

post actually held by Dr Munir Ahmed Khan, who claims to have little to do with his namesake from Kahuta.)

Dr Abdul Qadeer Khan, in fact, has stressed the entirely peaceful intentions of the Pakistani nuclear programme. He said that unlike India, where the nuclear power programme had been "based from the very beginning on sound foundations" under the patronage of the late Pandit Jawaharlal Nehru, Pakistan had made a relatively late and initially ill-organized start. Moreover, India, at least initially, could get encouragement and help from developed countries, but fear of an "Islamic bomb", which could be disseminated to all Muslim countries, had led the developed countries to impose restrictions on the export to Pakistan of even "the most minor products".

A bomb-making capacity depends, ultimately, on a uranium enrichment facility. On this point Dr Khan did not explicitly commit himself. He claimed only that Pakistan was far in advance of India in uranium enrichment and "not far behind foreign experts" in any field. The Pakistani Government is at present, he said, trying to purchase a 900 MW light-water reactor, and the uranium processing plant at Kahuta was being used to produce the necessary fuel.

Since it would take at least 10 years to obtain, install and operate such a reactor, the Atomic Energy Commission was "positive" that the fuel supply would be ready when needed. Those who thought that the plant was being used for uranium enrichment were deluding themselves, he said. A few minutes later, however, he observed that "as far as the supply of enriched uranium is concerned, we shall supply the Atomic Energy Commission, God willing, with as much as it needs."

Had they come from a politician, Dr Khan's words might well, for reasons of national prestige, be trying to imply a self-sufficiency which has not yet been attained. Dr Khan, however, is a scientist, and moreover, something of a special case. He was sent to study in Europe and then worked at the Almelo uranium enrichment centre in the Netherlands, returning to Pakistan in December 1975. He was subsequently charged, *in absentia*, by the Dutch government with industrial espionage, and he was sentenced, still *in absentia*, to four years imprisonment — a verdict which for prestige reasons, the Pakistan Government is still trying to get reversed.

As Dr Khan admitted in his interview, a special Dutch parliamentary committee appointed to investigate the affair stressed that Pakistan had gained much capability and saved considerable research expenditure on uranium enrichment as a result of his activities — although he maintains that the Dutch judgment was "unjust", "contrary to all the canons of law" and inspired by "anti-Pakistan and anti-Islam" elements.

Vera Rich

Nuclear power

French, plentiful and cheap

THE French national electricity utility EDF is making money at last, despite the enormous cost of the French nuclear power programme, which left EDF with debts of FF 150,000 million (£12,500 million). So claimed EDF director-general M. Jean Guilhamon during a visit to London, in a talk orchestrated by Sir Walter Marshall, chairman of the British Central Electricity Generating Board. Sir Walter, despairing of the future of nuclear power in the United Kingdom, used the opportunity of Guilhamon's visit to sign a fast breeder agreement (*Nature* 9 February, p.495) to ask him to demonstrate that in France, at least, nuclear power works. M. Guilhamon kindly obliged.

The giant EDF debt — in order of magnitude not far from the national debt of Brazil — has been amplified over the past two years by the halving of the value of the French franc against the US dollar — in which currency EDF borrowed much of its capital. But even allowing for making repayments and interest at commercial rates and for depreciation of plant, EDF is now making a profit, says Guilhamon.

France now produces 54 per cent of its electric power by nuclear plant (mostly pressurized water reactors), and with 26 more reactors already under construction or on order, the figure will be 70 per cent by 1990. That is near the practical maximum, given that it is difficult to switch off nuclear power to cope with nightly falls in demand — although EDF is offering customers cheap rates if they will take power nearly continuously.

Opponents of nuclear power have condemned the cost of building the stations, but the tables are now turning, Guilhamon claims. During the construction programme, the government set a low electricity price which made EDF unprofitable, he says. But the price encouraged new electricity consumers: for example, two-thirds of housing starts in France are now all-electric. Now, as more and more nuclear power stations turn on, displacing costly oil- and coal-fired plant, the profits of the programme are beginning to appear.

"In 1976 we were burning 14 million tonnes of oil. In 1984 we will burn less than 2 million tonnes", said Guilhamon. Coal burning has also fallen from 18 million tonnes to 11–12 million tonnes. "So we are now getting a very good return on our investment" at electricity prices at around 30 per cent below those of other countries in Europe.

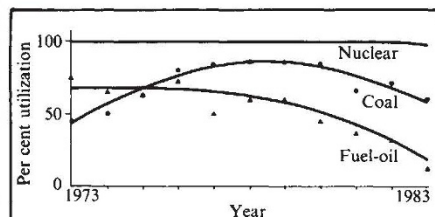
Guilhamon compared the whole French nuclear power programme, which by 1990 will amount to some 50,000 MW and spare France the purchase of some 50–60 million tonnes of oil, with the scale of British North Sea oil production.

Sir Walter Marshall, meanwhile, openly feared the loss of key British industries to

French soil, when in the 1990s French commercial electricity could cost only half the price of British power. Imperial Chemical Industries (Britain's biggest chemicals company) and British Steel might decamp to France, Marshall suggested.

Meanwhile, however, EDF does have a few problems caused by over-capacity and strong political pressure to burn French coal, and so keep the French miners happy. The surplus to traditional French markets will reach 50,000 million kWh in 1990, according to EDF, or around 15 per cent of total production. EDF will seek to place 20,000 million kWh in new markets it hopes to create in industry (for example, electricity to power boilers) and to export the other 30,000 million kWh. Certainly, at present French prices, electricity exports are increasing: 13,000 million kWh last year compared with 4,000 million kWh in 1982.

The pressure from coal, however, may be more difficult to withstand. Last week the government was attempting to arbitrate



Utilization of the average net operating power available from France's power stations. Coal and oil powered plants are used well below their capacity. The 100 per cent figure for nuclear power plants hides the loss in capacity due to structural defects and engineering problems.

between the French mining company Charbonnage de France (CdF) and EDF over a dispute in which CdF insists that EDF must buy fixed amounts of coal, or pay a fixed amount of money to CdF, for the next four years. EDF calculates this would cost it FF 2,500 million (£200 million) a year, essentially to support CdF. EDF does not wish to pay the bill (and since both companies are nationalized, the transfer of funds is somewhat notional); but it may have to.

Robert Walgate

● Meanwhile, accountants commissioned in 1982 by the then British energy secretary, Mr Nigel Lawson, to look into CEBG's pricing policy have argued forcefully that British electricity was not only over-priced (Sir Walter Marshall would agree with that — the government has set the price too high, he says) but ineptly priced (a comment less palatable at CEBG). The complex calculations by which the CEBG set its rate to bulk industrial customers are not based on sound economics, the accountants say. A proper pricing formula would result in cuts of 5–10 per cent followed by a few years' freeze. □