United Kingdom

18% photoefficiency claimed in BP energy research prize

FIXED photochemical energy amounting to 18% of visible light has been claimed by one of the recipients of a new energy research prize last week. The figure compares favourably with the electrical efficiency of solar cells, and is so far beyond the 3% normally regarded as the maximum achievable by plants that some specialists are highly sceptical about it.

The prize — £13,000 — comes from the oil multinational British Petroleum, which announced a £1.5 billion a year capital investment programme in its annual report published last week. "In the future" says the report "an increasing proportion of new investment, research and enterprise will be directed to activities additional to oil and gas". The BP energy prize is considered to be a way, said a BP spokesman, "to begin to get in on the act" on increasingly interesting energy research in the universities. But BP will not claim ownership of any of the results.

BP has awarded £39,000 to be divided between three groups from four UK universities. Similar awards will soon be made in ten other countries: Germany, France, Belgium, Denmark, Holland, Switzerland, Greece, Portugal, Canada and New Zealand. After a year's research, reports from the three groups in each country will be considered, and a national winner selected — who will receive a second year's grant and a cash prize of £5,000. These winners will also be considered by an international panel for an international energy prize of £10,000 to be awarded in July 1982.

The UK winners of the first leg are: Professor S J Pirt of Queen Elizabeth College, London, to develop an algal bioreactor for fixing solar energy; Drs H A O Hill of Oxford and I J Higgins of Kent Universities to improve the efficiencies of fuel cells powered by enzymatic reactions; and Dr R P Howson of Loughborough University to develop optical coatings for improved heat retention by windows. The prizes were awarded by a panel of five drawn from the Royal Society and the Fellowship of Engineering.

Professor Pirt hopes to build a $0.5m^2$ collecting area 'unit' bioreactor, which would be deployed in multiples over a solar collecting field. The collecting surface will be tubular, and carry a continuous culture of *Chlorella* fed by ammonia, salts, and 100% CO_2 ("which" says Professor Pirt "we have discovered is not toxic, contrary to expectations").

The system has been developed in the laboratory. The next stage involves scale-up, and the application of microprocessor control to adjust nutrients and flow rates for varying sunlight intensity.

"Our target is to fix 14% of solar energy incident on the field", Professor Pirt said last week. "We have reached 18% photoefficiency in the laboratory" he claimed. Asked if this was not a very high figure, he said there had been no reliable and consistent data for photosynthetic efficiency. "Figures vary by a factor of four". (Pirt has published his results in *J. Chem. Tech. and Biotech.* **30**, 25-34; 1980).

Photosynthetic processes were not at their most efficient at the CO_2 levels present in air, said Pirt. It had proved crucial to provide pure CO_2 to the organism "despite the fact that the books say more than 5% is toxic".

Pirt is "quite confident" that the capital costs of the reactor can be brought below those of competing solar technologies, such as solar cells.

One potential advantage of his closed system — where all external factors other than sunlight and temperature can be closely controlled — is that evolved oxygen can also be collected, and would become a by-product of the process. Moreover collected energy — in algal biomass — would be automatically stored, unlike the electrical energy from solar cells.

The biomass could be fermented to methane to provide natural gas; but fixed nitrogen would have to be recovered if the process were to be overall energy efficient. So "there are a number of other biotechnologies to be appended to this system", said Pirt, "before it is complete".

However, other biomass specialists are highly critical of Pirt's results. One pointed out that the currently accepted, "rock-hard" photosynthetic pathway proposed by Dr Robin Hill of Oxford 20 years ago required 8 photons to fix one CO_2 molecule. This leads to a theoretical maximum energy efficiency of 12%; in practice the record is sugar cane's 3%. But Pirt claims 18%, with a mixed culture of his alga and three heterotrophic bacteria.

"Pirt has claimed that one can produce 150tonnes per hectare per year, but the best practice anywhere else is 30 to 50," said the biomass specialist. "He is doing biomass a fantastic disservice by making these claims" he said.

Pirt said last week that the accepted photosynthetic pathway "lacked any sound energetic data in support of it". His data "implies that we must look at what is wrong with the pathway" he said. "The gaps in our knowledge of it are really enormous. Otto Warburg [Nobel Laureate for medicine, 1931] always claimed that 4 photons per carbon was the correct figure. Others claim 12."

Robert Walgate

Hungary

Paks power station secured in concrete

HUNGARY'S nuclear power stations at Paks, the first generating set of which will go on stream in 1981, is so safe that not even an earthquake presents any serious danger. So said MP Miklos Vida, recommending a new nuclear energy bill to the Hungarian National Assembly last month. On behalf of the parliamentary committees which had dealt with safety questions, Vida noted that "the nuclear power station in the Armenian SSR which resembles the Paks power station easily withstood the force 5 earthquake . . . of 1976; according to estimates it can withstand force 9 earth movements".

Nor, said Vida, is there any fear of a nuclear explosion. "The system of construction of our nuclear power stations is such that it is a physical impossibility for a chain reaction to get, so to speak, out of hand". The only possible danger would be from "harmful radioactive materials finding their way into the environment". And "all necessary measures" have been taken to guard against this. The spent fuel "which represents the greatest source of radiation", will be stored "for some time", then sent back to the Soviet Union for reprocessing.

The remaining waste (liquids with a "high radiation content" and "discarded installations and parts") will be sent to the "isotope cemetery" established in a lenticular clay deposit near Puest-oekszilagy, already used for radioactive wastes from industry and medicine.

For the Energy Ministry, Deputy Minister Gyula Szeker spoke of current fears regarding nuclear power, stressing that the western nuclear debate was encouraged by political, commercial and other interests which used "the revulsion felt for nuclear weapons" to "create a mood of opposition".

What Szeker did not mention was that the plans for the Paks power station depart from the standard Comecon doctrine that concrete containment vessels are unnecessary, and a capitalist ploy to raise costs. However "safe" the reactor, the Hungarians, it appears, will not neglect a little extra protection.

This somewhat more realistic approach to safety was also reflected in the speech of Imre Markoja, Minister of Justice. He admitted that even when all safety requirements are met "there can be some damage". Matters of responsibility and indemnity, he said, are therefore covered by the Bill. Although damage "due to exceptional events" in the course of operation of the reactor and the transport of nuclear materials is the least likely to occur, it is, however, the most dangerous. Indemnification in the case of damage, would be guaranteed by the state.

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