

Time for Japan to shine?

Talks last weekend on choosing a site for ITER, the fusion project, ended in stalemate. But ITER deserves to proceed, and Japan's commitment to it is strongest.

Fusion power is sometimes mocked for its alleged unfeasibility — it's been 40 years away since about 1955, detractors say. But for those who are optimistic about man's ability to meet tall technical challenges, its allure will never fade.

The power of the Sun and the stars derives from the fusion of hydrogen nuclei into helium at temperatures of about 100 million kelvin. Scientists and engineers already know a fair bit about how to harness this process here on Earth. The progress of existing, small fusion experiments has been steadily impressive.

Converting that progress into something akin to a fusion power plant will be difficult, but not impossible. The fuel of such a plant will instantly evaporate its surroundings unless it is suspended, probably by a magnetic field. Fusion itself produces an avalanche of highly destructive neutrons, which will embrittle any surrounding structures, requiring constant replacement.

For the faint-hearted, there are far more reasonable solutions available to our impending energy needs. Fission power can come back — preferably in someone else's backyard. Coal can be burned — there's a lot of it, probably enough to choke the planet in greenhouse gases. Windmills can be built, even if they will prove a blot on the beautiful landscape of the Scottish Highlands. And peasants in China and Africa can tend to their own energy needs by burning organic manure in biodegradable ovens.

None of these energy solutions should be glibly dismissed, of course. But neither should the immense potential of fusion. There are several approaches to harnessing it: some use inertial confinement, which applies immense heat and pressure to a tiny fuel capsule, producing a controlled explosion.

But magnetic confinement, in which the plasma fuel is held aloft in a magnetic field, is the best-developed avenue. This would probably be done in a doughnut-shaped vessel called a tokamak, invented in Russia. Successful tokamak experiments have been built in Japan, the United States, Britain, Russia and elsewhere. But for years, plasma physicists have sought a larger machine that would hold burning plasma for a sustained period, so they can study its behaviour in detail. Twenty years ago at a summit meeting in Reykjavik, Ronald Reagan and Mikhail Gorbachev bought the idea, and ITER — then the International Thermonuclear Experimental Reactor — was born.

Political problems

It hasn't exactly been plain sailing since then. The energy crisis has faded from the public mind, although it is now edging back. Fusion has suffered collateral damage from public unease with nuclear power — although fusion would produce no high-level radioactive waste and much less lower-level waste than fission. ITER's design phase was nonetheless completed in 1998, only for Congress to pull the plug on US participation in construction. That encouraged the remaining partners — Russia, Japan and Europe — to shrink the project. Now the United States has rejoined it, and China and South Korea are in too.

The time has come to choose a site. The two contenders are the European Union (EU), backing a site in Cadarache, France, and Japan, which would build ITER at Rokkasho. In a wretched and unnecessary

turn of events, site selection has become heavily politicized. The rot set in when Spencer Abraham, the US energy secretary, took the unprecedented step last year of butting into Europe's choice of its candidate site, expressing a preference for an earlier bid by Spain, presumably to smite France for its stance on the invasion of Iraq. But France won the European contest. On Saturday, Europe, Russia and China backed the Cadarache site while Japan, the United States and South Korea supported Rokkasho.

ITER is easily the largest international scientific collaboration on the table at present and it should not be bogged down in geopolitics. But the deadlock of recent weeks can be broken.

The way forward

A solution will involve providing the loser with a prominent role in a broader nuclear-fusion programme. This is much less of a problem than it might seem. International participants need a remote control facility to widen the use of the experiment. More importantly, a separate materials test centre built around a neutron source has always been required, in advance of the engineering prototype reactor, known as Demo, that will follow ITER. Such a programme would not only offer a compromise by giving both Europe and Japan a major fusion facility, but it would be a major boost to fusion science itself and to making better use of ITER.

France has considerable technical know-how in this field and a record of excellence in nuclear engineering. Cadarache is a superbly qualified site. But despite the rallying of EU states around France's bid, political and public support in Europe are less than whole-hearted.

Japan's bid is for a green-field site in the remote north of the country, and its selection would raise some logistical challenges and local opposition. But Japan's formidable state apparatus is now firmly behind the project. With no indigenous energy resources to speak of, the country's commitment to long-term energy sources is greater than Europe's, and much greater than that of the United States. The ITER negotiations have had a high public profile in Japan, and the nation genuinely yearns for an international scientific project of this calibre. Its existing JT-60 tokamak is on a par with any other facility in the world, and Japan's political structure and engineering prowess would be conducive to ITER's successful completion.

Yearning is no substitute for a capability to deliver, however, and last weekend's meeting decided that another gathering should be held in Vienna next month, where experts will be asked to go through a full comparative assessment of the sites as they stand, point by point. If Europe's case is technically strongest, then Japan's compensation should include international contributions to an upgrade to JT-60 to achieve critical science on the way to Demo. An upgraded JT-60 would, in particular, like ITER, be capable of sustained fusion burns, and complement ITER by making possible the comparison of plasma behaviour on different scales.

But if the technical strengths are well balanced, Europe should turn the other cheek to the Bush administration's mischief-making and break the impasse, by negotiating a deal to build computing and materials research centres in France and Spain, and ITER itself in Japan, the nation that most needs it and most ardently supports it. ■