Another route to fusion to be explored

US looks hard at inertial confinement

Washington

The Department of Energy (DoE) is proposing to set up what one official describes as a "bluest of blue ribbon" review committee to look at the prospects of developing inertial-confinement fusion (ICF) techniques as a commercial source of nuclear power.

The decision to take a hard look at ICF comes close on the heels of a new bill signed into law by President Carter two weeks ago pledging support for a substantially expanded programme of research into magnetic confinement fusion, at present the front runner in the fusion race.

The Administration has been persuaded to back the Magnetic Fusion Bill by a report from the DoE's Energy Research Advisory Board. This says that results using magnetic confinement techniques at, for example, Princeton University's Plasma Physics Laboratory, are sufficiently impressive to justify the next stage of the development programme.

The bill proposes setting up a National Magnetic Fusion Engineering Center to look at the technical problems involved in scaling up laboratory experiments. It also requires DoE to produce a five-year programme for magnetic fusion detailing budget and research schedules.

The same committee, chaired by Dr Solomon Buchsbaum of Bell Laboratories, has now been asked to look at the progress and prospects of ICF. DoE's proposal is contained in a letter from Energy Secretary Mr Charles Duncan to the Office of Management and Budget, accompanying the department's budget request for the fiscal year 1982.

Department officials feel that, largely as the result of significant advances made during the past year or so, research on the civilian applications of ICF has progressed sufficiently to make it possible to evaluate the relative merits of different systems now under development.

Research on ICF has also been given a boost by a recent DoE decision to start declassifying previously secret information on high-energy X rays produced by the explosion of deuterium–tritium pellets — the source of fusion energy.

Three weeks ago, the department reported that it had decided that the following statement should no longer be considered a military secret: "In some ICF targets, radiation from the conversion of focused energy (such as laser or particle beam) can be contained and used to transfer energy to compress and ignite a physically separate component containing nuclear fuel".

DoE officials play down the impact of classification on the civilian programme, insisting that this has not prevented its own scientists from weighing the relative merits of different approaches. University scientists, however, have long argued that classification has been a barrier to their research; designs for ion drivers, for example, have required access to details of pellet behaviour in order to optimize beam/pellet interaction. "This is the news we have been waiting for", said one person on hearing DoE's decision.

The main problem now facing the ICF research community is how to choose the best technology for moving on to the logical next stage, the construction of a facility to probe the engineering difficulties that may lie ahead.

There is a general consensus that for magnetic fusion the Russian Tokamak design is still clearly the front-runner, but several options remain for the drivers needed to produce the energy that ignites the pellet for ICF. These include gas lasers, glass lasers and particle accelerators using light and heavy ions.

For the medium term, the best prospects seem to lie with either glass lasers or light-ion accelerators. Support for the former, in particular, has been increased by recent results from the University of Rochester, demonstrating that halving the wavelength of the light produces an ultraviolet laser beam that interacts much more efficiently with the pellet than does an infrared laser.

Dr Moshe Lubin, director of Rochester's Laser Energetic Laboratory, said last week that it was now possible to reach an efficiency of at least 80 per cent in converting the wavelength of the laser beam. This raises the possibility that crucial scaling-up experiments could be carried out much sooner than expected.

Further ahead, both glass lasers and light ions could face major difficulties. The lasers are difficult to cool, and it might therefore be hard to achieve tha high repetition rates necessary for the large-scale production of power. Light ions, although effective at close range, are difficult to focus accurately.

Here, two other options may come into their own — krypton fluoride lasers, now being developed at the University of California's Lawrence Livermore Laboratory, and heavy-ion beams, at present being squeezed for funding by a congressional preference for glass lasers with potential military applications, but eagerly supported by nuclear physicists as an extension of particle accelerator research.

DoE officials are more sceptical, suggesting that some of the claims of nuclear physicists have been over-optimistic and partly motivated by inter-laboratory competition for funds. Nevertheless, they admit that heavy ions are a serious contender for eventual commercialization, and hope that the new review committee will throw some light on where research priorities should lie.

David Dickson

Canada's uranium with strings attached

There is a prospect of a dispute between Canada and Euratom over uranium supplies. Canada is prepared to stop uranium supplies to Europe if Euratom states fail to comply with Canadian non-proliferation policy. But Euratom "is not going to surrender", according to Euratom and Canadian officials.

The confrontation will come to a head later this year, when an interim arrangement reached in January 1978 expires. And since Australia is taking a similar stance to that of Canada and the position of the United States — the other potentially large uranium supplier in the 1980s and 1990s — is clouded by the 1978 Non-Proliferation Act, uranium supply negotiations are becoming an increasingly sensitive element in the future growth of nuclear power.

Australia is furthest ahead in its negotiations with Europe. West Germany has a major share in the new Ranger mine, which will give the country 20,000 tonnes of uranium oxide in 1982–86 according to a recent agreement with the Australian government — provided Australia secures satisfactory non-proliferation agreements with Euratom. (Euratom currently negotiates safeguards with suppliers for its nine members, and must "approve" any bilateral supply deals. But its supra-national authority is under strong challenge from France — a further complication.

France also has a draft deal with Australia for the supply of 2,000 tonnes of uranium a year — a fifth of its estimated need in 1990 — but again that awaits an agreement between Australia and Euratom. The draft deal itself includes outline safeguards arrangements; but both sides have dodged giving them firm interpretation. Australia, mindful of the strong anti-nuclear lobby at home, has a public commitment (as does Canada) to ensure that none of its uranium is used for weapons building; so its policy is to require "prior consent" for re-transfers of its uranium outside Euratom states, for re-processing and for enrichment beyond 20

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per cent. According to Australia, the draft deal with France is in accord with policy; but according to French statements it offers no restrictions on reprocessing.

French industry minister André Giraud said recently that "we have no intention of using a single gramme of Australian uranium for our military programme" but, challenged on safeguards, said "we can say exactly where our power plants are and how Australian uranium will be used".

Hoping that such statements will satisfy the Australians, Euratom negotiators expect to tie up an accord soon, thus clearing the tables for Canada. Euratom fears Canada most; the US position is too uncertain to consider yet.

Canada — which already supplies 50 per cent of Britain's uranium (the rest comes from Namibia) — has the experience of India's 1974 nuclear test, which used Canadian uranium, to keep her resolution firm. The Indian test raised a storm of public protest; and although non-proliferation is no longer an election issue, it could become one if a similar incident occurred with Canadian involvement. And then uranium export might be halted. Thus, Canadian officials argue, it is in the interests of security of supply that Canada requires clear controls over its uranium.

Canada's position is ostensibly the same as Australia's — requiring prior consent for reprocessing, re-transfer and high enrichment. But, say Euratom states, such an arrangement would interfere with national sovereignty, complicate fuel management and give Canada unfair advance warning of impending international commercial deals. Canada, after all, with its fuel-efficient Candu reactors and heavy-water plants, is in the nuclear business as a whole, and not just in uranium exporting.

In the end, everything depends on exactly what is meant by "prior consent". Euratom could be expected to object strongly if it means that each sensitive step in the fuel cycle must first be cleared with Canada: for since fuel streams are inevitably mixed when fuel elements are fabricated and fuel enriched or reprocessed, any reporting of movements to Canada would involve reporting — and clearing — all steps in the cycle. France has stated openly that it would accept no restrictions.

On the other hand, Canada has indicated that it is prepared to interpret prior consent "more broadly". For example, Canada might accept an agreement which stated that its uranium was to be used only for energy, and specified the facilities at which the uranium was to be reprocessed. Canadian experts would still have to be satisfied that Euratom's uranium book-keeping was effective, and that Canadian uranium could be "tracked" through the system.

And Euratom need be in no doubt about the firmness of Canada's commitment. "We stopped all uranium shipments in 1977 and we can do it again" said a Canadian nuclear official last week. Canada has already cancelled deals with India, Pakistan, and recently Switzerland — which objected to "prior consent". To cancel arrangements with Euratom would be more expensive (the UK needs contracts for another 2,000 tonnes of uranium per year by 1990, and France another 8,000 tonnes worth some $500 million dollars a year) but that appears not to frighten anyone in Canadian government. It does, however, frighten Europe. **Robert Walgate**

Swedish guidelines

Cloning committees

Stockholm

The regulation of hybrid-DNA research in Sweden is in a mess. Delegates to a recent microbiological conference at Umeå bemoaned the bureaucratic confusion foisted on them by a new regulatory system; and one firm has given up and is moving its activities abroad.

Since 1 January this year, any researcher wanting to work with hybrid DNA has been legally obliged to apply for permission under two existing laws: the Occupational Health and Safety Act (Arbetsmiljölagen) and the Law on the Protection of the Environment (Miljösyddslagen). The bodies that deal with the applications are the National Board of Occupational Safety and Health (NBOSH: Arbetarskyddsstyrelsen) and the Franchise Board for Environmental Protection (FBEP: Koncessionsnämnden törmiljöskydd), respectively. Both bodies are served by a Recombinant DNA Advisory Committee, set up in January under NBOSH. The committee's main task is risk classification. It has 17 members excluding its chairman (the director-general of NBOSH) and vice-chairman: four scientists, four members of parliament, five delegates from relevant authorities (National Board of Health and Welfare, Natural Science Research Council, etc.), three trades union representatives and one representative of industry and employers.

Both NBOSH and FBEP refer applications to the committee, which in turn passes them on to its working group on risk classification. If the application came from NBOSH, the working group classifies it and decides whether or not it is for new research (under the Occupational Health and Safety Act, only applications for new research have to be approved). The working group then makes its recommendation to the committee, which passes it on to NBOSH. The trouble with this is that nobody is quite sure what "new" research is. "It is difficult to interpret the meaning of this law", says Gustaf Brunius, who is in charge of DNA questions at NBOSH. "But *E. coli* K12 is a system that has been very thoroughly investigated, and if an application involves this system it is considered unnecessary to get permission for it unless the DNA sequences for toxins."

The procedure is even more complicated when the application comes from FBEP. FBEP sends the application not only to the committee, but also to 14 other bodies (including local government and health authorities and the Environment Protection Board), and asks for their comments. When all of them have replied — which takes months — FBEP holds a public meeting at which the application is publicly made and the various bodies which wish to comment publicly do so. FBEP then writes a judgement.

University researchers say they have not received any information about this system, and that they do not know how to apply. In practice, they are continuing their research without applying for permission at all, which technically makes criminals of them all. Only one firm has so far applied, and it is holding up its experience as an example of bureaucratic ineptitude. KabiGen which, in conjunction with Genentech Inc., owns the world rights for the production of human growth hormone, had applied for and been given permission to go ahead with developmental work under the old voluntary regulation system. When the new system was brought in, the firm made another application to use hybrid-DNA techniques to produce genes for human growth hormone, somatomedin B and human secretin. Six months later, permission was granted (in volumes of not more than 10 litres); but NBOSH specified P1 conditions, whereas FBEP specified P3. FBEP evidently did not take into account the revision in the National Institute of Health guidelines which occurred while it was considering the application. So KabiGen put in a new application to FBEP for permission to do the same work in P1 conditions. No decision has yet been made. The firm also applied again to NBOSH for a more general permission to do developmental work, and no decision has been made on that either. "We can do 10 litres here, but we want to do 400 litres", says KabiGen's research director, Dr Bertil Åberg. "It would take too long to get permission for that, and we'd lose too much money. We'll do it in England instead".

Some delegates to the Umeå conference, which was organized by the Swedish Microbiological Association (universities) and the Foundation for Biotechnical Research (industry), suggested that the researchers themselves should take some of the blame for the present chaos. "There must be experts on the Recombinant DNA Advisory Committee, but they need not be in the majority", said Staffan Normark, Professor of Microbiology at Umeå University. "But everyone taking part in the committee's decisions must know what the research is about. We in the field haven't told them; and perhaps we should."

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