USA

● Total spending on research and development in the United States is expected to reach nearly $41,000 million this year, according to figures compiled by the National Science Foundation. If the estimates are correct, support for research and development would stay ahead of inflation for the second year running, though the combined two-year increase would not be sufficient to wipe out inflationary losses incurred during the early 1970s.

According to the NSF study, the federal government is expected to spend about $21,800 million in 1977, a 10% increase over 1976, while industry is expected to spend about $17,500 million and about $1,500 million will come from universities, non-profit institutions and so on. In terms of constant dollars, the total is expected to be about 6% below the peak spending years of the late 1960s. Measured as a proportion of the gross national product, spending on research and development has declined steadily since 1964.

NSF has also published an estimate of the number of scientists and engineers employed in 1976, which suggests that after four years of growth, the scientific labour force now numbers 542,000. The total is about 20,000 below the 1969 level, however. Some 40,000 science and engineering jobs were lost during the 1969–1973 cutbacks, NSF reckons.

● While the nuclear industry in the United States was licking its wounds last month, following President Carter's decision to defer commercial reprocessing and to downgrade the breeder reactor programme, a report on nuclear power plant security drew some fresh blood. Published by the General Accounting Office (GAO), an investigatory agency of the Congress, the report concludes that "security systems at perhaps all power plants would not be able to withstand sabotage attempts by threats that are now considered minimum by (the Nuclear Regulatory Commission)".

Based on inspections of security systems at six power plants, carried out by GAO investigators, the report is written in uncharacteristically blunt language, laying blame at the doors of both the nuclear industry and NRC. It states that though the quality of security forces seems to vary greatly from plant to plant, some deficiencies were encountered on each inspection. The faults included lack of training of security guards (as little as four hours at one plant), high turnover of security personnel (up to 48% a year), and poor security equipment. In particular, the report cites the following two horror stories:

> We accompanied an NRC inspector to one power plant at night. The inspector asked the guard manning the guardhouse to aim a closed circuit television camera on a particular spot. The guard tried but was unable to work the system. The inspector opened a door which rang an alarm in the guard house. After waiting several minutes, the guardhouse was called to find out why no one responded to the alarm. A guard in the guardhouse answered that all of the available guards were too busy.
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> At yet another site, we asked a guard about the locations of certain critical systems of the plant, including the control room. He told us that the guard force knew nothing about the location of these systems because the guards were not allowed inside the power plant.

Although the NRC has recently published a set of new regulations designed to increase the effectiveness of security systems at nuclear plants, the regulations are not due to come into effect until August 1978. The GAO report says that although the new regulations are "on the right track", NRC should take steps immediately to ensure that operating plants are made more secure.

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serve just as well. To try to limit such potential abuses, the Institute recommends that medical insurance companies should establish an advisory committee to develop criteria for paying CT scan charges. It also recommends that requests for use of CT scans should be reviewed by a physician with responsibility to control access to the machine, who would determine whether the scan is appropriate.

The central question here is not whether CT scanners are useful, but what level of investment can be justified and how the machines should be allocated and managed. Those are questions that the American health care system finds difficult to address, given its fragmented nature, the competition between hospitals for revenues and prestige and the third-party payment system. As Dr Harvey Fineberg, Director of the Graduate Program in Health Policy and Management at Harvard School of Public Health put it last week, "The fundamental assumption that we in this country have not yet made is that the pot of resources available for health care is limited . . . if you ask whether CT scanners are useful, the answer would be 'yes', but if you frame the question 'would they be a sound investment', you may come up with a different answer". □

WEST GERMANY

Energy plan published

Werner Gries reports from Bonn on the energy research programme recently approved by the West German government

THE main emphasis of the German federal government's DM 6,200 million energy research programme for 1977 to 1980, published at the end of last month, is on nuclear research, but the rational use of energy, progress in coal technology and the development of new energy sources are also prominent. Details of the programme, which marks the first time the state has intervened to bring together systematically both nuclear research and work on other energy resources, are as follows:

Nuclear energy will take some 75% of the state funds. Fast breeder and high temperature reactors remain the first priorities in the country's nuclear power programme, but research and development work is to continue in the fields of uranium enrichment, reprocessing and the disposal of radioactive waste. A state subsidy of about DM 1,200 million will be needed just to complete the prototype power stations now under construction to house the breeder and high temperature reactors. Reactor safety is a key aspect of the programme; R&D on nuclear-powered ships will be continued only on a fairly modest scale, receiving about DM20 million annually.

Rational energy use: Around DM100 million annually will go into research into technologies for rational energy use. Attention will be given to techniques of remote heat supply, reverse cycle heating systems, heat recovery processes and the use of waste heat from power stations.

Coal technologies: R&D in coal technology, one of the most important aspects of the non-nuclear side of the programme, will receive increasing amounts of funding, amounting to an average of DM140 million annually. Coal gasification, improvements to coal-fired power stations to reduce pollution, coal liquefaction and improved mining techniques will all receive support.

New energy sources: The government will support the development of new sources of energy to the tune of DM130 million a year on average, with the focus on nuclear fusion (about DM90 million annually) and on solar energy. In the government's view, solar energy is of interest in West Germany only as a means of heating build-

ings and providing hot water, and research is being concentrated in this area. Further work on nuclear fusion is dependent upon the site of JET; the Research and Technology Minister, Hans Matthoefer, expressed his hope for an early desision on this.

It is Herr Matthoefer's ministry which has much responsibility for R&D in West Germany. Its budget in 1977 of DM4 million million compares with total research expenditure in 1977 estimated at DM26 million million. Federal research programmes are designed for a period of about four years, classified by sectors and provided with a corresponding budget during the planning stage. The energy programme is one of ten programmes for sectors that also include data processing, marine research and technology, raw materials, electronic components, space and aviation, and so on.

The outlines of the new energy programme were determined by the federal government following a cabinet resolution. The programme is not immediately binding for industry but outlines the frame of what the government considers essential. The country's primary energy consumption in 1975 broke down as follows:

Mineral oil	52.1%
Hard coal	19.1%
Soft coal	9.9%
Natural gas	14.0%
Nuclear energy	2.0%
Others	2.9%

The structure of energy consumption differs from the United States and other large countries. A breakdown of energy consumption by sectors in 1975 shows that industry consumed 35.9%, transport 19.7% and domestic 44.4%. In the government's opinion the largest savings have to be achieved in the domestic sector. Industrial energy consumption, related to national product, has actually stagnated for about ten years.

An output capacity of 33,000 MW from nuclear power stations in Germany was anticipated for 1985, but a maximum of only 25,000 MW can be expected because of recent breakdowns in power stations and the postponement of various building projects. □

SWEDEN

● A report recently published by Sweden's National Environment Protection Board shows that the business of making polluted lakes clean is slow and difficult. Sweden has 100,000 lakes covering 9% of the country's surface, and of these about 15% in the southern third of the land are being overloaded with phosphates and nitrogen. In general, the polluted lakes are victims of acid rain, sewage, industrial effluents and agricultural run-off. Recovery programmes are having limited success.

In the long term, acidity will be reduced only if fuels can be burned without releasing much sulphur into the air; but as a stop-gap measure, lime has been spread onto the lakes themselves in some severely-affected areas. Prospects for large-scale liming seem poor, however, not only because of the cost but also because the traces of toxic metals found in most commercial lime would become significant in the quantities involved.

Another recovery tactic has been to cut off flows of effluents into a lake and the streams feeding into it. This has only improved water conditions slightly, as the lakes' internal circulation of nutrients has not been affected enough to cut down the production of plankton to acceptable levels. Reducing pollution by treating sewage to remove the nutrients from it is not always effective either: although it caused plankton levels to go down in one case, the gains were partly offset because the farmers in the area increased their use of nitrogen fertiliser.

In some cases, causes and effects in the pollution cycle are impossible to determine. The fact that the burbot in Lake Vättern has decreased dramatically in the past ten years while its main prey species has increased could be due to the burbot's high PCB content or simply to overfishing. But once the balance between the two species has been upset it may never be re-established, and the reason for the change may never be known. Pike in Lake Vänern are black-listed because they contain mercury from industry at the northern end of the lake. The fact that they have been fished less has meant that their average size has grown, which has resulted in increased cannibalism and a slower growth rate in their population. In these circumstances it is extremely difficult to say exactly what the direct effects of mercury pollution on pike may be.

With these uncertainties, recovery programmes are hard to design. The report gives the impression that the problem would be easier to tackle by prevention rather than cure.

● The Nuclear Fuel Supply Company has reached an agreement with the French firm Cogema under which spent nuclear fuel from the Barsebäck 2 and Ringhals 3 reactors will be reprocessed at the French facility in La Hague. Cogema will accept spent fuel produced until the end of 1979, and will return it after reprocessing to Sweden for final storage. Because of delays in the Ringhals 3 programme, it seems likely that the spent fuel sent will in fact come only from Barsebäck 2.

Under the law specifying the conditions to be met by reactor operators before the government will give permission for the building and operation of nuclear power plants, the owners of Barsebäck 2 must organise secure reprocessing of spent fuel. In their opinion the present agreement fulfills their obligation. Sweden's Energy Minister, Olof Johansson, who is trying to stop Sweden's march into the nuclear society, is refusing to admit defeat. He says that the government can decide whether the owners have met the conditions only after it has examined the contract. The government's pronouncement is expected to be made by 1 October.

● According to a recent statement by the Minister of Education, Mr Jan-Erik Wickström, Sweden may be facing an acute shortage of people educated in technology and the natural sciences. The 1970s, said Mr Wickström, have seen difficulties in recruiting students to technical and natural science lines at both secondary and tertiary levels. He blamed this partly on the state of the labour market, which was unfavourable for natural science graduates at the beginning of the 1970s, partly on the evident inability of primary schools to exploit students' interest in natural sciences, and partly on the unpopularity of technicians and scientists in a society affected by the green wave.

A look at the official statistics hardly clarifies the picture. It is true that the number of students reading natural sciences and mathematics at tertiary level fell by 25% between 1971 and 1976. But that should be seen against a background of a general drop in interest in tertiary education: the number of students reading humanities and social sciences, for example, fell by 20% during the same period. Yet these years saw the number of students at institutes of technology increase by 9%. A similar pattern holds for doctoral degrees taken over the same period: down by 16% for mathematics and natural sciences, down by 17% for humanities and social sciences, but up by 5% for technology.

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