

ITER

Compromise Deal Hinges on a Graceful Runner-Up

CAMBRIDGE, U.K., AND TOKYO—A face-saving compromise is beginning to take shape in the battle between the European Union (E.U.) and Japan to host the \$5 billion International Thermonuclear Experimental Reactor (ITER). But it rests on one side agreeing to accept a consolation prize.

Researchers at the two sites vying for the reactor, or tokamak—Cadarache in southern France and Rokkasho in northern Japan—have spent the past month responding to questions about technical and lifestyle issues from the project's six partners. The answers are now being circulated, and representatives of those partners—China, the E.U., Japan, Russia, South Korea, and the United States—hope to select the winner at a 21 February meeting in Vienna.

It won't be their first attempt. A gathering in December ended in a bitter deadlock (*Science*, 2 January, p. 22), and the past 6 weeks have seen some heavy-duty lobbying for the right to host a machine that advocates say could open the door to cheap and almost limitless energy by squeezing hydrogen atoms together until they fuse. On 9 January, U.S. Energy Secretary Spencer Abraham told Japanese business leaders that the United States favors Rokkasho as the technically "superior site." E.U. research commissioner Philippe Busquin declared Abraham's comments to be "inappropriate and inopportune," and French Prime Minister Jean-Pierre Raffarin suggested that Europe could go it alone if the collaboration were to choose Japan. "We're not blackmailing [anyone], but it's a situation we have to face," the E.U.'s chief negotiator, Achilleas Mitsos, told *Science*.

Most scientists hope a split in the partnership can be avoided. "All parties recognize that building ITER is really the most important thing that has to be done to realize fusion energy," says Jung-Hoon Han, head of international cooperation at South Korea's National Fusion R&D Center in Daejeon. But because someone's stance has to change if ITER is going to be built, any sign of movement is seen as potentially significant. Late last month, President George W. Bush's science adviser, John Marburger, told reporters at a meeting at the Organisation for Economic Co-operation and Development in Paris

that U.S. support for Rokkasho was based on a preliminary assessment of the sites and could change as more technical data become available. And although China and Russia insist that they still favor Cadarache, South Korea remains resolutely on the fence.

Away from the political posturing, scientific managers and researchers have been feeling their way toward an amicable compromise. The key element is that although ITER is the main trophy, other facilities will also be needed before any commercial fusion power plants can be built.

The first item on the wish list is an International Fusion Materials Irradiation Facility (IFMIF). It would provide experimental data on the wear and tear on the containment vessel from swarms of high-energy neutrons produced by the tokamak's plasma. The data will be needed to win approval for future commercial fusion reactors from licensing authorities, as ITER isn't designed to provide such information and regulators

provide such information and regulators



East-West impasse. Japan and Europe tout their chosen sites as the best location for ITER.



won't trust modeling. The centerpiece of IFMIF is an accelerator that would blast sample vessel materials with a high-flux, high-energy neutron beam day and night for long periods to test their resilience.

Fusion researchers would also like to have access to "satellite" reactors—existing machines or ones on the drawing board—that could carry out finer-scale studies of fusion physics and train reactor operators. And some elements of the ITER project, including data collection and dissemination, could be performed on the other side of the world from the tokamak itself.

Such additional facilities would not come cheap. But "there is a lot of extra money sloshing around," notes Christopher Llewellyn Smith, director of the U.K.'s Culham Labora-

tory, home to the world's biggest tokamak, JET. Japan and the E.U. have each promised to provide 48% of ITER's \$5 billion budget if they are chosen as host. Coaxing the loser to maintain that level of funding would put an extra \$1.5 billion on the table. "It's a long shot," says Llewellyn Smith, "but worth a try."

In the meantime, each side is touting the virtues of finishing second—to the other side. European officials assert that Japan would be an ideal host for some of the additional facilities. Japan's planned upgrade of its JT-60 reactor at Naka, they argue, would make an ideal satellite tokamak after JET ends its supporting role in the ITER project. And Rokkasho, they say, would be a perfect site for IFMIF because the accelerator would need far fewer staff at the remote location. The view from Japan, of course, is different. "Japan would be in favor of splitting up the project," says Satoru Ohtake of the education ministry, "as long as the [ITER] tokamak comes to Japan." Yoshikazu Okumura, head of the ITER office at the Japan Atomic Energy Research Institute, insists that negotiations over additional facilities have "no relation" to deciding where to site the tokamak.

The fresh data provided by the sites could be the deciding factor. Although the documents remain under wraps, European ITER supporters claim that both China and the United States are concerned about earthquake risk at Rokkasho, which is located in an area of moderate seismic activity. Its snowy climate and nearby nuclear reprocessing plants also are cited as

deterrents. "I would not go with my family to a place like that," says one European researcher. Japanese sources, meanwhile, say that the documents now being circulated raise major questions about Cadarache's location. Critics of the French site have claimed that it is too far from a seaport—about 95 kilometers—for efficient transport of major tokamak components arriving from overseas. Rokkasho is adjacent to a port.

Ministers from ITER's partner countries do not want to convene a meeting that will end in another embarrassing deadlock, sources confirm. That puts the onus on the senior managers meeting in Vienna to convince France or Japan that there's no shame in finishing second.

—DANIEL CLERY AND DENNIS NORMILE