

feels, to choose a different site and set up a private association to which national research councils could contribute, avoiding the need for complex international agreements. (There is a similar foundation at the Institut Laue Langevin at Grenoble.)

There is also a rapidly increasing interest in synchrotron radiation in industry, Farge believes. DCI at Orsay profited from industrial participation by £5,000 in 1979, and the figure will be £20,000 this year. Oil companies appear to be interested in the routine use of the light to seek out significant trace elements in core samples for oil prospecting; the X-ray intensity available could give them a factor of 1,000 in speed.

However the ESRF itself is a long way from a final design. A sub-group of Farge's committee, headed by Dr DJ Thompson of Daresbury, has prepared a preliminary study which defines a 5 GeV, 0.5 Amp, 604 m circumference ring with the brilliance function shown in the figure. Drs B Buras and G V Marr have also defined a shopping list of instrumentation. The machine and building plus half the instruments would cost £55 million at present prices, and could be constructed within 3 to 6 years.

But a new idea has occurred to the committee: that it be an "all-wiggler" machine, a design in which the experimental radiation is taken not from the main bending magnets of the ring, but

from multipole, high field magnets which introduce local high curvature wiggles in the beam path. This would enable the machine to use lower energy and beam current for the same radiation intensity. And the overall radius, as it happens, would be "just right" for the CERN ISR tunnel.

The uses of the ESRF radiation would stretch from molecular biology to nuclear physics, the meeting was told. Using 'undulators' — wigglers with 50-100 poles that produce coherent radiation — spectral brilliances up to seven orders of magnitude greater than those obtainable at DCI are conceivable. Such increases are very rare in science, said Farge, and the consequences are unpredictable.

However Daresbury's Dr Mike Hart, who took the role of the ESRF's chief bubble-burster, claimed one thing is predictable: that such an intensity of radiation from the undulator would destroy most samples. Quick calculations by Farge and Thompson led to estimates of 33-300 Watts onto the sample. "You'll have cooling problems," says Hart.

Probably the most exciting application of the high intensity, coherent light from an undulator would be to illuminate a zone plate X-ray microscope — one that depends on diffraction effects to produce focusing and de-focusing equivalent to the lenses of an ordinary light microscope. This application is limited by the fineness

with which zone plates can be drawn, but object resolutions of 100 Angstroms are foreseeable; and with a wavelength of 25 Å, tuned to detect carbon but not oxygen, the prospect opens of following ultrastructural movements in live cells.

Nevertheless the ESF has not argued the case sufficiently for the ESRF as against existing synchrotron light sources, says Hart; 70% of the arguments used in the ESF document "the scientific case" for the ESRF apply to synchrotron radiation in general, and not to the ESRF in particular. The document will have to be rewritten in two years' time, Farge admits.

Robert Walgate

Four documents on the ESRF are available from the European Science Foundation, 1 quai Lezay-Marnesia, F-67000 Strasbourg, France: 'The Feasibility Study', 'The Scientific Case', 'The Machine', and 'Instrumentation'.

Training

Thoughts from the think tank

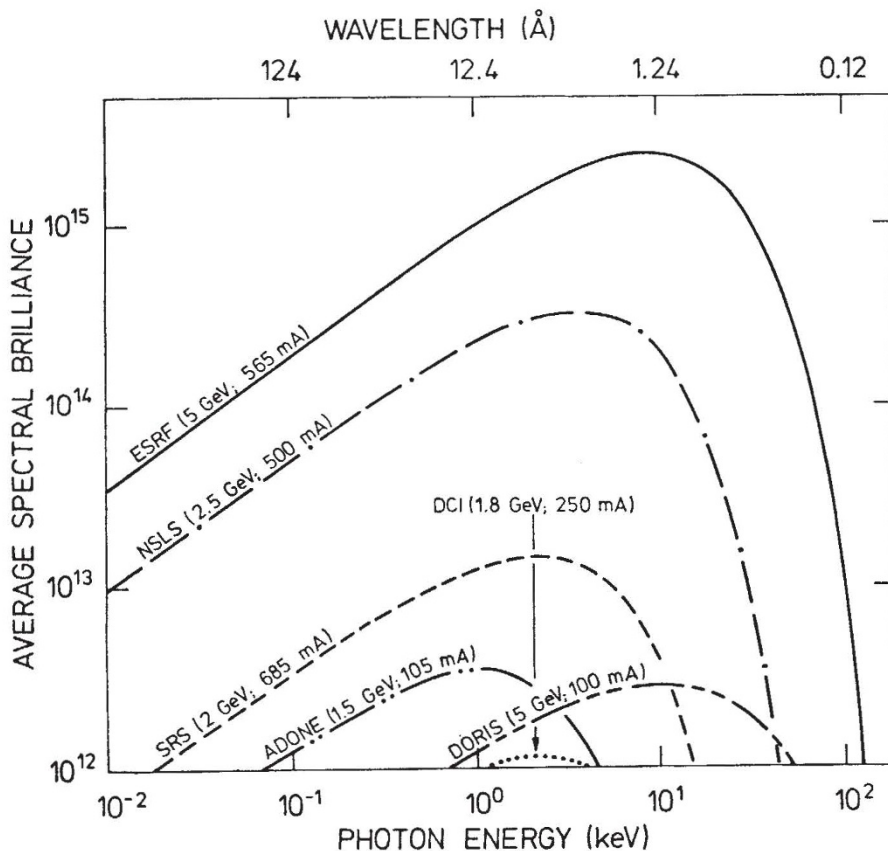
THE British government's own think tank, known as the Central Policy Review Staff (CPRS), published last week a mildly subversive prescription for making the products of the British educational system more suited to what is called "the world of work". The CPRS report ("Education, Training and Industrial Performance", HMSO, £4.25) gives no explanation of how it came to be published or even written.

Among the points at which the recommendations of the report may seem at odds with current government policy, the following are conspicuous:

- There should be formal standards and qualifications for skills acquired by means of vocational training.
- The government should continue to provide vocational training for young unskilled workers.
- More attention should be paid, especially in the age range 16-18, to the acquisition of practical skills, preferably in colleges of further education, not schools.

The CPRS does however accord with current government policy in its advocacy of a core curriculum (consisting of English, mathematics, science, a practical subject and "possibly" a foreign language) in the age range 11-16. The report also asks that the financing of further education by public loans should be reconsidered.

The CPRS is suitably modest in its acknowledgement of how little is known of the relationship between education training of any kind and the eventual benefits to employers and the national economy. There is no single issue on which a government initiative would, in the CPRS's judgment, make training radically more effective — and, even if there were, implementation would be hampered by the



Spectral brilliance (in photons s⁻¹ mm⁻² mrad in 0.1% bandwidth) is compared for the proposed ESRF, the Brookhaven NSLS (ready

October 1981), the Daresbury SRS (October 1980), and the Frascati ADONE, the Hamburg DORIS and the Orsay DCI (in operation).

decentralisation of the British educational system.

Some of the ironies of the British educational system are however neatly described by the report, which is based on an unsystematic survey of the opinions of educational and other organisations and on the CPRS's own views. One large company is quoted as holding the view that university science courses are "too academic" but nevertheless choosing to recruit graduates from the same academic courses in the belief that these would have attracted the most able students.

In its assessment of the provision of education and training, the CPRS echoes the conventional wisdom that Britain is better supplied with means of initial education and training than with facilities for continuing education and retraining.

The report has few concrete suggestions for the improvement of continuing education in Britain. It remarks that elsewhere than in the United Kingdom, and especially in the United States, continuing education flourishes because people acquiring extra qualifications are often rewarded with extra pay, and notes regretfully that "pay policy and union pressure" have prevented such incentives emerging in the United Kingdom. It therefore pins its hope for the future on part-time and evening study.

The more controversial recommendations are, predictably, those that affect the pattern of school education in the United Kingdom. The CPRS comes to the same conclusion as the Secretary of State for Education and Science, Mr Mark Carlisle, that there should be a core curriculum in the age range 11-16 but that this should be adopted voluntarily by educational authorities and not centrally imposed by Act of Parliament. (The report notes that the only present legal compulsion, the requirement that religious knowledge should be taught in schools, "has not been notably successful".)

The CPRS also wants there to be a more deliberate concern by those who design school curricula for the needs of industry

(and is explicitly critical of the School Mathematics Project, now widely used in British schools, for its failure to consult with industry).

On the shortage of science and mathematics teachers in British schools, the report asks that the government should "grasp the nettle" of paying teachers with special skills more than teachers of other subjects. The report does not refer to the longstanding opposition of the teachers' unions to proposals of this kind.

The CPRS also has views about the way in which academics in British higher education should be paid. It refers in its report to the system in the United States under which some academics are paid for only nine months in each year, but are free to take paid employment elsewhere (or to carry out research) in the remaining months.

The CPRS is especially attracted by the way in which this practice may give some academics first-hand experience of industry, and asks that the Department of Education and the University Grants Committee should consider the problem and "use their influence" to get rid of existing restrictions. It hazards no guess at the salary levels that would be established after such a reorganisation. □

Three Mile Island

Reactor entry bid aborted

AN attempt by two Metropolitan Edison engineers to enter the contaminated containment dome of the damaged Three Mile Island reactor was abandoned last Tuesday (20 May) soon after 9.00 am when the inner door of an airlock refused to open. The engineers made three attempts to open the 3' thick steel door leading into the containment dome by the normal procedure of giving the wheel of the door a three quarter turn and pushing. After a

total of 11 minutes of the planned 15 minute "mission", the men were recalled by radio. A total of 10 millicuries of krypton-85 was vented to the atmosphere during the procedure and the engineers received a whole body radiation dose of 10 to 15 mrem.

Officials from Metropolitan Edison in Middletown, Pennsylvania, and General Public Utilities in Parsippany, New Jersey, said that further attempts to enter the dome would be postponed "indefinitely", until the situation could be analysed further. "We have only one theory" said Sandy Solon of Metropolitan Edison. "Corrosion, either around the hinges or around the door seals, is causing the door to stick". The airlock door is made to close tolerance and has not been opened for 14 months.

By noting which instruments inside the dome have not been operating, engineers have estimated that the dome is flooded to a depth of seven feet, "plus or minus one or two per cent". The airlock door is 20 feet above the floor so "there is no danger of a release of radioactive water into the airlock." Video monitors show a steady mist is falling inside the dome as heat from the reactor (which is still at 200°F) causes water on the dome floor to evaporate, rise to the ceiling and condense. "The atmosphere inside is highly corrosive, to say the least" said Bill Murray of GPU.

The presence of corrosion in the door "bodes ill" for the functioning of ventilation equipment inside required to cool the dome and maintain a negative pressure with respect to the outside to minimise the possibility of leaks. Engineers have rejected the possibility of forcing the door with hydraulic jacks for fear of tearing the polyplastic inflatable door seals. A failure of the air-lock door to re-seal might necessitate the uncontrolled venting of the 57,000 curies of krypton-85 still trapped in the dome. Bill Murray of GPU said that the Nuclear Regulatory Commission may give the plant operators permission to make a controlled release of the radioactive gas to the atmosphere, thus

Three Mile Island reactor — which way back in?

