

# Where in the world are the most powerful computers?

Charles Arthur

BRITAIN's most powerful computer is not hidden away at MI6's new headquarters at Vauxhall Cross, nor at any other outpost of the secret services. It is in Reading, where it predicts the unpredictable European weather up to 10 days ahead.

Installed this year and used by the European Centre for Medium-range Weather Forecasting, the machine—a 16-processor Cray Y-MPC916—is the 12th most powerful in the world. That is, if you believe the findings of a group of American and German researchers who have drawn up a list of the world's Top 500 supercomputers.

Perhaps more surprising, the list suggests that academics have better access to supercomputers than classified government users. Of the top 500, 19 are listed as being for classified use, while 148 are for academic applications.

The world's most powerful machine is located at the home of the atomic bomb, Los Alamos National Laboratory in New Mexico. The Thinking Machines CM-5 incorporating 1024 parallel processors can, in theory, perform 131 billion floating point calculations per second—over four times as many as the system at Reading. It would be

used for calculations arising from fusion experiments.

The league table was compiled by Jack Dongarra of the University of Tennessee's computer science department, and Hans Meuer and Erich Strohmaier of the University of Mannheim in Germany, helped by information from computer companies and academics. For this reason, it is likely that more powerful computers bought by governments have slipped through the net.

Britain's second most powerful system belongs to an oil exploration company, Grant Tensor of Slough. "We use it for processing data from surveys," explains Dennis Crampton, a programmer with the company. "We may have up to  $10^{14}$  bytes of data from a survey covering tens of square kilometres in the North Sea. It can take several months to process, but two or three years ago people couldn't even dream of the processing we're doing now."

A Cray Y-MP8 capable of only half as many calculations, installed at an undisclosed date at the Ministry of Defence's GCHQ "listening post" in Benhall, is listed as the British government's most powerful machine. But when asked to confirm this, an MoD spokesman said: "This is like the Polaris fleet: it's the sort of thing

we don't give out details about."

Parallel-processing supercomputers have enjoyed a boom in the past few years. By linking small processors together, designers can make them cheaper yet more powerful than mainframe computers. Rather than working through a problem by tackling each equation in sequence, they can split it into smaller independent problems and solve those, leading to faster solutions.

This makes parallel processing especially popular among companies and researchers working in computational fluid dynamics, for example, to model airflow over a prototype aircraft wing. So it is not surprising to find that Martin Marietta, the huge American defence and aerospace company, owns six Crays—the largest investment in computing power by a single company.

Britain can claim some eminence in the supercomputer stakes, with 23 of the world's top 500 installations. But the US and Japan are far ahead. The US has 232 of the top 500, Japan 109, and Europe 140. Britain's 23 represent just 3.7 per cent of the largest processing power available—unless, of course, there are some larger systems lurking Polaris-like under the statistics. □

## Swarm of protest greets pest control by wasps

Mark Newham, Nairobi

IF AFRICA is to feed itself, the continent must rid itself of the main enemy of maize—the stemborer pest. Now, researchers in Kenya believe they might have found a natural means of eradicating it. But the finding has caused alarm among environmentalists, who fear it could do more harm than good.

Up to 40 per cent of Kenya's maize crop is destroyed by the stemborer (*Chilo partellus*), the larva of a moth which originally arrived in Africa in food shipments from Asia. The Kenyan government spends about \$4 million a year importing pesticides to control the stemborer, but only affluent farmers can afford the treatment and concern is rising over the damaging environmental effects of the chemicals.

A three millimetre-long wasp, *Cotesia flavipes*, which is native to Pakistan, provides a potentially economical and environmentally acceptable replacement, say researchers at the International Centre of Insect Physiology and Ecology (ICIPE) near Nairobi.

The female wasp seeks out a stemborer and injects its eggs into the larva's body. When the wasps hatch they feed on the stemborer's tissues, from the inside out, killing it in about 10 days.

As part of a project sanctioned by the Kenya Agricultural Research Institute, the ICIPE is releasing 60 000 wasps. The project team, led by American entomologist Bill Overholt, has already released

about half the wasps in three trial areas on Kenya's coast.

Overholt is cautiously optimistic that the wasps can do the job. But uncertainty remains over how well the wasp will adapt to Kenyan conditions.

That uncertainty is echoed by environmentalists who fear the introduction of an exotic species of insect into Africa could upset the continent's ecological balance. Kenya's National Environment Secretariat, part of the environment ministry, was kept in the dark about the project, as were the UN Environment Programme, which is based in Nairobi, the World Conservation Union and envi-

ronmental specialists at Kenya's universities. All have expressed concern that ICIPE failed to consult them and are shocked that the wasps were released before anyone had studied their likely effect on the environment.

Overholt has tried to reassure the doubters by referring them to laboratory trials that show the wasps attack nothing but stemborers and that their numbers will be regulated by the number of stemborers available. Moreover, he adds, the wasps have been introduced to other parts of the world and there have been "absolutely no reports of detrimental effects". □



Healthy harvest: but Kenyan maize is threatened by the stemborer (right)



N. Cattlin/Photo Studios



themselves. Referees are only human-like the rest of us they cannot keep abreast of all that is happening and so do not notice the repeats slipping through. As on television, repeats may even serve a useful purpose: "another chance to read" the paper that you missed the last two times it appeared in other journals you were too busy to look at.

I suppose that what I am asking for is a return to the time when scientists did not write papers—or discriminating journals

did not publish them—until they had something to say, and then said it only once. Given the money to be made from publishing journals, the pressure on editors to keep the pages filled and the pressure on scientists to be seen to be producing something, it seems that this is asking too much. It looks as though Enid Blyton got it right, in terms of output, after all. Though I bet Dick and Julian would have thought it a beastly shame. □

## The desert tightens its grip

Lack of data is hampering projects in the Sahel, says Mark Newham

SUN, sand and sex. It sounds like an advertisement for an 18-30 holiday. But note the missing ingredient—sea. That gives a clue to the location of this particular "resort". This is the Sahel belt on the southern fringe of the Sahara, where the other three ingredients are in plentiful supply. In fact there's a surplus of them, which is the reason why the Sahara is sweeping relentlessly down into the Sahel.

The sun and sand elements of the equation are self-explanatory. But sex? How did that get in there? Overpopulation, naturally. The Sahel belt—stretching from Cape Verde in the west to Chad in the east—is experiencing one of the highest population increases in the world. Result: excess pressure on what fertile land there is, over cultivation in marginal areas, overgrazing, destruction of natural vegetation as it disappears for firewood without being replaced and massive soil erosion. There is nothing to stop the desert tightening its stranglehold on the region.

So much has been written about desertification that people are in danger of being desensitised to the problem by the sheer volume of information hurled at them. So let me take you to one particular microcosm of the Sahel for a taste of what the inhabitants have to endure—year in, year out.

Just 30 years ago, Oursi, a remote outpost of 8000 people in northern Burkina Faso, was the centre of a thriving grain belt producing twice as much cereal as it needed and exporting the surplus to less fertile regions. Oursi also had the luxury of a permanent lake, 8 kilometres long, which kept the townspeople supplied with fish and periodically flooded their houses.

Looking at the exhausted remnants of the region today, it is difficult to comprehend how such a dream by Sahelian standards could have been allowed to wither into such nightmarish proportions. The fertile pastures are no more and the lake has disappeared. In their place are vivid, ochre-coloured sand dunes where cattle once grazed and crops once grew, and a totally exposed lake bed where donkeys and goats paw the ground in a futile search

for the waters that once covered it.

The fertile land that does remain is capable of producing enough cereal to meet only two months' requirements, and the famished cattle have to be fed imported wheat to coax them to give only 1 litre of milk each a day. Oursi's inhabitants have to rely on the national grain board of Burkina Faso for the bulk of their millet diet. The men of the town have had to turn from



Desert on the move. Sands build up around the town of Oursi

farming to labouring in the region's small gold mines to pay for the food they now have to import.

When the work of digging the town's most northerly houses out from the sand is finished (sandstorms invade the town with increasing frequency), the inhabitants generally return to the one topic of conversation that reduces all others to mere insignificance: what have they done to deserve such a fate and how could it have happened?

The elders blame the region's changing climate, and reason, correctly, that the encroaching sands have blocked the inlets to the lake. But excess pressure on the land is rarely mentioned. The Burkinabe authorities and the international development agencies operating in the region are trying to change that.

Oursi has been designated one of 15 areas in the three worst-affected provinces of Burkina Faso—that is, Oudalan, Seno and Soum—to receive assistance from the United Nations' Development Programme, and from West Germany, for environmental rehabilitation over the next 20 years. The plan is for each of the areas to

be subjected to a total integrated socio-economic programme involving the planting of 400 hectares of local species of trees. Specific zones will be set up for various agricultural purposes and the local population will be educated about the hazards of overstepping the supportive capabilities of the land.

Bitter experience has taught the Burkinabe authorities and the local representatives of CILSS—the French acronym for the Permanent Interstate Committee on Drought Control in the Sahel—that only total land management schemes have any chance of stopping the remorseless march of the desert southwards. An earlier reforestation experiment in northern Burkina Faso failed miserably because it involved the planting of the non-indigenous species of eucalyptus, which returns little of the nutrients it takes out of the soil, and because local people were not taught to replace cut trees.

André Roch-Compaore, the coordinator for CILSS in Burkina Faso, is adamant that a project involving indigenous species stands a 100 per cent better chance of succeeding. He may well be right. But there are some aspects of CILSS's approach to the problem that give cause for concern, if not alarm.

Essentially, through no real fault of its own, CILSS appears to be adopting remedies to the problem without fully understanding it in the first place. The difficulty surrounds the database on which CILSS is basing its strategy for combating the desertification. The organisation simply has no clear idea of how fast the desert is spreading, nor of the rate of deforestation—or, for that matter, of reforestation—throughout its nine member states.

Cash shortages severely restrict the establishment and operation of monitoring stations in the Sahel, and CILSS is forced to rely on sporadic and unreliable reports reaching its main centre in Ouagadougou, the capital of Burkina Faso, from such areas as Oursi. Data on the problem from organisations such as the Food and Agricultural Organisation and the United Nations' Environment Programme do not appear to be held in high regard by the people at CILSS, because few of the representatives of these bureaucracies are ever seen in the region before the figures are released. Members of CILSS's coordinating committee prefer to rely on what they can see with their own eyes, and local reports of perhaps dubious origin, to gauge the extent of the desert's southward migration.

What a way to run a scientific programme. But until the international donor agencies can be persuaded to come up with sufficient resources to fund a serious comprehensive monitoring programme in the Sahel, there is no other way for CILSS to operate. And the people of Oursi will continue to wither in the desert sun while the bureaucrats pontificate and prevaricate in their air-conditioned conference rooms. □

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## Beyond the fridge

Donald Gould on a development that makes his blood run cold

**W**ILL Paul Segall of the department of physiology and anatomy of the University of California at Berkeley become as famous as his fellow physiologist, Robert Edwards of Cambridge, the test-tube baby king? I fear it may be so.

According to a news item modestly tucked away on the back page of the financial section of the *Sunday Times* (of all places), Segall has been beaver away for the past three years at the task of deep-freezing various inoffensive animals and then bringing them back to life.

He apparently got the idea from the remarkable lifestyle of Canadian frogs. These creatures get pretty cold during the arctic winter—so cold that their tissues freeze solid and they don't breathe and their hearts stop beating. But, come the spring, they perk up and start hopping about and croaking again, and indulge in reproductive orgies for all the world as though the winter had never been. They manage this annual act of death and resurrection by secreting glycerol which acts as an antifreeze so that no ice forms in their cells, and this simple trick is, it seems, sufficient to preserve intact the pattern of the molecules of life.

Segall clearly felt that anything frogs could do he could do too, and set about experimenting with hamsters. He gave his unwitting subjects exchange transfusions, using a mix containing glycerol in the proportion that saves the croakers from a frosty tomb. Then he froze them and thawed them and replaced their proper blood and they appeared not one jot the worse for wear. Thus encouraged, he tried the same routine on a dog called Miles, who is said to be in the best of canine spirits six months after spending more than an hour in the freezer. Monkeys are next on the list.

So when will people be able to enjoy this rare experience? Oh—he wouldn't, would he?

You bet your life he would!

Not just yet, perhaps, but, if the *Sunday Times* report is to be believed, the good scientist foresees the time when sufferers from dreadful maladies, like Alzheimer's disease and certain cancers, will, quite literally, be "put on ice" until such time as a cure for their afflictions may be found. Also, citizens needing transplants, and teetering on the edge of death, and so with only hours or days to spare, might have their progress to the grave stopped short by residing, changeless, in the limbo of cold storage until a well-matched donor obligingly appears.

It couldn't happen—could it?

Oh, no? Back to the famous Robert Edwards.

In 1965, this then young and unknown physiologist published a paper in *The Lancet*, describing the "apparent fertilisation" of human ova by human spermatozoa on the laboratory bench. I was, at the time, editing another, brasher medical magazine, and, thinking that this looked like a pretty good story, I sent a reporter down to Cambridge to interview the lad. I



No laughing matter. "Sleepers" could yet become a reality

also rang up several eminent persons to ask their reactions to the news.

Sir Peter Medawar acknowledged the usefulness of being able to culture early human embryos in order to study destructive chromosomal abnormalities, but added: "Some people might look at this work and start thinking in terms of 'test-tube babies', but test-tube babies are out, and this isn't the importance of the discovery at all."

Alexander Comfort said: "There might well be an uproar, arising from the fear that we shall now start culturing human babies from embryos in test tubes, but the people who protest will never ask themselves why anybody should want to do this. The normal method is more fitting, I think, to most of our purposes. It seems to me to be entirely a work of supererogation."

So what's happened? Exactly!

The moral is, of course, that once something can be done it will be done, and no laws, or pronouncements of committees, or any other kinds of hindrance (let alone the dictates of prudence and common sense), will stop the process.

Thus, we may confidently look forward to the establishment of immensely costly body-banks, the first of which will doubtless grace the Californian scene. Sufficiently wealthy but ailing oldsters will refuse to die. Even perfectly healthy yuppies, accused, say, of insider dealing, may choose to "retire" for a decade or so until the scandal evaporates, leaving their ill-gotten capital to fatten at compound interest rates, ready for their second coming. The possibilities are endless and horrific.

Perhaps there's some fatal and so far undetected flaw in the Segall technique, making it inapplicable to *H. sap.* But I fear not. I fear that Paul Segall may become even more famous than Robert Edwards, and that his contribution to the realm of physiological legerdemain may prove yet more disruptive of the laws of God and man.

## Solar research gets left in the shade

Mark Newham with a salutary tale from Niger

**O**NE OF the great energy ironies of our time has come home to roost in the vast but little known central African state of Niger. Having depended on exports of uranium for the world's nuclear industry for the past 20 years, Niger's economy has hit rock bottom now that the demand for uranium has fallen off.

Buildings in the capital, Niamey, are left unfinished, roads are becoming little more than Tarmac links between the potholes, and reforestation projects wither as fast as the trees themselves in this furnace of a country. But the ironic twist to the tale is to be found near Niger's university where, until a few years ago, the National Solar Energy Centre flourished.

Some of the profits from the sale of uranium to power nuclear reactors were ploughed back to fund Niger's researches into technologies for tapping solar energy. But not any longer. Funds for research into solar energy have dwindled in parallel with the fall in the price of uranium on the world market and solar projects in Niger have suffered accordingly.

A huge solar thermal pump which once generated 4 kilowatts of power to irrigate crops in a remote corner of the country lies abandoned in a corner

of one of the centre's sheds. Researchers had taken it back to the centre to repair leaks in the system and to add more solar collectors to increase the pumping power to 10 kilowatts. But then the slump began to bite and there seems to be little chance that the pump will ever see sunshine again.

A factory for solar water-heaters on the premises does little but shelter the workforce from the very resource they are trying to tap. According to the director of the centre, a Nigerian called Albert Wright (his mother came from Niamey, his father from Birmingham), the factory could, if it had

Cold comfort: a solar-powered water heater that few can afford



the orders, make five solar water-heaters a day. With the economy in its present state, they are lucky if they get the chance to make 10 heaters a year. At about £125 for a heater, there aren't many Nigerians who can afford the luxury of solar-heated water, or, for that matter, heated water from any source.

Wright is not amused by the irony. "I started this research in 1965 to try to adapt technologies that originated in your world and make them more suitable and affordable in mine. The whole essence of the work was to try to find ways of reducing Niger's dependence on imported fuels and on firewood, which is largely responsible for the horrific rate of deforestation and desertification here. Now, again, your world is proving the downfall of mine."

Despite his disappointment, Wright has one reason to smile, and his face lights up at the thought. "We have generated our own little irony as well, but this time it's in our favour." He points at what looks like a cloche in an English vegetable patch. "That is our finest development," he grins.

It is apparently not a cloche but a solar-powered, water distillation plant. Bad, salty or polluted water is placed inside it, the Sun's heat vaporises the water, the vapour condenses on the cooler surfaces and the clean, distilled water is channelled into demijohns. The genius of the system lies in its simplicity and the fact that it can be built out of cheap, locally available materials.

"But here's the best bit," says Wright, almost unable to contain his mirth. "This device can produce distilled water at half the price of any other system, so we started selling it at that price. But no one would buy it. They thought that, at that price, it couldn't really be distilled water and were scared of using it in their batteries. It only started selling when we doubled the price for exactly the same product."

Another of the centre's developments which has become quite popular is a large scale solar drier in which farmers dry their crops. But the success of the drier has been directly offset by the dismal failure of the solar ovens developed by Wright in an effort to stop people burning firewood and destroying what's left of the forest.

"They say that Niger has lost half of its forest since 1970 and I believe wood stoves are largely responsible. If people would only use the one resource that Niger possesses in abundance—solar energy—to cook their food, our forest replanting programmes might get somewhere. At present, we're at the stage of taking one step forward in lead sandals and fifty steps backwards in cushion-soled walking boots."

Apparently, it's not really the technology that's at fault, although the solar stoves won't heat up properly if they're not pointed directly towards the Sun. The problem has to do with people's reluctance to change their habits. Most rural families traditionally eat in the evenings, whereas the solar ovens and stoves work best, for obvious reasons, at midday. The result is that the solar stoves have worked well in trials but have failed heroically under real conditions.

The same could be said of Niger's forest

replanting programmes. The country's authorities have concentrated to a large extent on planting large areas with quick-growing eucalyptus for cropping for firewood. They have also irrigated some of the plantations to make the trees grow as quickly as possible. Not only does the growing of eucalyptus damage already fragile soils by returning few of the nutrients it takes out, but the cost of irrigation puts the

final product out of reach of the average Nigerian. As a result, anarchic tree felling and gathering of firewood continues in direct contradiction to the aim of the projects.

The trouble is that, once started, such extravagant projects cannot be altered without the government forking out yet more money. In the present economic circumstances, that seems unlikely. □

## What is the ABRC up to?

More comment from Westminster

### THISTLE DIARY



Tam Dalyell MP

THE practice is shameful but governments have always done it. Controversial proposals and awkward reports (as with Westlands last year) are invariably published just before parliament goes into the summer recess. Was it coincidence, then, that the Advisory

Board for the Research Councils should have chosen 21 July to reveal its recommendations for restructuring British research (*New Scientist*, 23 July, p 16). The council says that control of research support should be increasingly centralised, and that a third of Britain's universities should be excluded from receiving research funds.

First, a politician's question. Would I advise a constituent who asked to send an offspring to a university where no research took place? Not on your nelly!

It makes you wonder who could pass such cavalier judgment on the research of a university and on what criteria. I press an academic heavyweight to say which Scottish universities he would relegate. By a process of elimination, he answers that Dundee and Stirling would be candidates. Now, I know from the opinions of knowledgeable friends in Cambridge that Dundee has one of the best schools of biochemistry in Britain and that Stirling excels in marine sciences and much else. It all depends on departments.

So what, I ask, is the ABRC up to? Break the heart of a third of our universities, to comply with a chancellor who thinks that the be-all and end-all is to reduce the standard rate of income tax to 25p in the pound. I have scarcely ever been so angry in my public (or private) life.

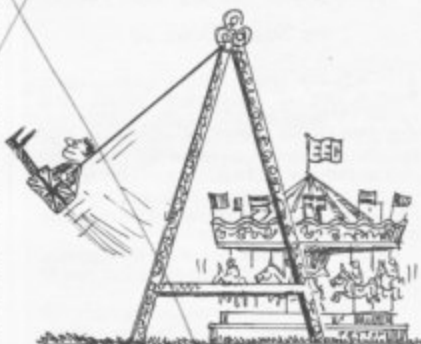
Now, I would welcome the establishment of well-supported "centres of excellence" in appropriate areas of research. This is sensible in fostering interdisciplinary studies and in making use of expensive facilities. But that's not what the ABRC seems to be about. It seems to be obliging a wrong-headed and parsimonious ministerial whim.

I became an MP at the time of the Robbins report on higher education and when the charming and concerned Sir Edward Boyle was Minister for Education. The ABRC's report must have Robbins and Boyle turning in their graves. I am sure that many informed Conservative MPs are

as horrified as I am at the recommendations. Just wait to see the explosion in the Commons when a range of MPs of all parties find that the universities in their constituencies are branded third—or even second—rate.

A word of advice for Kenneth Baker. Kenneth, if you go ahead with these ill-conceived, wrong-headed and barmy proposals, your own colleagues in parliament will simply not elect you Leader of the Conservative Party. You will have made too many enemies, and it will have served you right.

WHAT ABOUT the second phase of a full-scale fusion reactor which would cost £640 million? Until a few weeks ago, there was little doubt in anyone's mind that it would be built at Culham, where much of the preparatory work was undertaken. Now it's not quite so firmly in the British bag. Reason? Our European partners are hopping mad at Margaret Thatcher's intransigence over the EEC's Framework research programme. Britain, it is felt, bitched the Other Eleven. If they thought Thatcher was going on for ever, the Other



Eleven might bitch Britain. I hear that Geoffrey Howe and the Foreign Office are being left to pick up the pieces.

WITH parliament in recess, and the season for party conferences approaching, people who want to persuade their political colleagues of their impeccable antinuclear views will be hatching all sorts of speeches on renewable forms of energy. Now, I'm all for alternative forms of energy, but in no way do many of them present a soft option for people who want to avoid the political difficulties of nuclear power.

Michael Spicer, influential junior minister at the Department of Energy, tells David Amess, the Conservative MP for

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## The one-sided power struggle

High rates are inhibiting private suppliers, says Mark Newham

RETURNING from the town hall recently after paying a long overdue rates bill, I suffered one of the most disconcerting moments of my life. Turning into my street, I was startled to see a flock of birds huddled on my roof. No other house in the street offered the same attraction. The realisation dawned that, on this particularly chilly day, my roof was the warmest in the area and that mine must be the only house without loft insulation.

With potentially gargantuan gas and electricity bills imminent, I decided it was finally time to investigate the possibility of insulating my loft. I knew the quantity of material needed but knew as much about the types of insulation available as I did about the dark side of the Moon. I decided to consult a supplier.

"What you don't want," said the man behind the counter, "is the granular type. When the wind blows through the eaves it goes all over the place."

"How about floorboards over the insulation to stop it moving?" I asked.

"No good, mate. When the bloke from the insulation grants office comes to inspect the work, he'll tell the rates people that you've improved the property by putting flooring in the loft and your rates will go up."

"By how much?"

"Difficult to say," the man said, "but it could be as much as 12 per cent if you nail the boards down. It's less if you use screws. If you screw the boards down, it's regarded as a temporary measure and the rate increase is lower. Nails are for ever."

I decided to raise the issue with Peter Walker, the energy secretary, who fortuitously was addressing a meeting of the Parliamentary Alternative Energy Group at the House of Commons that same evening. I didn't get the chance. I was beaten to the punch by a representative of the British Wind Energy Association (BWEA) who had a more important rates issue to raise.

"Can the minister explain," asked Peter Musgrove of Reading University, the inventor of the Musgrove vertical-axis wind turbine, "why it is that the owners of private energy generators supplying surplus power to the grid under the auspices of the 1983 Energy Act have to pay rates of between 1.5 pence and 2.0 pence per kilowatt hour generated, when the CEBG has to pay rates of only 0.1 pence per kilowatt hour on power supplied from large central power stations?" At some times of the year, Musgrove said, the rate demand is more than the area electricity boards pay the owners of private generators for the power they supply to the grid.

Walker looked as though he was about to step on a mine. "If you would write to me about that point, I'll make sure you receive a reply," he managed to say before disappearing from the room in a cloud of private secretaries.

The BWEA and a host of other energy associations have marked the rates issue down as one of the prime reasons why so



few private power suppliers have sprung up to take advantage of the Energy Act, which was introduced to undermine the CEBG's monopoly on power supply. The latest figures from the Department of Energy show that only 70 private generators are connected to the grid in Britain. The combination of the threat of hefty rates bills, together with heavy fixed charges for connection to and use of the grid to export the power (which do not vary according to the amount of power the generator can supply), is severely restricting the growth of private power generation.

Add to that the fact that area electricity boards often pay less for the power they buy from private generators than they charge

for the power they supply to the owners when those generators cannot operate at maximum capacity, and you can see that only an idiot or a company looking for a tax loss would even consider partaking in such a scheme.

To be fair to the Department of Energy, the rates problem does not fall within its territory. The Department of the Environment is responsible for policy on rates, and reports from within the power industry suggest that the two departments are at opposite poles over the issue.

Moreover, it is difficult to find anyone who has actually received a rates demand for selling surplus power to the grid. But that is not the issue, says Reg Clare, chairman of the BWEA. It is the threat that the rates could be applied which is worrying potential producers.

To resolve the problem once and for all, the BWEA is planning to force a test case likely to involve the new 2000-kilowatt wind turbine at Ilfracombe, North Devon, built and operated by the Wind Energy Group—a consortium of Taylor Woodrow, British Aerospace and GEC.

Until the issue is resolved, says Clare, there seem to be only two options under the Energy Act where a private producer—using wind, water, wave, solar or any other kind of power—can profit from the venture. The owner either installs a small generator sufficient to supply the needs of a farm—a generator supplying power for agricultural use is not subject to rating—or the owner installs a machine with an output in excess of 100 kilowatts specifically to generate for the grid. Only at this sort of size can the supplier accommodate the heavy connection charges and hope to make a profit. So much for equal opportunity under the Energy Act. □

## A broader base for schools

The dark ages may soon be over, as Ros Herman explains

IN THE MIDDLE of all the upheaval that funding cutbacks have caused in British universities, it may seem peevish to quibble about the question of entrance requirements. Nevertheless, Anne Sofer, SDP spokeswoman for education, chose to berate 300 senior academics on the topic at a meeting last October to discuss the future of the academic system. So did R. P. Brown, president of the Secondary Heads Association, who described the assembled academics as "deckchair attendants on the Titanic, arranging the chairs as the ship sinks".

Both speakers wanted to remind the universities that, as far as the outside world is concerned, their internal traumas are part of a major reshaping to meet the needs of society. The universities will be judged not by how they cope with financial cuts, but by their response to other challenges from the outside world.

They may, for example, have finally to honour an idea to which they have paid lip service for decades. That is to do what they can to stop the very early subject specialisations forced on children in secondary schools. Children have to make often irrevocable choices about their future careers at ages as early as 14 because, when they get to

17 or 18, universities will select those who have done best at an advanced level in a very small number of subjects.

Technically, any two A-levels qualify a candidate for admission. Beyond this, universities and faculties are free to set their own requirements for entrance to specific courses. The Committee of Vice Chancellors and Principals (CVCP) has a pamphlet that provides general guidance. For science-based courses, for example, it says that "The best combination for keeping as many options open as possible is mathematics, physics and chemistry." Possible substitutes are further mathematics and biology. Physics could be replaced by engineering science or physical science. Those whose interest is mainly biological could perhaps substitute botany or zoology for biology.

The CVCP's booklet, *Choosing A-levels for University Entrance*, says nothing about alternative combinations of subjects, let alone give credit for breadth of study or the importance of languages. And it makes no reference at all to qualifications apart from A-levels.

Does this mean, then, that the universities are irrevocably stuck in the educational dark ages? Almost, but not ▶

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