuclear power programs are already well established.

I think that energy is one of the key issues in the Eurasian Land-Bridge project on which the Chinese and Japanese governments have agreed recently. Nuclear energy will play an important role in the project, to effectively utilize the natural resources in the area. By using nuclear energy, these countries' natural resources could be used more as raw materials for a variety of beneficial purposes, and used sparingly as fuel sources.



This is the cover of a 1971 educational booklet, one of 50 different topics published by the U.S. Atomic Energy Commission in its "Understanding the Atom" series.

EIR: You had also proposed using nuclear energy for non-electric energy applications, by producing hydrogen. How does this fit in with your view of the future energy mix?

Hori: About 30% of the world's primary energy sources are converted to electricity at present. The remaining 70% is consumed mainly as process-heat (for industry) and space heating, and in transportation. Even if we increase the ration of electricity to 50% in the future, that leaves 50% to be taken care of.

As it is becoming increasingly essential to reduce the use of fossil fuels, from the viewpoints of both resources and the environment, it is important to explore the possibility of nuclear energy replacing other energy sources for non-electric applications. The most promising and realistic way to fulfill this need is to produce hydrogen by electrolysis, using nuclear power stations. Hydrogen is a good energy carrier, and hydrogen produced by nuclear power is estimated to be commercially competitive at present with hydrocarbon-based hydrogen, in a region where off-peak nuclear power is available.