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All together now

The decision to site the fusion experiment ITER in France left relatively little bad blood between the international partners, who must now rally behind the project.

So ITER — the international fusion-power experiment whose faltering progress sometimes seems to echo that of fusion research itself — may finally be built, after all. The countries involved have agreed in principle that construction should begin in France next year.

No one will question the technical capabilities of the hosts: France has an awesome tradition in nuclear technology, a strong will to make the project happen, and firm backing from the rest of the European Union (EU). A few reservations remain about the technical approach taken in ITER's design (see page 318), but most fusion researchers are delighted that the project looks set to proceed.

Some important details need to be resolved before that happens, however. Funding for the project is still to be lined up by most of the partners, for example, and much of it is likely to come at the expense of other, existing fusion research projects. Broadly speaking, the EU is supposed to pay half of the construction costs, while the other five partners — Japan, the United States, Russia, China and South Korea — pay 10% each. Additionally the nature of secondary facilities, to be built in Japan, has yet to be determined.

In several member countries, ITER will clash with domestic research priorities. In the United States, for example, the Bush administration has already tried once to shoehorn the $50 million annual cost of ITER construction into the existing $230 million budget for magnetic fusion research. Sherwood Boehlert, chairman of the House science committee, has rightly warned that this won't wash. If the administration is sincere in its support for a project that the Department of Energy has selected as its top-priority facility, it will allocate extra funds for ITER in its 2006 budget proposal, which comes out in February.

Some in Congress are bound to question support for any international project — especially one in France. But if the US scientific community unites behind the project, then a desire to treat the rest of the world with less than total contempt will prevail in Congress, as happened when a similar amount of money was successfully appropriated over many years for the US contribution to the Large Hadron Collider in Switzerland.

The second issue concerns the types of supporting facilities to be built and their funding. Such projects are likely to include a materials testing centre, a computing centre for data analysis, and an upgrade for Japan's JT-60 fusion experiment. In return for Japan's agreement to drop its bid to build ITER itself, the EU will support Japan in its bid to lead these projects. Japan is best qualified and best equipped to do this. It should step up as a true leader, as it failed to do when pursuing ITER's construction. Other countries should support Japan in this role.

Among these projects, the most expensive — and the most valuable from the point of view of international progress towards fusion energy — would be a neutron source for use in materials testing. The crystalline structure of stainless steels and other metal alloys that might be used in working fusion reactors is expected to deteriorate rapidly under neutron bombardment. In the absence of a test facility that can supply a suitable neutron flux, no one has been able to search for metals or ceramics that might survive this bombardment for the lifetime of a working fusion reactor. Such a facility is needed, alongside ITER, to take magnetic fusion forward.

But progress has been slower than fusion advocates would like. To be fair, there has been a chicken-and-egg aspect to this: investment has been withdrawn from magnetic fusion research when it was most badly needed. Naysayers joke that fusion power has always been 50 years in the future — and always will be. Their scepticism needs to be balanced against the unique and almost boundless potential of fusion, should it be harnessed. Anyone who doubts this potential should try getting up early one morning to watch the sunrise. ■

Socialism in one country

Cuba's scientific community has made substantial progress in addressing social problems.

Despite a floundering economy, restrictions on free speech and the incessant hostility of its powerful neighbour to the north, Cuba has developed a considerable research capability — perhaps more so than any other developing country outside southeast Asia. Whatever one thinks of its leader, Fidel Castro, it is worth asking how Cuba did it, and what lessons other countries might draw from it.

When Castro came to power in 1959, Cuba had almost no scientific infrastructure. Now it boasts a biotechnology industry that has produced effective drugs and vaccines of its own, a large and fairly influential scientific work-force, and a fledgling pharmaceutical industry with its sights set on export markets. The agricultural sector, in which small farmers benefit from partnerships with agricultural researchers, is also quite successful (see page 322).

Some of the reasons for Cuba's success are straightforward. The government has invested heavily in elementary and secondary education, and has attained developed-world standards of literacy and numeracy in its population. After university, large numbers of young scientists are sent abroad for training — once to its Communist allies, more recently to Europe and Latin America — and Cuba ensures, by fair means or foul, that they return home afterwards to work.

But one aspect of Cuba's scientific success is often overlooked. At