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## **Exporting Armageddon**

Saving the nuclear industry may cost the earth. The literal truth of this grim conclusion is at last beginning to dawn, even in the UK. The worldwide export of nuclear technology and materials, including not only nuclear reactors but also enrichment and reprocessing plants, enriched uranium and plutonium, is creating a spread of nuclear weapons capability that may soon be beyond any semblance of control. Within ten years the number of countries able to manufacture nuclear weapons will probably have passed two dozen, and will be growing rapidly. By 1990 the amount of plutonium produced in civil nuclear installations in developing countries alone will probably be enough to make more than ten atom bombs per day. The much-trumpeted 'safeguards' against misuse of civil nuclear technology are patently ineffectual, and growing more so. What impels the nuclear exporters to pursue a course of such suicidal irrationality? The stake, according to recent developments, is the survival of the world's nuclear industry. But the price may be unthinkably high.

The control of nuclear proliferation is becoming the most pressing issue on the international agenda. Unfortunately, however, current transactions in the nuclear market-place demonstrate that what prevails now in nuclear policy is not statesmanship but salesmanship. The US is proceeding with plans to sell reactors to Egypt and Israel; agreements were initialled on 4 and 5 August. Neither Egypt nor Israel is a party to the Non-Proliferation Treaty. On 6 August France signed a contract to build two nuclear power stations in South Africa, beating a joint bid from the US, West Germany and the Netherlands. South Africa is not a party to the NPT. On 4 August France announced an agreement to sell two nuclear power stations to South Korea. On 4 July West Germany signed contracts to build two nuclear power stations in Iran; France is in the running for two more, and the US for eight.

France is also considering supplying Iran with a reprocessing plant for the recovery of plutonium. France has also agreed to supply a reprocessing plant to Pakistan even though Pakistan is not a party to the NPT, and has only one small nuclear power station. On 8 August US Secretary of State Henry Kissinger failed to persuade Prime Minister Zulfikar Ali Bhutto of Pakistan to drop plans for the reprocessing plant. Earlier in the year the US had been able, by what was reported to be uncompromising arm-twisting, to persuade South Korea to drop plans to obtain a reprocessing plant from France. But the US had been unsuccessful in its objections to the landmark deal between West Germany and Brazil, involving not only eight reactors but also an enrichment plant and a reprocessing plant. Contracts for the first two reactors were signed on 22 July. Brazil is not a party to the NPT. In January 1976 Canada agreed to sell a second CANDU reactor to Argentina - not a party to the NPT - and one to South Korea. In March 1976 France announced that it had agreed to supply a reactor to Libya. When the France-Libya agreement was announced even case-hardened nuclear veterans blanched. On that evidence the headlong enthusiasm for nuclear exports had at last clearly overridden almost any imaginable criterion of caution.

Ironically, the upsurge of nuclear export activity coincides with the final public admission by nuclear experts that the manufacture of nuclear weapons is frankly not very difficult, given the necessary fissile material - plutonium or highly enriched uranium. Why, then, are the nuclear industry and exporter governments suddenly so committed to making widely available precisely the

missing ingredient which a prospective weapon-maker will require? The official government and industry response to this query is that they are moved by the desire to provide recipients with 'cheap nuclear electricity', the energy of the future, which will power the world when the oil runs out, will raise living standards in developing countries and will be an all-round boon to mankind. However, closer examination of the fine print reveals the desperate self-interest behind this altruistic posture. The truth of the matter is that the nuclear industry is in dire trouble, and that exports seem to be the only means available to keep the industry from coming unstuck at every seam.

Consider, as an admittedly egregious instance, the nuclear industry of the UK. The UK industry has not sold a reactor overseas for a dozen years, but it is mounting a renewed effort to make a place for itself on the export bandwagon. Sir John Hill, chairman of the UK Atomic Energy Authority, made this clear in his recent report to Tony Benn, Secretary of State for Energy. The report, published on 6 August, declared that the UK nuclear industry faces a real danger of collapse unless a minimum programme of domestic orders for nuclear power stations are backed by a 'vigorous export policy'. Sir John's deputy chairman, Dr Walter Marshall, who is also Mr Benn's chief scientist at the Department of Energy, made a similar assertion at a nuclear industry conference in London on 8 July.

To be sure, the UK nuclear industry is in a parlous state; so with all its woes it cannot be blamed for looking with longing at the burgeoning international trade in civil nuclear technology. But the international trade is burgeoning precisely because the UK industry is by no means alone in its doldrums. On the contrary, UK circumstances are only a somewhat extreme example of the domestic malaise affecting nuclear industry everywhere. Even the mighty US industry, led by Westinghouse and US General Electric, is finding it difficult to cope with the mounting disillusion of US utilities about nuclear electricity. In 1975, after earlier boom years, Westinghouse won only four domestic orders for new nuclear power stations, GE only one; neither Babcock & Wilcox nor Combustion Engineering won a single order.

Thirteen stations already ordered were deferred for up to four years, and another six indefinitely; eight were cancelled outright. Four of the eight cancellations and two of the indefinite deferrals left the order book of the Shell-Gulf joint venture General Atomic completely empty. In November 1975 General Atomic announced that it was withdrawing from the nuclear power business. In San Francisco GA's vice-president, Richard McCormack, told the annual joint conference of the American Nuclear Society and the Atomic Industrial Forum why: 'Front-line vendors (of nuclear stations) to the electric utility industry have yet to make a dollar with certainty, after some twenty years of effort.'

Elsewhere the picture is not much brighter. In Canada, at the end of 1975, Ontario Hydro, the major customer for the CANDU reactors of Atomic Energy of Canada Ltd, cut \$5,200m from its expansion plans for the coming decade. Three new nuclear stations, a total of 12 CANDUs, are to be postponed, as is another station also expected to be nuclear. One heavy-water plant will be delayed and another probably cancelled outright. In France the general manager of Electricite de France, Marcel Boiteux, wrote in early August to the French government Industry Minister, Michel d'Ornano, warning that budget cuts proposed by the Finance Minister will delay EdF's nuclear power programme. After the French nuclear euphoria of 1974 more realistic estimates of available capital and future demand for electricity have led to progressive reduction of the headlong commitment initially undertaken. Framatome, the French manufacturer of nuclear power stations, has seen 1,000 megawatts per year lopped off the plans, representing a reduction of up to 20 per cent from the original programme.

In West Germany the major manufacturer of nuclear power stations, Kraftwerk Union, is still hovering on the verge of a split, as a result of losses sustained on its nuclear contracts. KWU is a

joint venture of Siemens and AEG-Telefunken, and AEG have for some time been deeply unhappy about the deficits run up by KWU every year since its formation. KWU's latest annual report, published in July, recorded a loss of DM 47m for KWU and its daughter companies; in earlier years the losses were even higher, running well into the hundreds of millions of deutschmarks.

Presenting the annual report, KWU chairman Klaus Barthelt stressed the importance of export orders for KWU's future. In so doing he echoed the sentiments of his colleagues in nuclear industries everywhere. But he failed to specify just how export orders are becoming essential to the finances of the nuclear industry. In general the role of exports in nuclear finances - and that of finance in nuclear exports - has hitherto received far less attention than it deserves. The interrelation between exports and finances may hold the key to the only credible policy for control of nuclear weapons proliferation.

Nuclear finances have long been a grey area. It is impossible to identify with any degree of completeness even the quantifiable costs attributable to a unit of nuclear electricity. The cost of research and development of the technology has always been borne largely by government, initially through weapons programmes and now by government research agencies. Fuel cycle services - uranium exploration, mining and milling, enrichment, reprocessing, radioactive waste management and transport - have hitherto been covered to an undefined but substantial extent by military budgets, leaving the expected cost of new civil facilities at this stage largely guesswork. Regulatory bodies are of course government-funded; in the nuclear field their responsibilities are considerable, and the resources allocated to them are proportionally high.

Insurance for civil nuclear activities is on a different basis from that for other energy industries; for nuclear insurance, third-party liability limits and government guarantees are laid down by statute, whereas competing industries must make their own provisions for insurance from their own funds. Compounding these uncertainties is a rapid and erratic escalation in the capital cost of nuclear power stations themselves, at a rate presently well above that of general inflation. Accordingly, any claim about the eventual cost of a unit of nuclear energy, especially on a comparative basis, must be regarded with profound scepticism.

A nuclear export receives yet another form of government subsidy - which may now be the most essential of all. Each nuclear exporting government has an export credit agency which is invariably involved in financing the country's nuclear exports, on terms more attractive than those available in commercial money markets: loan guarantees, low interest loans, deferred payment and similar provisions. The implications are noted in a scathing critique of the commercial, economic and security aspects of nuclear exports, prepared for the US Energy Research and Development Administration by Barber Associates. The Barber report, ERDA-52, discloses that, as from December 1974, all the Western nuclear exporters were offering enticing financing; France was prepared to provide up to 100 per cent of the capital for a nuclear export at a rate as low as 6.3 per cent over 15 years. On that basis the recent French success in contracts with South Africa and South Korea is understandable. Curiously enough, however, with the exception of one involvement in Italy many years ago, the World Bank has never taken part in a nuclear loan. Nuclear facilities do not meet its criteria for economically sound investment.

These considerations clarify the essential role of exports in the finances of the nuclear industry. The pattern is closely akin to that of the traditional arms trade. A nuclear supplier finds an overseas customer. The supplier's government advances the customer a loan on favourable terms to make the nuclear export sale possible. The proceeds from this loan, of course, go through the hands of the overseas customer into those of the domestic nuclear supplier. In effect, the overseas customer is a conduit through which the exporting government passes funds from its domestic taxpayers to its domestic nuclear industry - a subsidy without which the industry may be unable to survive.

The practice has a long pedigree, dating from the first 'Atoms for Peace' programme initiated by US President Dwight Eisenhower in 1954. The US government and the US Atomic Energy Commission were determined to establish civil nuclear technology on an industrial basis, despite its lack of economic appeal. Abundant US reserves of coal, oil and gas made it unlikely that nuclear power could compete in the US; only sweeping government financing, coupled with thinly veiled threats to electrical utilities, at length made it possible to launch the domestic Power Reactor Demonstration Programme. But US interests were convinced that there would eventually be a sizeable overseas market for civil nuclear technology, and every effort was made to establish this market. Enriched uranium was made available at knockdown prices; technical information was provided which eventually prompted the emergence of major European nuclear industries, at first using US nuclear technology under licence, and later becoming full-fledged and aggressive competitors to the US industry. The US also instigated the establishment of the International Atomic Energy Agency, to promote the cause of 'Atoms for Peace', and encourage the development of civil nuclear activities all over the world. Its current budget totals some \$36m; of this sum \$30m is earmarked for promotional activities, and only \$6m for safeguards. In early 1976 Dr Rudolf Rometsch, IAEA inspector-general of safeguards, had a professional staff of just 75, of whom only 44 were field agents. It does not seem a safeguard commensurate with the threat.

Comparatively few people, however, took the matter of misuse of civil nuclear technology very seriously until 18 May 1974. On that date, in the Rajasthan desert, India detonated a nuclear device, made with plutonium manufactured in a research reactor provided by Canada in 1956 and using heavy water from the US. The explosion shook many people a long way from Rajasthan. However, rather than suspending nuclear exports, the nuclear supplier countries instead disappeared behind closed doors for highly confidential discussions about how to minimise weapons proliferation without actually interfering with their export activities. Initially these discussions included seven participants: the US, the USSR, the UK, France, West Germany, Canada and Japan. The nuclear press dubbed them the 'Secret Seven'. More formally known as the Nuclear Suppliers' Group, the exporters have now held several meetings in London. The matter of their deliberations has been shrouded in quasi-military secrecy; only the most platitudinous generalities have emerged.

It is believed that the main concern of the Suppliers' Group - to whose ranks have now been added Sweden, Belgium, the Netherlands, Italy, East Germany and Poland - is to agree on guidelines to prevent competing exporters from undercutting each other on contract details concerning safeguards. In every recent export transaction the exporting country has claimed to have insisted on safeguards provisions yet more stringent than any other. Most recent of these one-upping pronouncements was from the US State Department: the Washington newsletter *Energy Daily* for 9 August quotes a US official to the effect that safeguards provisions in the agreements with Egypt and Israel are 'the most stringent ever incorporated in any nuclear power document'. However, a discomfiting corollary to such assertions is the implication that safeguards provisions in earlier agreements are significantly less stringent.

Such is indeed proving to be the case. After two years of bitter soul-searching Canada failed to persuade India to accept more stringent safeguards. In May 1976 the Canadian Government announced that it was withdrawing further nuclear assistance from India - the first time an exporting country has been prepared to accept the economic consequences of refusing to make nuclear exports. In the US, however, controversy flared over plans to ship some 20 tonnes of enriched uranium reload fuel to the Indian nuclear station at Tarapur, in 1962 the first US nuclear export to a developing country. A landmark hearing on the Tarapur fuel export took place before the US Nuclear Regulatory Commission on 20-21 July. The Commission's ruling, expected by the end of this month, will mark a fundamental redefinition of US nuclear policy.

Recent US statements have made it possible to anticipate the tenor of the new policy. What US officials most fear is the accumulation of separated plutonium in non-weapons countries. Accordingly, their present pressure is directed toward prevention of the establishment of plutonium recovery - that is, reprocessing - in these countries. Outline agreement with Iran, for example, has been achieved, according to which Iran will reprocess only under international auspices, or will ship used US reactor fuel back to the US for subsequent management. A similar agreement is being sought with India regarding fuel for Tarapur. (India, it should be noted, has nearly completed a reprocessing plant at Tarapur.)

UK opinion shows signs of favouring a similar approach: reprocessing at Windscale rather than in the customer country. After a brief and unenlightening flurry of discussion in early 1976 the UK Government gave British Nuclear Fuels Ltd the go-ahead to offer reprocessing and plutonium recovery services to overseas customers. A proposed contract for BNFL to reprocess 4,000 tonnes of Japanese nuclear fuel remains unsigned; but the stumbling block seems to be mainly money, rather than such significant details as the eventual future of the 40 tonnes of plutonium which would be recovered. Present UK plans for such overseas reprocessing simply entail returning the recovered plutonium to the customer country, a procedure which hardly satisfies criteria for proliferation control.

In any case, such measures as international reprocessing beg the essential question: is it worth it? Quite apart from the many technical and political roadblocks impeding such arrangements, there remains the probability that even on its own terms nuclear electricity is not, and will never be, an economic way to supply energy, even to industrialised countries. Certainly - as the Barber report makes clear - nuclear electricity is supremely irrelevant to developing countries, except as a form of technological colonisation which will make them permanently dependent on supplier countries. It can therefore be argued that civil nuclear technology has been an aberration: well-meant, initially promising, but ultimately too difficult, too expensive and too dangerous a course to follow.

The UK, which can fairly claim to have led the world into the nuclear age, now has a unique opportunity for leadership in a fresh direction. Clearly the process must be gradual; but it must be begun. The Government should think again about plans to expand the floundering UK nuclear industry. The resources thus earmarked should be reallocated in other directions offering more employment, more efficient use of indigenous resources and more promise for export: advanced coal technology (in which the UK is a world leader), solar heating and cooling, heat pump technology - the list could be extended indefinitely.

Rather than planning to expand, the UK nuclear industry should plan to contract, over a period of years; past activities have already left a legacy of sufficient problems to keep the industry busy through a lengthy programme of phasing out. Reprocessing and separation of plutonium from oxide fuel is not presently being carried out; it should not be restarted. Instead, work should be undertaken to determine the optimum method of long-term management of the existing stocks of used oxide fuel, with its plutonium content, of existing stocks of separated plutonium, and of the 700 cubic metres of high-level radioactive waste now stored at Windscale. Needless to say, any proposal to build a full-size plutonium fuelled fast breeder reactor should be shelved. Existing nuclear power stations will require reload fuel and maintenance throughout their operating lives, and Magnox fuel - which deteriorates in water storage - will probably require reprocessing; there will not, therefore, be any rapid loss of employment from existing nuclear facilities.

In any case, redirection of emphasis away from nuclear electricity - one of the most capital-intensive of all industrial activities - will enhance rather than detract from employment. With such a fundamental shift in its domestic energy policy, the UK will then be able to move into the world market for energy technology, offering a credible alternative to nuclear exports. If favourable

financing can be offered for nuclear exports, it can also be offered for non-nuclear alternatives - with more economic justification.

It could happen - particularly if UK policy-makers take seriously the responsibility which their present opportunity offers. On past performance, however, the prospects do not look very propitious. The momentum of the international nuclear juggernaut may already be impossible to overcome. On 19 January 1976 the US Senate's Government Operations Committee heard testimony from David Lilienthal, who from 1946 to 1950 was the first chairman of the US Atomic Energy Commission. Mr Lilienthal did not mince words:

*The tragic fact is that the atomic arms race is today proceeding at a more furious and more insane pace than ever. Proliferation of capabilities to produce nuclear weapons of mass destruction is reaching terrifying proportions. We have to decide now what we can do, now, within our own capabilities, to prevent a very bad situation from becoming a disastrous and inevitable one. I therefore propose as a private citizen that this Committee, with its great prestige, call upon the Congress and the President to order a complete embargo to the export of all nuclear devices and all nuclear material, that it be done now and done unilaterally.*

*If a great number of countries come to have an arsenal of nuclear weapons, then I'm glad I'm not a young man, and I'm sorry for my grandchildren.*

It is a bleak and chilling epitaph for the 'peaceful atom'.