資料第４－７号

ＥＵ及び米国の動向について

平成９年５月２６日

＜ＥＵの動向について＞

○　５月１５日に開催された研究相理事会において、第５次研究開発フレームワーク（案）に関する最初の議論が行われた。同案自体については、ＥＵ計画全体とのバランス等に対する懸念からスペインが拒否し、引き続き検討を進めることとされた。核融合については、席上、議長国であるオランダより核融合研究開発に関する５つの中長期的シナリオが提示された。

○　今後ＥＵ内部において、同シナリオに関し、予算上の配慮を含めた第５次研究開発フレームワークへの反映を検討し、１０月初めまでに同理事会に報告することが求められているとのこと。

○　同理事会では、報告を受け、１１月に改めて第５次研究開発フレームワーク期間における核融合研究の進め方について議論する予定。

＜＜議長より示された核融合研究に関する５つのシナリオ＞＞

①　核融合研究の断念
　－ＪＥＴの停止、ＩＴＥＲ計画の中止

②　科学としての核融合研究の実施
　－欧州の核融合研究の科学的・技術的基礎の維持

③　2000 年以降への決定の延期
　－ＪＥＴの２～３年の延長、第４次フレームワークと同程度の予算

④　ＩＴＥＲの建設

⑤　欧州域内計画としての核融合実験炉（Next Step）の建設
　－欧州単独による計画を実施

（以上 European Report (EU)等より入手）

＜米国の動向について＞

○　下院科学委員会（センセンブレナー議長）は、９８年度の核融合関連予算に関し、政府要求額より１５百万ドル多い２４０百万ドルを上限として決定

○　また、同委員会の議長以下８名の署名により５月７日付で、歳出委員会エネルギー・水資源小委員会（マックデード議長）に科学委員会の提案を尊重するようレターを発出

○　最近の核融合関連の報道振り

・　ＩＴＥＲ計画は、予算不足のために来年１月につぶれる危機にある
・　今月日本では、財政難により、ＩＴＥＲ建設が３年遅れるとした記事が掲載された
・　エネルギー省Ａ．デービス核融合部長はインタビューに対して以下を回答
　－　ＩＴＥＲは、建設が開始されるまでに３年間現在の活動を継続する可能性がある
　－　米国がＩＴＥＲに対し５％しか負担できないことが他３極を消極的にしている
　－　現時点では、100％の資金の積み上げの見通しが得られていない
　－　現時点ではどの極も誘致表明はしていないが、日本が誘致を望んでおり、最大の貢献をするだろう
　－　日本は、原子力委員会にＩＴＥＲ計画懇談会を設置し、ＩＴＥＲ計画の進め方を審議中。来年早々には政府の対応が明らかになる見通し
　－　伊政府が誘致に関心を示しており、サイト検討中である

（５月２０日付 New York Times より）

still has to contend with the problem of monitoring its external borders, through which illegal immigrants enter before moving on to other EU Member States. Signed in June 1990, the Schengen Convention proposes the abolition of routine border checks within the EU (airport and land frontiers) and stepping up surveillance at external borders.

RESEARCH:
FIVE SCENARIOS FOR EUROPEAN NUCLEAR FUSION PROGRAMME

Will the European Union continue its research effort in the area of controlled thermonuclear fusion (under the specific Fusion Programme)? Will the EU be willing to invest the enormous sums (about ECU 1.05 billion between 1999 and 2002) required to build the International Thermonuclear Experimental Reactor (ITER)? These questions will be on the agenda in the context of negotiations in preparation for the Fifth Framework Programme for Research and Development (R& D), which will define strategic opinions for the next century. The future of the Fusion Programme, discussed at the May 15 Research Council, is uncertain, and it could even be abandoned altogether, under one option of five floated by the Dutch Presidency of the European Union.

(May 20, 1997 - European Report - 471[/A])

The Dutch Presidency has distributed a Note to its European partners analysing the Fusion Programme. This document calls upon the European Commission to study five possible scenarios for the medium- and long-term future of the programme and their budgetary implications. Due to opposition on the part of Spain (for reasons only distantly connected to research; see European Report N° 2224), the Council was not able to adopt formal Conclusions following the May 15 meeting. The other 14 delegations did support the Presidency's conclusions, particularly as concerns the future of the Fusion Programme. Spanish opposition will only delay consideration of this crucial issue, which has implications for the EU's energy supply in the 21st century.

Alternatives to nuclear fusion. Basing its findings on an assessment of the Fusion Programme conducted by a group of experts in 1996, the Dutch Presidency emphasises the need to view research within a broader context encompassing all sources of energy, including fossil fuels, uranium, biomass, wind and wave power. None of these resources can be ignored, as there are no guarantees as concerns long-term (for the year 2050) energy supplies. Renewable energy sources (solar energy, biomass, wind and wave power) could meet 20% of energy needs by the year 2030 if research efforts continue. Among fossil fuels, coal is the resource most likely to be available over the long term, but it poses the biggest problem of CO_2 emissions. Uncertainty concerning the quantity of uranium available and the hazards of nuclear waste cast doubt on the prospects for nuclear fission.

In this context, thermonuclear fusion merits further study as fuel supplies are unlimited and it generates little waste. A fusion reaction occurs when two hydrogen isotopes heated to extremely high temperatures unite. However, this technology is highly complex and requires more long-term and expensive research.

An international-scale programme. The objective of the Fusion Programme, as part of the Fourth Framework Programme on Research and Development (1994-1998), was to develop a new experimental reactor known as the Next Step Torus, as the prototype for the electricity plants of the future. Research under the 4th Programme, with a budget of ECU 895 million, has led to further progress with the feasibility and operational stages of the Joint European Torus (JET), a world-leading intermediate facility, for extrapolation of research results to the next generation of experimental reactor.

JET has put Europe in the forefront of fusion development, although the Community has for some years been collaborating with the United States, Russia and Japan in the international experimental reactor project. The international cooperation agreement the four partners signed for the construction of ITER, a world-class version of the Next Step, expires in July 1998 and it is expected to culminate in a detailed plan for the construction of ITER. So far, none of the partners is legally committed beyond July 1998. ITER's location is also being hotly disputed. In October 1995, the Council of Ministers asked the Commission to consider possible sites in conjunction with the Community's partners. While the United States has given up on the idea of hosting ITER, Japan is still interested. In Europe, meanwhile, the idea of a site in southern Italy

is being considered, as it would be eligible for Structural Fund aid. However, the Member States are hardly falling over one another in their eagerness to assume 10% of total construction costs.

The five options. No site has been chosen, given the uncertainty surrounding the future of the Fusion Programme and reflected in the five scenarios proposed by the Dutch Presidency:

- **Abandoning fusion research**: The closure of JET and cancellation of cooperation agreements with Russia, the United States and Japan and an end to the programme would be the equivalent of halting research in which Europe has already invested some ECU eight billion over the past 30 years. The cost of dismantling the Fusion Programme could reach ECU 250 million over the period of the Fifth Framework Programme (1999-2002).

- **Science-driven fusion: continuing research without ITER**: Under this option, ITER would not go ahead but Europe's current scientific and technological basis would be preserved. Budgetary commitments would be reduced to about ECU 400 million for 1999-2002; maintaining JET would bring the total budget to about ECU 700 million.

- **Postponing a decision until after 2000**: this option would give Europe and its partners time to make strategic choices and to assess the alternatives to nuclear fusion; the EU could take a page out of the United States' book (President Bill Clinton recently commissioned an analysis of energy needs for the next century and the means - energy conservation, renewables, fission and fusion - being considered to meet them). Delaying a decision would allow consideration of a better international distribution of energy research. This option assumes that JET would be pursued for two or three years and cost some ECU 850 million, the same amount allocated under the 4th Framework Programme.

- **Construction of ITER**: This is by far the most ambitious and costly option and the most difficult to apply; the construction of ITER in a European Member State would cost some ECU 3.5 billion over ten years (50% of the total cost); moreover, for the period of the Fifth Framework, it would cost ECU 1.05 billion. Building ITER in Japan would be more responsible in budgetary terms, but would rob Europe of its current leadership role in the fusion field.

- **A 100% European experimental reactor (Next Step)**: if international cooperation with the US, Russia and Japan proves impossible, an entirely European action should be considered; this option cannot be ruled out although it would be very expensive (the Dutch Presidency's note does not cite any amount).

SPANISH AND FRENCH MARKET GARDENERS AT LOGGERHEADS

The annual confrontation between French and Spanish fruit and vegetable growers got under way in earnest on May 13, when French market gardeners in the Vaucluse region hijacked and destroyed consignments of Spanish melons, strawberries, and tomatoes in protest at the heavy price erosion brought on by an influx of cheaper Spanish imports onto the French market. The two countries' respective fruit and vegetable growers' associations then proceeded to fan the flames of the row with an exchange of insults and allegations. Ramon Martinez, spokesman for FresHuelva, the association of strawberry growers of the Huelva region, called on May 16 for an immediate suspension of all EU aid to French fruit and vegetable growers as a retaliatory measure. Claude Trémola, spokesman for the French vegetable growers' association FNPL-PACA, retorted that Spain was guilty of *"exporting its economic crisis to France"*, and called on the French Government to either invoke a safeguard clause against further Spanish exports, or to introduce an agricultural restructuring programme designed to phase out market gardening in France altogether.

The problem stems from the fact that Spanish growers harvest their produce earlier than their French counterparts, which enables them to reach optimum production levels sooner. French growers assert that the price levels set by their Spanish competitors do not permit them to cover their costs. On May 14, Spanish courgettes were selling in France for 2 Francs

F. JAMES SENSENBRENNER, JR., Wisconsin, CHAIRMAN

U.S. HOUSE OF REPRESENTATIVES

COMMITTEE ON SCIENCE

SUITE 2320 RAYBURN HOUSE OFFICE BUILDING
WASHINGTON, DC 20515-6301
(202) 225-6371
http://www.house.gov/science/science.htm

May 7, 1997

The Honorable Joseph M. McDade
Chairman, Subcommittee on Energy and
Water Development
2362 Rayburn House Office Building
Washington, D.C. 20515

Dear Chairman McDade:

We are writing to request that you include $240 million in the Energy and Water Development Subcommittee bill for the Fusion Energy Sciences program.

Last month, as you may be aware, the Science Committee approved legislation authorizing the Department of Energy's Research and Development programs for Fiscal Years 1998 and 1999. Included in that bill was a two-year $240 million authorization for the Fusion Energy Sciences program. This increase of $15 million over the Administration's FY 1998 request reflects considerable support for the program on the Science Committee.

In addition, this increase over the Administration's request for the program recognizes the following:

1. The fusion program is undergoing a substantial restructuring as was recommended by the 1996 report of the Fusion Energy Advisory Committee (FEAC). FEAC recommended the minimum annual funding for carrying out the restructured program to be on the order of $250 million.

2. At the present funding level of $225 million, many aspects of the program are constrained, including work on innovative alternate confinement systems, operations of remaining major experiments, theory and computational research, and university fusion science and technology programs. As a result, progress in U.S. fusion science is substantially slowed and existing taxpayer investment in costly experimental equipment is poorly used. Therefore, the Science Committee's report language (enclosed) explicitly states that the additional $15 million should be spent to address these specific constraints.

3. As is spelled out in the FHAC report, there is a strong interdependency between the domestic and international elements of the fusion program. First, if we are to take full advantage of other, more well-funded international fusion efforts, we must maintain a strong domestic program. At the same time, while maintaining that strong domestic program, we must have resources in the program that are explicitly directed towards international collaborations. In this regard, beginning next year, we may be entering a period of some uncertainty with regard to construction of the International Thermonuclear Experimental Reactor (ITER) project. Therefore, in its accompanying report language, the Committee requires the Department of Energy to address and provide a report on key issues surrounding the U.S. role in this period of uncertainty and to suggest how, in this interim period, we can guarantee that its international involvement is providing the maximum benefit to U.S. fusion science.

4. Finally, fusion energy research fits extremely well with the funding criteria laid out in the Science Committee's Views and Estimates earlier this year -- it is long-term, high risk, non-commercial, cutting edge, has great potential for scientific discovery, is highly relevant to agency missions, and it is highly involved in international partnerships that leverage U.S. taxpayer R&D investment.

While we fully recognize allocations are likely to be very tight this year, we ask that the Energy and Water Development Subcommittee support the Science Committee's recommended level of funding for this important science program. Thank you for your consideration.

Sincerely,

F. JAMES SENSENBRENNER, JR.
Chairman

GEORGE E. BROWN, JR.
Ranking Minority Member

VERN EHLERS
Vice Chairman

TIM ROEMER
Ranking Minority Member
Subcommittee on Energy and Environment

KEN CALVERT
Chairman
Subcommittee on Energy and Environment

FJS/cf
Enclosure:

THE NEW YORK TIMES SCIENCE TUESDAY, MAY 20, 1997

Money Shortage Jeopardizes Fusion Reactor

By MALCOLM W. BROWNE

Insufficient financial support has thrown the future of a proposed international fusion reactor so much in doubt that the project could be killed by January.

At stake is the construction of the International Thermonuclear Experimental Reactor, or ITER, a $10 billion project intended to demonstrate by the year 2008 that hydrogen isotope fusion, a process somewhat similar to that which powers the sun, could be a commercially practical source of energy. The project is supported by Japan, a consortium of European nations, Russia and the United States.

Many have dreamed of an unlimited source of power drawing its raw material from sea water. The dream has persisted despite a growing realization of the extreme difficulty of fusing ordinary hydrogen nuclei, as distinguished from hydrogen's rare isotopes, deuterium and tritium. Even the expectation that hydrogen fusion would be wholly nonpolluting has been dampened by the estimates of some experts who believe that parts of a fusion reactor would become dangerously radioactive.

The problems of ITER (meaning "way" in Latin and pronounced "EAT-ur") are the latest in a series of recent blows that have closed down the world's most powerful experimental fusion reactor and dimmed prospects for building a commercial fusion reactor in the foreseeable future.

Press reports in Japan this month quoted unnamed official sources as saying that a lack of money would delay the start of construction by three years. In an interview, Dr. Anne Davies, director of the office of fusion energy at the United States Department of Energy, acknowledged that about three years of design work, research, engineering and environmental study would be required before construction could begin. But she said the work planned for this interim period would have had to precede the construction phase in any case.

Still, the fact that the United States has agreed to pay only 5 percent of the project's cost has clearly discouraged the other partners.

"It took them a while to realize that we really meant it," Dr. Davies said. "They had trouble accepting the fact that we, the United States, large though we are, couldn't contribute more than about 5 percent. The Japanese have said informally they could put in 50 percent, but the Europeans have said informally that if the reactor is built in Japan, they would contribute no more than the Americans. So it doesn't add up."

Russia is not expected to contribute an appreciable amount, so the shortfall would probably be close to 40 percent. Japan would be expected to pay the largest share because that nation is likely to act as the host of ITER, if it is built. But Japan has not yet offered a site for the reactor.

Several months ago, Dr. Davies said, Japan appointed a high-level committee including electric utility experts, scientists, engineers, industry executives, artists, architects and social scientists to study ITER and decide whether or not Japan should act as its host. The committee will submit its report at the end of summer, and next January, when the Japanese Government announces its budget, the world will know Japan's decision on the reactor.

No nation has yet offered a site for ITER, and nuclear regulators and licensing agencies have therefore been unable to begin their studies "as we had hoped would have begun by now," Dr. Davies said. Asked whether the ITER project could totally collapse next January, she replied, "It's always possible."

But she added that the Italian Government had shown some interest in the possibility of providing a site for ITER, and other governments might also make offers.

Hopes for the development of magnetic-confinement fusion, the system that ITER would exploit, have been dealt several blows in the last year.

Last December, experts at the University of Texas and the Princeton Plasma Physics Laboratory concluded that without design changes "the reactor will not sustain a reaction producing much more power than is put into it."

Their conclusion was contested by some experts, but there is general agreement that some redesign of the reactor will be necessary in the next few years, if it is to be built.

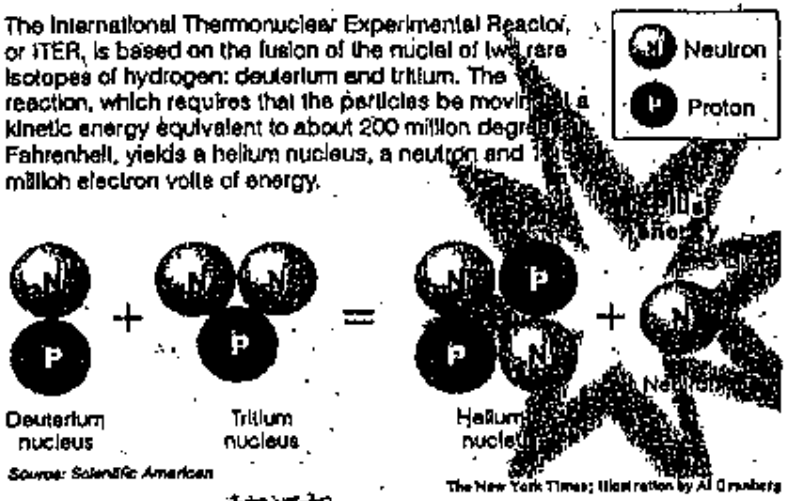
Last year, Congress reduced financing of American fusion programs by 33 percent, and in April the Tokamak Fusion Test Reactor at the Princeton Plasma Physics Laboratory in New Jersey — the most powerful such reactor in the world — was forced to shut down permanently. The reactor was being used as a test apparatus for studying technical problems that must be solved if the international reactor is to work as hoped.

Since the 1950's, when the renowned Soviet physicist Andrei Sakharov and his colleague Igor Tamm invented the doughnut-shaped tokamak, this device has been widely regarded as the most promising approach to hydrogen fusion. In common with other magnetic-confinement systems, a tokamak uses electric and magnetic fields to compress and heat electrically charged hydrogen to a point at which hydrogen nuclei fuse together, releasing energy. Prospects for developing tokamaks capable of generating power at a commercial level now seem bleak.

At the Lawrence Livermore Laboratory in California, however, construction is about to begin on the National Ignition Facility, a fusion reactor that would generate power by detonating a stream of miniature hydrogen bombs. Like the Princeton Plasma Physics Laboratory, the Livermore laboratory is supported by the Department of Energy, but much of its work is financed by military programs within the Energy Department. One of these, the Nuclear Stockpile Stewardship Program, finances the National Ignition Facility, because the project would continuously assesses the effectiveness of

Recipe for Nuclear Fusion

The International Thermonuclear Experimental Reactor, or ITER, is based on the fusion of the nuclei of two rare isotopes of hydrogen: deuterium and tritium. The reaction, which requires that the particles be moving at a kinetic energy equivalent to about 200 million degrees Fahrenheit, yields a helium nucleus, a neutron and 17.6 million electron volts of energy.



Source: Scientific American

The New York Times; Illustration by Al Grumbers