Fast breeder reactors

And after Superphénix?

SUPERPHENIX, the European commercial-scale fast breeder reactor — and the world's largest — at Creys-Malville in southern France, is completing the loading of its plutonium core this week, after "going critical" for the first time on 7 September.

All has gone "very well" with low-power performance tests so far, according to the international agency NERSA that constructed the reactor, despite problems earlier this year with vibrations in the primary sodium cooling circuit (see *Nature* **315**, p.269; 1985). The vibrations were "purely hydrodynamic", and were solved by a slight diversion of sodium flow within the core, an operation which set the Superphenix programme back by only three weeks, says NERSA.

Tests in the past two weeks have measured neutron spectra at a reactor thermal power of only 1 MW, and tested the operation of the control rod system, and all is now deemed well for a full loading of the core. Superphénix is due to be connected to the national grid at 20–30 per cent of its design 1,200-MW electrical power in January 1986, and to be brought up to full power by the spring. This will make Superphénix the world's most powerful fast reactor, followed by the Soviet Union's BN-600 (550 MW) which first produced power in 1980, and West Germany's SNR-300 (300 MW) which is due to go critical next year.

The next question in Europe will be what should follow Superphénix. Should it be Superphénix II, also in France? A French design for a 1,500-MW version which would be 40 per cent cheaper than Superphénix I is ready, and according to the French atomic energy agency (CEA) it would be possible to begin construction in 1987. According to the 1973 treaty between France, Italy, West Germany, the Netherlands and Belgium under which Superphènix I was constructed, West Germany should pay the lion's share of a second fast breeder, but now it seems that the French design is most favoured — and thus CEA would like to renegotiate the 1973 terms.

According to CEA, Superphénix II — or "project 1500" as it is now called — would shave costs by eliminating the containment vessel (because the previously "maximum credible accident", a catastrophic fast meltdown, is now considered "incredible"), and by large reductions in the length of the costly stainless steel cooling system.

As for the cost of Superphénix I itself, this was — according to NERSA — some FF 9,300 million (1977 prices), or around £1,000 million, excluding interest charges. This was partitioned 51 per cent to the French national utility, Electricité de France (EDF), 33 per cent to Italy, and 16 per cent to West Germany, the Netherlands, and Belgium. Each country will receive electricity from Superphénix in proportion to its stake, and according to EDF this will make Superphénix electricity about 2–2·2 times the price of that available from its existing pressurized water reactors. This will, however, only match the cost from the (admittedly expensive) EDF coal-fired plants, says EDF. The utility last week, however, refused to quote a capital cost for Superphénix, saying that "we are computing the cost" and that it was "too soon and delicate" to be definitive.

Nevertheless, EDF is interested in future fast breeders "as a protection against a crisis in the uranium market". Uranium prices are now depressed, supply being much greater than the demand as the expansion in world nuclear power production predicted in the early 1970s and acted upon by uranium prospectors has simply not taken place. However, this could change in "10, 15, 20, even 5 years", EDF speculate: thus there is a strategic need to preserve the fast breeder option. The breeder would be economic competition for pressurized water reactors only if the uranium price was to increase 10-fold, however, EDF believes.

Robert Walgate

UK plant breeding research

In search of green thumbs

"ANYONE who takes the profits out of a plant breeding programme instead of putting them back in is not a plant breeder". By that definition the UK government has no green thumb: it has taken more profits out of the Plant Breeding Institute at Cambridge (PBI) than it has returned in financial support. Cuts in government support, which in 1986–87 alone amount to a shortfall of £180,000, have resulted in the internationally known institute for the first time in its history searching for private funds to support breeding programmes.

The search has been successful for triticale, a cross between wheat and rye which is used primarily for animal feed and grows well on marginal land. Given the grain surplus in the European Community, says Dr Peter Day, Director of PBI, these attributes also meant that the triticale programme was marked as one whose loss would "hurt least". Financial support for the programme will now be provided by Semundo, a plant breeding and seeds company with European breeding facilities and a UK branch primarily concerned with marketing. Semundo, says its general manager Christopher Green, sees "no limit to where the grain can be used"; its potential makes the risk of £600,000 over five years a good investment.

In return for its support, Semundo receives marketing rights to any new variety of triticale that is developed in the programme. The company can back out of the arrangement or move the programme away from PBI in five years, but neither possibility is likely. Semundo recognizes that plant breeding cannot be a short-term speculation, and it values the "technical excellence of the institute".

The long view necessary for plant breeding is exemplified in Dr Richard Gregory, who has led PBI's triticale programme since its beginning in 1970. The result so far is three varieties of triticale with plant breeder's rights (which means royalties are received on the seed), three in second-year testing and two in first-year testing. Only this autumn will the first of the varieties be harvested for the seed trade.

While it was government funded, says Dr Gregory, the triticale programme tested its varieties only in Britain, thus choosing characteristics appropriate to the UK climate. Semundo involvement will encourage testing elsewhere in Europe and selection for hardiness and resistance to snow mould. A danger of too much private support, warns Gregory, is the loss of free exchange: competing companies would be unlikely to allow exchange of information or breeding material.

Since the announcement of cuts of £10 million each in the 1986–87 and 1987–88 Agricultural and Food Research Council (AFRC) budgets, the role of private companies in Britain's breeding programmes has been much debated.

One option now being considered is amalgamation of the 28 research institutes controlled by AFRC into a smaller number. Another option is to merge and privatize PBI with the National Seed Development Organization (NSDO), the marketing arm of government-funded plant breeding (see *Nature* **314**, p. 2; 1985). After all, supporters point out, NSDO returned £2 million to the Treasury in its last financial year and 79 per cent of those profits come from PBI varieties. If NSDO alone were privatized (another proposed idea), it would be severed from its life source, "twitch for a while and then lie still".

Mr Derek Garner, Chief Executive of NSDO, says that merging NSDO and PBI "looks as though it could be done" but he sees no governmental moves in that direction. Without that direct a funnelling of profits generated by PBI back into its breeding programme, the future of the institute, according to Dr Day, will rely on gaining support "from a wide base of private sector structures".

Elizabeth Collins

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