SCRAM

The Safe Energy Journal

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Decommissioning - The Beginning of the End ... The End of the Beginning ?

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COMMENT

The abandoning of fast reactor research has major implications for the rest of the UK nuclear industry. As Andrew Holmes pointed out in SCRAM 66, "what conceivable purpose is there in reprocessing nuclear waste if there is no prospect of using plutonium for electricity production?" If there is an economic reason for reprocessing then why aren't the Americans doing it? There hasn't been a military reason for reprocessing since the 1970s, according to Peter Taylor, so why bother to keep open the world's most polluting nuclear plant?

The first casualty of the fast reactor decision is likely to be the plutonium fuel fabrication plant at Sellafield. The Prototype Fast Reactor will require, at most, one more re-load core, much of which is almost certainly to hand.

It is well known that Japan have put up one third of the capital for the Thermal Oxide Reprocessing Plant under construction at Sellafield, and have been delivering spent fuel there since 1979. What is not so well known, is that British Nuclear Fuels may, if they so wish, return the fuel to Japan intact and unreprocessed, without repaying any of the Japanese capital.

No matter how lucrative the Japanese contract might be for BNF, THORP is also dependent on the British electricity boards. The CEGB have long been dubious about the economics of reprocessing - they took almost ten years to negotiate the current contract for AGR spent fuel - and they, together with the DoE are investigating dry storage and direct disposal of spent fuel as an alternative. Companies like GEC Energy Systems have been insisting for years that dry storage of spent fuel is cheaper, easier and safer than reprocessing, and keeps all options open until the problem of disposal is resolved.

The cost of THORP has risen by nearly 60% in real terms since 1978, and reprocessing charges to customers by more than 100% in the same period. So potential shareholders of 'Big G' will be keen to discover the details of the contract which the CEGB have agreed with BNF. If there is an escape clause 'Big G' may well wish to reappraise their whole involvement in THORP.

BNF say they have every confidence in THORP and have just announced a 1,000 tonne increase in throughput estimates for its first ten years of operation commencing in 1993. The extra capacity is being offered to BNF's existing customers. But with Japan building their own reprocessing plant due to come on line in the early 1990s, and other customers such as Sweden and Spain now opting for long-term dry storage, the whole future of THORP must be open to considerable doubt.

Dounreay in the Balance

Following the Government's decision to cut funding for fast reactor research, MIKE TOWNSLEY looks at the future for the UKAEA's Dounreay outpost, and asks what are the economic alternatives to nuclear domination of Caithness.

The battle lines appear drawn over Caithness, with the pro and anti nuclear lobbys locked in bitter conflict; it is time to reflect on their common purpose: the economic salvation of Caithness.

Many of the problems facing Caithness stem from the decision, in the early 1950s, to construct the experimental fast reactor at Dounreay. The distant site was chosen because the "remote possibility of an explosion" would have less effect on the dispersed population: "In view of this risk it is undesirable that the factory should be located within some miles of any town, and it should be at a considerable distance from a large town," proposed the Atomic Energy Division of the Ministry of Supply in October 1953.

Because of the remoteness of Dounreay "it will be necessary to import the skilled artisans and professional staff," the memorandum continued. It is clear that many people moved into Caithness because of Dounreay, changing the local economy from one of agriculture and fishing to an industrial one. The reversal of this trend, emigration of skilled and professional staff, will seriously disrupt the present economy, but could leave the county with facilities on which to base a new beginning.

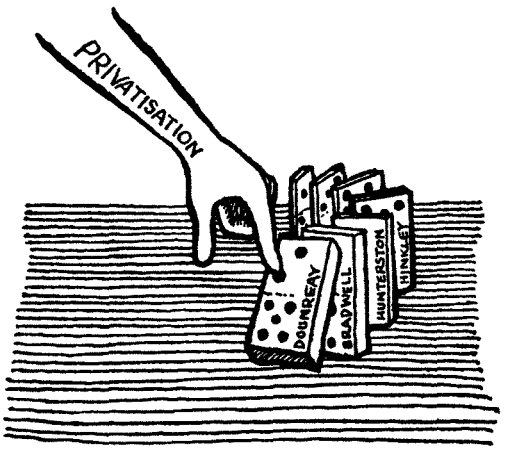
The Highlands and Islands Development Board (HIDB) have said that the run-down of Dounreay - a loss of 300 jobs in the next 3 years, with a further loss of 200-300 jobs in the next 3 years - "will have a significantly bigger impact" than the closing of the Invergordon smelter in late 1981, "in terms of the number of people affected and in proportion to the size of the population." Eventually three quarters of the plant's 2,100 staff will be shed.

The HIDB Chair will sit on a joint liaison committee, with representatives of Highland Regional Council and Caithness District Council, to discuss ways to minimise effects of the run-down, and examine future employment schemes for the area.

PRO-LOBBY WANT THE DECISION REVERSED

However, Caithness District Councillor Allan Byron, a Dounreay worker, is one of many who believe the only solution is the unlikely reversal of the decision: "I am concerned that the HIDB are only going forward with the alternatives. There is a strong argument for going on with the Prototype Fast Reactor programme."

Others look at the decision in a wider context. Dounreay Director, Gerry Jordon, told a packed meeting in Thurso that, "Vitally important though the local aspects are, they are not so important as the future national and international effects that would flow from a lack of resolve in this country to remain in the forefront of fast breeder technology."



Caithness Chamber of Commerce don't agree: "every job at Dounreay supports another somewhere else in the County. If many of (those who lose their jobs) leave for the South it could have a disastrous effect on house prices and on the viability of many local businesses ... We have had the nuclear dream for 25 years now and we are now getting a rude awakening. We must make sure that Dounreay, and the county for that matter, never has to depend so greatly on a single programme in future."

For the Government, Scottish Secretary Malcolm Rifkind "accepts a responsibility to ensure the long term prosperity of Caithness and will help to identify new sources of employment to replace those that will be lost by the gradual run-down of Dounreay ... we will now be exploring with the HIDB, the local authorities, and local business community, how to diversify the economy." But this is something that should have been done long ago.

ANTI-LOBBY WANT RENEWABLES CENTRE

The anti nuclear lobby are promoting the establishment of a renewable energy research centre, using some of the existing plant and workforce. There are several factors to favour this idea.

The Energy Technology Support Unit, the body responsible for alternative energy research and development under the control of the UKAEA, have drawn many of their staff from the ranks of the nuclear industry. This has been the source of considerable controversy, but could be turned into a positive factor in this respect, provided adequate funding and political will is applied.

The wave and wind regime of northern Scotland are particularly suitable for exploitation, and would provide an excellent opportunity for research and development. It has been suggested that one of the two wind farms the Government may establish in Scotland, as part of their wind energy demonstration programme, could be attracted to Caithness.

This is unsubstantiated, but does have a certain poetic justice: the area which has been at the mercy of the nuclear industry for over three decades could form the core of a development leading to the industry's downfall. Now is the time for a feasibility study.

However, as the Chamber of Commerce observe, the future success of the Caithness economy depends on diversification and not on a single programme.

Caithness without the fast reactor may face problems, but the its presence poses a far greater threat for Caithness and indeed northern Europe. The right decision has been made, for the wrong reasons: Caithness deserves a future free of the Atomic Menace.

Nuclear Accounts

The accounts of the Electricity Council reveal the extent of the nuclear establishment's self-delusion. Only one year ago, the industry over-estimated the contribution of their nuclear power stations by 25%.

Their excuse for the nuclear failure: it was all due to those AGRs, but now we are moving to a new generation of PWRs so everything will be all right.

But how, only one year ago, could Lord Marshall and the other nuclear genii be so wrong?

The report records that the nuclear contribution was 32.9 Terrawatt-hours (thousand billion units). What it fails to mention is that last year the CEGB forecast the nuclear contribution would be 44TWh - they were 11.1 thousand billion units wrong! They could not - and still cannot - bring themselves to recognise the nuclear disaster enveloping the industry.

The accounts were presented to the public in a way which suggested that prices must be increased. Profits were, alas, down from £1,165 million in 1987 to £865 million.

What the press reports mainly ignored is that the industry actually repaid to the Government £1,261 million of their borrowing and they had enough money to spare to fund the entire investment programme of more than £1 billion.

This last item is particularly important. The Government are trying half-heartedly to pretend that the increase in electricity charges of 8% - which began this April and is not included in the latest accounts - is intended to finance the building of future power stations (as well as to increase profits.)

But the industry have shown that they are capable of financing the building of such projects as Sizewell B out of current revenue even without the latest tariff increase. And there is another increase, of around the same amount, due next April.

On the figures given last month, the industry are producing £2,261 million a year in excess of need, even before this April's increase; and with another increase next April, they will be swimming in money.

The truth is that the increases are designed to add to the profits of the shareholders after privatisation and are unnecessary.

Nuclear Waste Report

The Association of District Councils (England and Wales) Working Party on Nuclear Issues has come out in favour of a single deep disposal site for nuclear waste. Although an offshore repository is not supported because of the risks and costs involved, a deep vault on land or under the seabed accessed from land are both considered "acceptable."

The Working Party consulted Nirex, but there is no evidence that they consulted anybody else. Consequently the report's section on nuclear waste reads rather like a Nirex handout:

". . . there is a recognised need, reflected in Government policy, to establish permanent safe disposal facilities, which will remove from future generations any burden of management of current accumulations and future arisings of such waste."

The Working Party do, however, make a number of other recommendations. These include the lowering of the 'action level' for radon in houses; the establishment of a local authorities Radiation and Radioactivity Monitoring Advice and Collation Centre (SCRAM 66); and that spent fuel rods in transit to Sellafield should not be parked overnight, particularly in urban areas.

US Nuke Costs

Escalating operating and maintenance costs are threatening to erode any cost advantage that operating nuclear power stations may have, according to the US Department of Energy's Energy Information Administration.

Furthermore, those who assume that nuclear power plants may operate for 40 years may be overoptimistic. If operating costs continue to escalate, it may become economical to close plants much earlier. According to the DoE, operating and maintenance costs, and large post-operational capital expenditure, escalated at about 12% and 17% respectively, between 1974 and 1984.

A Little Bit of Glasnost

Photo: Frances McGlinchey

A 5000-strong anti-nuclear demonstration took place in Vilnius, Lithuania on 15 July.

Since Chernobyl a strong anti-nuclear movement has developed which has succeeded in influencing the authorities to an extent. The demonstration was to oppose a four-reactor nuclear plant by the side of a beautiful lake, heavily used for recreational purposes, including fishing.

The fourth unit has been cancelled, the third has been mothballed. But the pressure is still on. The placards read: "1 atomic energy unit, 2 atomic energy units, 3 atomic energy units - the end!" and "Atomic Energy Stations: Sweden knows, Lithuania doesn't!"

Monitoring

Low-flying aircraft to detect gamma radiation are being used by the Scottish Universities Research and Reactor Centre at East Kilbride to carry out an airborne radiation survey of 47,000 hectares in Cumbria.

The survey was commissioned by the Ministry of Agriculture, despite an earlier similar application to the Department of Environment being turned down. They expect to be asked to carry out similar surveys in Scotland and Wales. (SCRAM 65)

In his evidence to the Agriculture Select Committee, Professor Murdoch Baxter, the Centre's Director, said that "The emergency response after Chernobyl, and the future plans typified thus far in the RIMNET system, are based on technically outmoded and primitive methods which are unsuited to the UK's topography and are inconsistent with the necessary timescale for response."

"The solution," he said "involves airborne radiation monitoring to cover the country quickly, identify fallout 'hot spots' within days and provide Ministers, scientists and the public with accurate, easily understandable, coloured radiation maps on a short timescale appropriate to efficient emergency planning and to maintenance of public confidence."

The Committee appear to have taken this on board, and recommended that a feasibility study be undertaken to explore possible advances in this field.

Wylfa Campaign

Following the CEGB's announcement that they will be seeking planning permission to build a third PWR at Wylfa on Anglesey, currently the site of Britain's largest (1310 MW) and youngest Magnox reactor, which started operation in 1971, a new group, People Against Wylfa B has been set up.

Gwynedd County Council are taking a very critical attitude and are seeking advice from Somerset County Council and other sources to mount an effective campaign against the proposal.

CONTACT: People Against Wylfa B, Sloned Huws, 10 Tan y Bonc, Menai Bridge, Anglesey, Gwynedd.

Magnox Malady: Hunterston

Two out three fuel charge machines at the SSEB's Hunterston A magnox station in Ayrshire are currently out of service because of doubts over the quality of their welds. The machines are used to insert fresh fuel rods into the top of the two reactors; spent fuel is discharged from the bottom - this system is unique to Hunterston.

The reactors are designed to be refuelled while they are running, and at pressure. However, because the charge machine essentially becomes part of the pressure vessel during this operation, any failure of one of the welds could have the same effect as a leak from the reactor itself: part, or all of the 200 tonnes of radioactive carbon dioxide coolant could be released.

Hunterston A first generated electricity in February 1964, and is the third oldest commercial magnox station in Britain. The NII's long term safety review on Hunterston is due to be published later this year.

The safety reviews of Bradwell and Berkeley so far published both mentioned refuelling operations. Bradwell's charge machine welds were thought to be suspect, and the CEGB were required to undertake tests of components before continued extended operation would be allowed; Berkeley has recently been operating an off-load refuelling regime which the NII would not like to see reversed before a comprehensive safety case has been drawn up. The CEGB have decided to shut Berkeley rather than commit the added expenditure.

If Hunterston A is to remain in service the reactors will have to be shut down for refuelling. This could cost £500,000 a month if both reactors are refuelled on a monthly basis, according to nuclear engineer John Large. Moreover, testing the welds and repairing them where necessary, will also attract lost revenue costs as well as the repair bill.

The SSEB refuse to comment on Large's estimate, but engineers have said off the record that running the reactors in an off-load refuelling regime will make them totally uneconomic.

It is possible that SSEB policy makers are coming to the same conclusion as the CEGB did over Berkeley. Because of the 100+% overcapacity, now they have Torness on stream, the SSEB are in a more 'fortunate' position than the CEGB: the loss of Hunterston A will present no problem, only an embarrassment at having to burn more Scottish coal.

Plutonium Transport

Over 150 people crowded into Prestwick Community Centre on 18 August to tell Mr McLaughlan, BNFL's transportation director, exactly what they thought of plans to use Prestwick airport to fly recovered plutonium to Japan.

The meeting was organised by John Baillie, Strathclyde Regional councillor for the area, following widespread public opposition to the plans.

The major concern for the people of Ayrshire was the road transport to the airport. The question was posed: "Why not Manchester?" Mr McLaughlan explained that there was only 5 miles difference in distance between Sellafield and Prestwick, and Prestwick is closer to Japan. This was greeted with howls of laughter: "Manchester may be further away, but it is 3 hours travelling time closer than Prestwick."

Several speakers emphasised that the roads in south Ayrshire were among the worst in Britain, and that this may require their closure each time the transports travelled north.

Mr McLaughlan also claimed that plutonium will not be stored at the airport: the operation will be organised so that the material will not leave Sellafield unless it could be loaded onto the aircraft and depart the same day.

However, because the US authorities are reluctant to allow more than 7kg of plutonium to each flask, and upwards of 100kg will be returned to Japan on each flight, it is difficult to imagine what road transport vehicle would be available to carry 14 flasks each weighing 8 tonnes on a regular basis.

All Parties represented at a meeting of Kyle and Carrick District Council's Environmental Services Committee, held the morning before the public meeting, expressed their full support for the campaign against the plans. But Mr McLaughlan implied that if Prestwick was the most suitable choice, then local opposition will be ignored.

Double Standards

The Advertising Standards Authority (ASA) recently failed to uphold complaints made by BNFL about two advertisements which Greenpeace ran after the imprisonment of Hans Guyt for attempting to block the Sellafield pipeline.

However, the ASA did criticise Greenpeace and felt that they had been unwise to rely on one scientific source to support allegations of fatalities associated with BNFL operations. Greenpeace, however, are quite at liberty to run the adverts again if they so wish.

This was despite the fact that the figure used - 115 lives which might be lost as a result of operations at Sellafield - was taken from the Biological Effects of Ionising Radiation Committee Report (BEIR), the only internationally recognised committee which publishes such risk estimates. The ASA said that such figures should be "accompanied by all appropriate caveats about the tentative nature of such conclusions."

Owen Dumpleton of Tyneside Anti-Nuclear Campaign writes:

"A recent advertisement for BNFL states without any caveat that 'Storage of highly active nuclear waste in liquid form has been a safe option for 30 years' and that 'Vitrification represents an even safer development.'

"Those who think that the safest development would be to stop generating nuclear waste altogether should now write to the ASA on every possible occasion objecting to questionable claims by the nuclear industry and to urge that they be accompanied by all appropriate caveats."

"My own experience with the ASA left me feeling that they had a strong bias in favour of establishment bodies but at least they will count the number of letters received. So if enough people complain there will be a good chance that at least unofficially a few words may be passed to the nuclear power and electricity industries to tone things down a bit plus a rather more tolerant attitude to Greenpeace in the future."

The address of the ASA is Brook House, Torrington Place, London, WC1E 7HN.

Nuclear Waste Policy

Despite being "heavily loaded in favour of the nuclear industry," according to FoE and Greenpeace, the Radioactive Waste Management Advisory Committee (RWMAC) occasionally reach some surprisingly damning conclusions on Government nuclear waste policy.

This year's Annual Report is no exception. "There remain a significant number of issues on which policy remains disappointingly confused or deficient," says the report, pointing to "deficiencies in strategic planning" and "the severe limitation upon resources for the radiochemical inspectorate arm of Her Majesty's Inspectorate of Pollution (HMIP)."

RWMAC are not convinced that Nirex will have their deep disposal site in place by 2005 as planned, and they express short-term worries about the disposal capacity at Dounreay and Drigg. They are also concerned about the doubt surrounding the disposal route for large scale decommissioning items, but recommend the sea disposal of decommissioned submarines.

BNFL have in hand a major capital investment programme to make substantial changes in methods of operation at Drigg. The old trench system will be replaced by engineered vaults; waste will be compacted in secondary containers; the trenches will be capped against rainwater infiltration; there will be groundwater cut-off walls and improved drainage and leachate monitoring.

All this means that Drigg's capacity will be reduced, and the area which currently has planning permission - about one third of the Drigg site - will be full by about 1999. Should further vaults be required then planning permission and new authorisations would be necessary.

RWMAC also report that the generating boards and DoE are still looking at dry storage and direct disposal of AGR spent fuel as an alternative to reprocessing, although this route has been rejected on economic grounds for magnox spent fuel.

RWMAC were asked by DoE to examine whether the ion-exchange facility at the Dungeness Magnox Dissolution Plant (SCRAM 65) should be operated on a regular basis to virtually eliminate radioactivity from the effluent. At a cost of £0.7m, they decided this would have "very limited cost effectiveness in terms of cost per life saved."

The committee also look at research by OECD's Nuclear Energy Agency into the feasibility of seabed disposal of high level waste. Research has confirmed its feasibility and the existence of potentially suitable sites in the deep ocean. The radiological consequences they say are "likely to be extremely small."

Drilling has started at Nevada's Yucca Mountain to test the rock's suitability to become the nation's high level waste dump. The Investigation will cost $1 bn and last 5 years. (SCRAM 64).

The Tory dominated Energy Select Committee are extremely critical of the "frighteningly tight timetable" that the Government have adopted for privatisation of the electricity industry. They believe it "runs the risk of producing ill-considered, spatchcock legislation."

They lament the lack of information on a range of unresolved issues, and are particularly concerned about the Government's plans for only 'light' regulation of the privatised industries.

Colin Robinson and Allen Sykes, authors of several pamphlets for the right wing Centre for Policy Studies told the MPs that "under the present regime the Government does at least have some control over pricing; with a poorly-regulated duopoly, we would expect prices to be higher than under continued nationalisation."

Donald Miller, chairman of the SSEB, fails to understand how the two Scottish Utilities can be required to co-operate in the running of the nuclear company, which will produce 60% of Scotland's electricity, and at the same time compete with each other to provide the rest. "To our knowledge," he said, this "has no precedent anywhere in the world."

The Committee concluded that yardstick competition between the two Scottish Utilities would be "largely meaningless" - they could not understand why vertical integration was acceptable in Scotland, but not in England and Wales. They want to see a separate Scottish Regulator, who would help to ensure that Scottish consumers did not subsidise exports of surplus electricity across the Border.

NUCLEAR CRITICISM

Some of their most scathing remarks are reserved for nuclear power: "the Committee is strongly of the view that the nuclear pre-occupations of the Government have played a dominant part in its thinking, so much so that the nuclear tail seems to be wagging the ESI dog." For example, the Government dismissed the idea of splitting the CEGB into 5 companies, because it would not assist the safe and efficient management of nuclear plant. Yet, if it were, each company would be twice the size of the SSEB.

The Government have advanced only two reasons why nuclear power should be protected by requiring the distribution companies to purchase around 20% of their supplies from non-fossil sources. One is the need for diversity of supply, and the other is that they have a manifesto commitment to support the industry.

The Committee point out that there are many ways of maintaining a diversity of supply without going down the nuclear road - the AGR has been such a disaster that nuclear power is not so secure anyway. They are also "worried about the costs of nuclear power" and want the full costs of the nuclear option to be exposed. They find it difficult to reconcile the "bunkering of the nuclear industry with the best interests of the consumer," and they recommend that a limit of around 10 years is placed on the 'non-fossil' rule.

EFFECTS ON COAL

On coal the MPs confirm that most producers for the international market are barely covering their costs and express their wish that the threat of imports is used only as an incentive to British Coal to improve its performance rather than any increased actual dependence on imports. "One of the most disturbing aspects of the Government's privatisation proposals" says the report "is the uneven treatment it has given to the coal and nuclear industries." As a result the economy could be unnecessarily damaged.

The MPs hope privatisation will remove the difference between project appraisal rates in the private and public sectors, thus helping new generators enter the market. The Association of Independent Electricity Producers are pessimistic: "there is no indication at the present moment that there is going to be any increase in independent generation in significant terms." If the Government decide to sell off the ESI at a discount, it will still enjoy an unfair advantage, so the MPs recommend that a specified 'floor level' be set to stop the new utilities gaining the assets too cheaply.

The MPs hope that the regulatory regime will benfit environmentally benign technologies, and that both CHP and energy efficiency are considered as ways of meeting the 20% non-fossil requirement.

MONEY DOWN THE DRAIN

It is gratifying to note that recent SCRAM contributors made a considerable impact on the Committee's conclusions. They agree with Andrew Holmes that we should ensure that "efficiency of electricity use is placed on the agenda and kept there," and with Andrew Warren who wants the distribution companies and the Scottish utilities to be obliged to consider energy efficiency investments as an alternative to new supply. They want the Regulator to make sure this happens: "We disagree with those who characterise the powers of US Public Utilities Commissions as draconian in this respect."

David Olivier et al are quoted: "to allow the new ESI to continue to buy new central power stations, even when they cost up to an order of magnitude more than energy efficiency measures, is the national equivalent of every person in the UK throwing away approximately £200 per year for the next 40 years."

Whilst the Committee sympathise with the Government's overall objective of improving the efficiency of the ESI, it will depend mostly on how the industry is regulated. The MPs regret the "misty outline." They say its impossible to decide whether privatisation will make electricity cheaper or more expensive, and conclude "that the structure proposed, and the light regulation of generation hinted at ... are incompatible if consumers' interests are to be safeguarded."

The CEGB have decided how the assets will be split between the three successor companies. The Board will be divided into three shadow organisations from January 1989. The timetable has been charted as follows:

Nov/Dec 1988 - Introduction of a single parliamentary Bill for England, Scotland & Wales
July/Oct 1989 - Bill becomes law
First half of 1990 - flotation of 12 Area Boards
Autumn 1990 - flotation of 'Big G'
Spring 1991 - flotation of 'Little G'

The timing of the flotation of the Scottish Boards has not yet been decided, but it is intended they should be floated simultaneously.

Catalogue of Blunders

Readers of SCRAM 66 will be aware of MAFF's sheer incompetence over the handling of Chernobyl fallout in the UK. PATRICK GREEN reviews the House of Commons Agriculture Committee report on the episode, which finally accepted those claims as 'official'; and KATIE SAMPSON assesses the research into modelling of caesium movement in soils.

The Agriculture Committe's report, although couched in moderate language, is a total vindication of the claims made by Friends of the Earth and other environmental groups over the last two years. It clearly describes how the Government's response was a catalogue of blunders from when the news of the accident first reached the West.

Firstly, there is a clear acknowledgement that the UK **did not** have any contingency plans for an accident of this nature. The level of communication between government departments was extremely poor, and "an authoritative central voice was lacking." When the fallout cloud did reach the UK, Ministers failed to keep the public properly informed about the likely hazards from fallout.

SCRAM readers will remember that the UK's limits for radioactive contamination of food are the second highest in Europe, next only to France. The Committee called on the Government to "justify its decisions about what levels of radiation are publicly acceptable" and stated that the National Radiological Protection Board (NRPB) should consider whether their limits "should be revised downwards."

However, most of the Committee's criticisms can be directed at the Ministry of Agriculture, Fisheries and Food (MAFF). The Committee doubts whether MAFF monitored in all the worst affected areas and accuse them of negligence over their handling of the Skipton Moor incident: "in respect of North Yorkshire, where a clear case of negligence emerged."

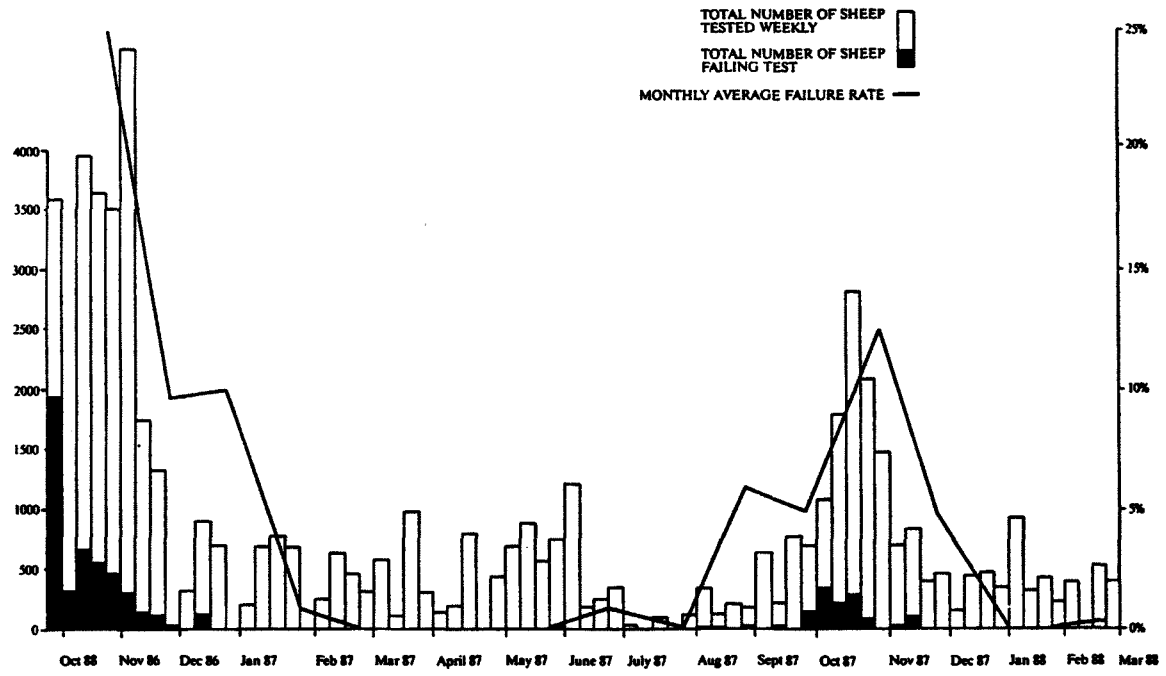
Most important, the report confirmed that lamb contaminated with caesium reached the food chain: "Our examination of the evidence leads us to the conclusion that there are several routes by which lamb above the limit may have gone to slaughter and that it must therefore be highly probable that some did so." A suggestion that predictably did not please the Government, leading to allegations that they tried to highjack the report. At the launch of the report, the Committee chair, Tory MP Jerry Wigan, stated that this was a mistake and changed the wording to "probable". The Labour members publicly disagreed with his statement stating that "highly probable" was the correct wording.

The Committee were also critical of MAFF's handling of the lamb bans and their failure to predict their longevity: "When the restrictions were first imposed in 1986, it was generally supposed that they would be quite short-lived; nobody in official circles anticipated or, if they did anticipate, predicted publicly that some areas would remain under restriction two years later, with no prospect of early relaxation."

MAFF's prediction was based upon the Soil Plant Animal Dynamic Evaluation (SPADE) computer models which are used to predict the behaviour of radionuclides into the environment. Such models are based upon knowledge of the chemical behaviour of specific radionuclides, as well as knowledge of the ecology of the biological systems into which the radionuclide may be released.

The SPADE model was designed for general use

WEEKLY NUMBERS OF SHEEP PASSING AND FAILING LIVE-MONITORING IN CUMBRIA, WITH MONTHLY AVERAGE FAILURE RATE (%)
(LAMBS NOT INCLUDED)



throughout the UK and was based upon experimental data and field studies from mainly lowland soils and pastures. Using these models MAFF expected that caesium deposited on vegetation would quickly be washed away by rain into the soil, where soil minerals such as clay and potassium would absorb and bind the caesium so that it was not biologically available for uptake by vegetation.

LIMITATIONS OF COMPUTER MODEL

As is now common knowledge, the contaminated upland soils are ecologically very different to lowland soils, so why did MAFF fail to take this into account?

In their evidence to the Committee they attempted to suggest that they have always been aware of the limitations of the SPADE model, and did intend to develop a model for upland soils, a claim that is not accepted by the Committee: "One expert ecologist advised us that any plant ecologist with a broad grasp of his subject should have been able to predict what happened. It is particularly disappointing to find that the appropriate ecological insights did not penetrate the relevant authorities." However, the Committee note that the NRPB were also "surprised" at the persistence of the problem. Consequently the Committee did not think "MAFF can fairly be reproached for lacking foresight."

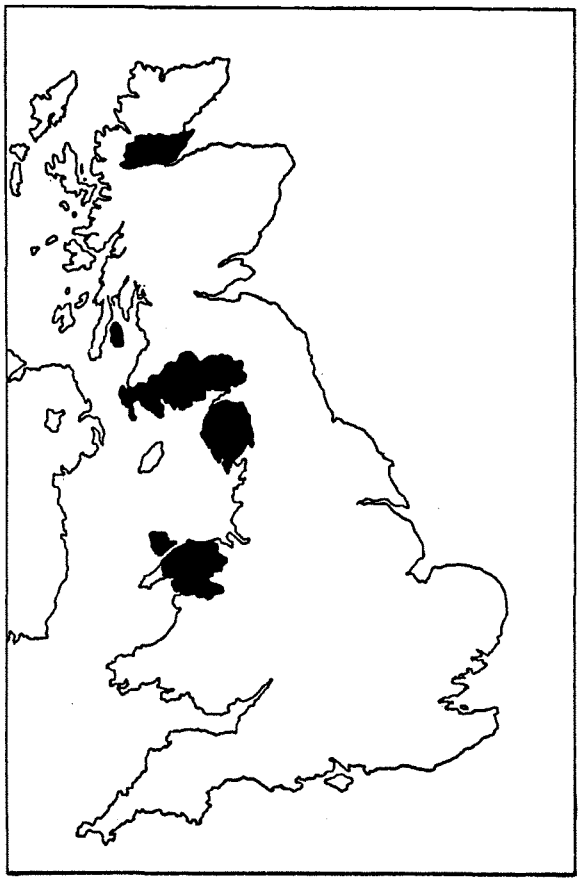
However, what the Committee's report does not mention is that before 1986 there were many publications which compared the slow dynamics of infertile upland areas with those of the fertile lowland areas. These show that there are many factors such as slow growth rate, longer life spans, storage and recycling of minerals within plants growing on infertile soils, which would result in the long term retention of caesium within the vegetation. In addition to this, infertile soils of the upland areas are low in clay minerals but have a high organic content, so the caesium would not be as readily bound into the soil. The soils are also acidic, increasing the bio-availability of minerals and metals for uptake into plants.

Such differences between fertile and infertile pastures were recognised in July 1986 by the Swedish National Institute of Radiation Protection, who stated that "soil with a high clay content binds caesium and leads to a low uptake of radioactive caesium in plants . . . badly fertilised natural grazing land can give rise to a higher caesium uptake via the roots."

EARLY STUDIES SHOW PERSISTENCE OF CS-137

If such information was available to the Swedish Radiation Protection Authorities, MAFF and the NRPB should have been aware as well. Furthermore, in 1963 a Professor Fredriksson showed that mutton from sheep in hill areas of Britain contains higher levels of caesium-137, from nuclear weapons fallout, than any other type of meat when heavy rainfall enhanced deposition.

In addition, at least two other studies have shown that caesium-137 would remain in soils over a long timescale. During a 1977 survey of environmental radioactivity, a small excess of caesium-137 was discovered in the top 15cm of soil to the south east of Sellafield. This was attributed to the release of caesium during the Windscale fire some twenty years earlier. Most other research conducted after the fire was based upon iodine-131, despite the fact that caesium was released into the environment, so other studies have not confirmed this.



Restricted sheep movement areas, June 1986.

During the 1950s the Atomic Energy Research Establishment at Harwell conducted single dose experiments to investigate weathering effects on caesium-137. In 1956 one millicurie of caesium-137 was deposited on plots of five different soil types. The studies showed that even after 4.8 years, 50-80% of the caesium activity would remain in the top 5cm of peaty soils. At this depth the caesium would still be accessible to grass roots.

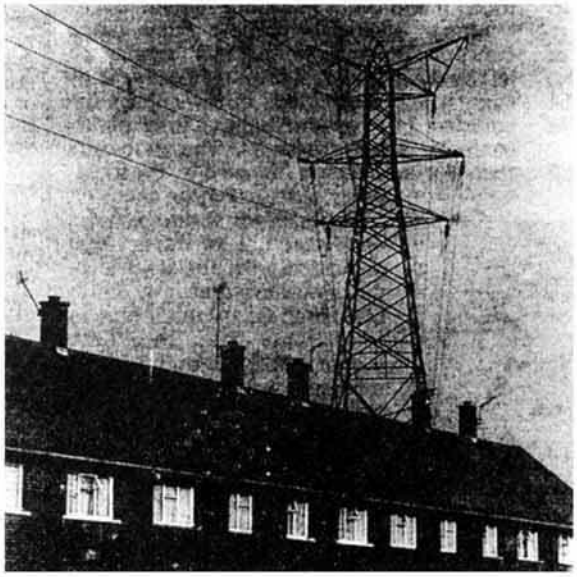
Since Chernobyl, MAFF have funded a number of research programmes on the behaviour of caesium in upland soils. The Committee noted, "We hope the Government will also build on its decisions to publish its monitoring results after Chernobyl by ensuring that the conclusions of all research are made public and an informed discussion encouraged of its implications." To date very little has been published.

Fortunately for the Government the report was published just before Parliament's summer recess. Not only should the report's conclusions be debated, but also the Government must consider some form of disciplinary action against MAFF. MAFF failed to fulfill their responsibility in a nuclear emergency. Not only was their response negligent but also the Committee's rejection of many of MAFF's statements in evidence can only mean that their attempts to mislead the Committee failed. One can only hope that the Government will take appropriate action; at the very least the Minister should resign.

PATRICK GREEN is Friends of the Earth's radiation consultant. KATIE SAMPSON is researching caesium modelling for FoE.

Can Cables Cause Cancer ?

In March this year the CEGB announced a £500,000 study into the possible health effects of electromagnetic fields generated by power lines. LOUIS SLESIN details previous US studies, and concludes there is now plenty of credible data to support a link between low level EMFs and childhood cancer.



Electricity utilities long ago realised that building power plants, whether coal or nuclear, could be the cause of major headaches. Those headaches are becoming migraines as more and more studies suggest a link between cancer and extremely low frequency (ELF) fields emitted by power lines. For each power plant, utility planners have to grapple with the 'not in my back yard' syndrome. But when it comes to power lines, they face an endless series of backyards. In the US alone, there are over 600,000 miles of overhead transmission lines.

Even though the cancer threat from power line fields is still far from proven, US juries are already making sizeable awards. In 1985, a Texas jury ordered Houston Lighting and Power Company to pay a local school district $25 million for building a transmission line through school property.

A "JUGULAR ISSUE"

The possibility of further litigations, coupled with the sheer pervasiveness of power line fields, prompted a senior executive with the Electric Power Research Institute (EPRI), a utility-sponsored group, to call the ELF-cancer link a "jugular issue" for the industry.

Power line electromagnetic fields (EMFs) were first linked to cancer by Nancy Wertheimer and Ed Leeper in 1979. They combed childhood mortality records around Denver, Colorado, and correlated the incidence of cancer with the network of high-current power lines. This landmark epidemiological study showed an association between long-term exposure to weak (60Hz) magnetic fields and increases in the incidence of cancer. At the time, the findings seemed preposterous. After all, the magnetic fields in question were a hundred times smaller than that of the earth. There is one crucial difference, however. the earth's magnetic field is relatively steady, while power line fields are constantly oscillating.

The cancer issue resurfaced in 1982, this time in the workplace. "I noticed that among men whose occupation required them to work in electrical and magnetic fields there were more deaths to leukaemia than would be expected," Samuel Milham, an occupational health physician at the Washington State Department of Social and Health Services, told readers of the **New England Journal of Medicine.** For instance, compared with other people not exposed to EMFs, power station operators had two and a half times the death rate from all types of leukaemia.

"SUSPICIOUS ASSOCIATION" SUPPORTED

A bustle of activity followed as researchers checked whether Milham's findings held true for other sets of cancer data. Letters to the editor soon appeared in the medical literature, and most supported what Milham called a "suspicious association."

By early 1986 even sceptics were becoming troubled by the weight of evidence. Out of 17 surveys of electrical and electronic workers, 15 showed some link between ELF fields and cancer. Yet few in the utility business seemed to care. Only a couple of dozen of the more than 2000 attending a power engineers meeting in February that year bothered to come to the specially organised symposium on the biological effects of power lines.

Meanwhile, Dr Lennart Tomenius, a Swedish researcher working in his spare time without funding, had painstakingly repeated and found support for the original 1979 findings. In a study published in **Bioelectromagnetics,** he confirmed that the distribution of childhood cancer in Stockholm was linked to power line magnetic fields. Also, Wertheimer and Leeper had extended their findings to adults: although the association was weaker than the one they had observed in children, it was still statistically significant.

Many scientists, however, wanted more substantial evidence of a cancer risk. Yet, without major funding, no one could try to repeat the Wertheimer/Leeper study for the general public or initiate a full-scale occupational study. Money was scarce and the Reagan administration had no interest opening up a new front of environmental activity. The field might have stayed quiescent had it not been for a 10 year old power line dispute in New York State.

In 1973 environmental groups fought the New York Power Authority's proposal to build a 765kV power line to import cheap hydro-electricity from Canada. The State's Public Service Commission okayed the line, but, after acknowledging "unrefuted inferences of possible risks that we cannot responsibly ignore," ordered the utilities to chip in $5 million for a five year research project on the health effects of EMFs.

The New York Power Line Project initiated a mini-explosion of activity that permanently transformed

research on the biological effects of EMFs. Most important, it paid for a repetition of the Wertheimer/Leeper research. David Savitz, a young epidemiologist at the University of Colorado, embarked on a $350,000 study with two colleagues in the school's Department of Electrical Engineering. They measured magnetic fields in the homes of children who had developed cancer, as well as healthy children. But there were still insoluble problems: they would never know the precise magnetic fields the children were exposed to years earlier. Any conclusions from the Savitz group could therefore always be disputed.

"prolonged exposure to low-level magnetic fields may increase the risk of developing cancer in children"

In Toronto, in September 1986, the attendance of utility managers at the first international symposium on the health effects of power line fields told much of the story: it was double the expected numbers. Richard Philips, editor-in-chief of the Bioelectromagnetics Society's journal, told a jammed audience that he would not buy a house along a power line right-of-way - not even with a $25,000 discount to mitigate any perceived risks. The statement sent a chill through the crowd.

Two months later Savitz finally announced that "prolonged exposure to low-level magnetic fields may increase the risk of developing cancer in children." In July 1987, the New York project released their findings: they endorsed Savitz's conclusions but maintained that the cancer link was still a hypothesis, albeit now a "stronger one."

Application	Frequency
Power lines	50Hz(Europe), 60Hz(US)
Naval submarine communications	76Hz
Radio and TV	530kHz to 806MHz
Nuclear Magnetic Resonance	various MHz
Hyperthermia heat treatment	50MHz to 1GHz
Radar and electronic warfare	various MHz and GHz
Microwave ovens, satellite and telephone communications	2.45GHz
Visible light	500THz

Some applications of the non-ionising electromagnetic spectrum.

Some epidemiologists and utility experts remain unconvinced. Dr Philip Cole, chairman of the Department of Epidemiology at the University of Alabama, Birmingham, has informed Florida state, who are drafting power line exposure standards, that the Savitz study is only "suggestive of a weak link," and that the data are inconsistent. Moreover, he says the research shows no dose-response relationship - ie it provides no direct proof of a relationship between ELF exposure and cancer. Indeed, Cole characterises the entire ELF literature as showing that "either there is no relationship between EMFs and cancer in human beings or if there is an effect it must be of very low magnitude even among people who are moderately to heavily exposed."

ELECTRIC BLANKETS LINKED TO MISCARRIAGES

Dr Sol Sax, chief physician at Ontario Hydro, would like to see additional health surveys of individuals with higher exposures than those in the Savitz study. On this point, he agrees with Wertheimer and Leeper, who have been pressing for studies on users of electric blankets. (The zigzagging wires in the blankets carry electric currents that generates both heat and ELF magnetic.) They have already shown that pregnancies among couples who use electric blankets are more likely to end in miscarriages than those among couples who do not heat their beds electrically. However, a possible cancer connection has yet to be investigated.

Risk assessment will not be easy. Regulators used to setting standards for nuclear radiation and toxic chemicals will scratch their heads when confronted by EMF effects that can come and go as the field becomes stronger. Mechanisms of cause and effect will have to be verified and thresholds discerned. Yet at the present time when new studies are showing increasing cause for concern, government research funds have dried up.

SWEDEN LEADS THE WORLD IN RESEARCH

The US Congress could take a cue from Sweden. There, health officials have already embarked on a large-scale epidemiology study of all those with certain types of cancer who lived within 300 metres of a 220 or 400kV power line for at least one year between 1960 and 1983. This and related ELF research will cost the Government $1 million. Sweden, a relatively small country, continues to lead the world in their commitment to the environment and occupational health.

The Savitz study prompted Congress to hold hearings, but the funding burden will probably fall elsewhere - perhaps again on New York State. Early in 1987, a group of more than 55 landowners filed a $60 million suit against the New York Power Authority, alleging the half completed extension of the originally disputed line could create a "cancerphobia corridor," destroying the market value of their property.

Some observers claim that these landowners are primarily concerned about the aesthetic damage resulting from the construction of large power lines. But regardless of their motivations, their attorneys will take the cases to court. Because the industry and the government have refused to fund the necessary studies, policies for siting power lines will remain in the hands of local juries across the country, and there is now plenty of credible data supporting those who allege a cancer risk.

LOUIS SLESIN is the editor and publisher of Microwave News, a New York newsletter covering the health effects of non-ionising radiations.

(This article is an abridged version of paper which was first appeared in the October 1987 issue of Technology Review.)

THE CITY OF EDINBURGH DISTRICT COUNCIL

EDINBURGH

IMPROVING SERVICES – CREATING JOBS

Magnox - Going, Going . . .

July 1988 was not a good month for the UK's nuclear industry: observers may one day look back on it as a turning point in the history of nuclear power. The Government announced the run down of the fast reactor programme, with the eventual loss of 1500 jobs. But more significantly, the Central Electricity Generating Board pulled the plug on the magnox power station at Berkeley in Gloucestershire.

Attention must now be addressed to the problem of what to do with the nuclear carcasses: how should they be decommissioned? In these four pages we examine the options open to the nuclear industry, and, more immediately, look at the future for Berkeley and the other magnox stations.

JAMES GARRETT looks back on the troubled history of Berkeley, and suggests that, with privatisation of the electricity industry looming, the other magnox stations will soon follow the world's first commercial nuclear power station to the nuclear knacker's yard.

Berkeley, is to finally close next March, three years earlier than the CEGB would have preferred. It is likely to be followed into retirement by the rest of the geriatric magnox stations. Bradwell in Essex, Hunterston A in Ayrshire, Hinkley Point A in Somerset, Trawsfyndd in north Wales, Dungeness A in Kent, and Sizewell A in Suffolk are all expected to be shut down prematurely during the next five years.

Although the generating board claim no specific design life was attributed to the early magnox stations, a figure of 20 to 25 years is widely accepted by observers. The CEGB extended this to 30 years in the early 1980s. Oldbury- on-Severn near Bristol (began operating 1967) and Wylfa on Anglesey (1971), which are of a more modern design, were explicitly designed to operate for 25 years, and only these two stations are expected to remain in operation for something approaching their proposed life.

The announcement of Berkeley's closure could not have come at a worse time for the Government, who are trying to foist a third nuclear power station on the inhabitants of west Somerset and to privatise the electricity industry. At a time when Whitehall would like maximum public confidence in the nuclear industry, the enforced closure of Berkeley was just the type of publicity they did not want.

BRADWELL'S STAY OF EXECUTION

However, the CEGB did cushion the blow by not announcing, at the same time, the closure of the ailing Bradwell station, as had been widely expected. Instead, the Board claimed Bradwell, which opened only months after Berkeley, would be kept open for a further 3 years, subject to annual reviews.

This sleight of hand was accomplished by persuading the Nuclear Installations Inspectorate (NII) to relax their demands for safety improvements. The NII's acceptance of a simpler and cheaper means of inspecting welds in pressure circuits was undoubtedly greeted with much relief at the station,

UK magnox reactor stations

the CEGB's Sudbury House headquarters, and at the Department of Energy.

Whether Bradwell will really continue to supply its 245MW to the national grid for three more years, or whether the final closure will follow as soon as a decent interval has elapsed after the Berkeley announcement, remains to be seen.

According to consulting engineer John Large, an independent nuclear expert, "Putting Bradwell on the back burner is just to maintain public confidence. It was closed down by the NII, but the CEGB have managed to persuade them to move the goalposts. I still expect the whole magnox system to be decommissioned in the next 4 years, maybe even quicker."

At Berkeley the Board admit that one of the 26 year old reactors will finally shut in October, and the other will follow next March. Removing the 40,000 fuel rods from each reactor and transporting them to Sellafield for reprocessing is expected to take five years. A further 7 years will be required to clear the ancillary buildings, boilers, generators and turbines. The final stage - complete dismantling or encasing the reactor cores in concrete - has yet to be decided, but will probably not be done for decades, neatly shifting the problem of what to do with a decommissioned nuclear reactor on to future generations.

Negotiations over the future of the station's 532 workers began in August; the negotiations are expected to be tough, as the resulting deal will affect redundant employees from all nuclear power stations. Early CEGB announcements said half of the work force would lose their jobs next March, whilst the remaining half will be employed in the decommissioning process.

Berkeley was doomed long ago not to reach the 30 year operational life that the CEGB planned for it. Its electricity has always been expensive (30% more than average costs) and its output was reduced to 200MW from its design capacity of 275MW because of various problems. Nevertheless, deputy manager Dennis Joyson, last year, felt able to inform SCRAM that the station was "very, very profitable indeed."(SCRAM 62)

CANCER CLUSTERS AROUND BERKELEY

In addition to its economic burden, Berkeley is regarded as very 'dirty', levels of radioactivity outside its perimeter are 12 times those allowed by the NII for more modern plant.

There are two cancer clusters in the area around Berkeley and the neighbouring Oldbury station. Campaigners have accused the stations - particularly Berkeley - of being responsible for the clusters in Northavon district and the Lydney area of the Forest of Dean. Northaven is one of Britain's top 20 leukaemia hotspots. In 1984, 12 people died of the disease, while there were a further 7 deaths in 1985. If it conformed to the national average there would be just 3.9 cases a year.

At Lydney, on the other side of the Severn from Berkeley, 6 children under the age of 7 were diagnosed as having leukaemia or Hodgkin's disease between 1979 and 1983. 1980 saw 12 cases of leukaemia, or lymphoma, among adults - only 3.5 were expected.

The plant's death blow came with the demand by the NII, in April, that the CEGB spend millions making essential safety improvements or close the plant down. The closure reflects the Board's reluctant realisation that they've finally run out of excuses for keeping the station open.

Magnox power stations have never fulfilled the original promise of electricity "too cheap to meter." The generating costs when Berkeley opened was 0.51p a unit, compared with 0.2p for the latest coal-fired station at the the time. This comparison remains unchanged.

That is, of course, not the way CEGB chairperson Lord Marshall sees it: "Collectively the rest of the magnox stations have years of service ahead and will save the electricity consumer hundreds of millions of pounds over that time." He lamented: "I am very sorry indeed we have reluctantly decided to cease generation at Berkeley."

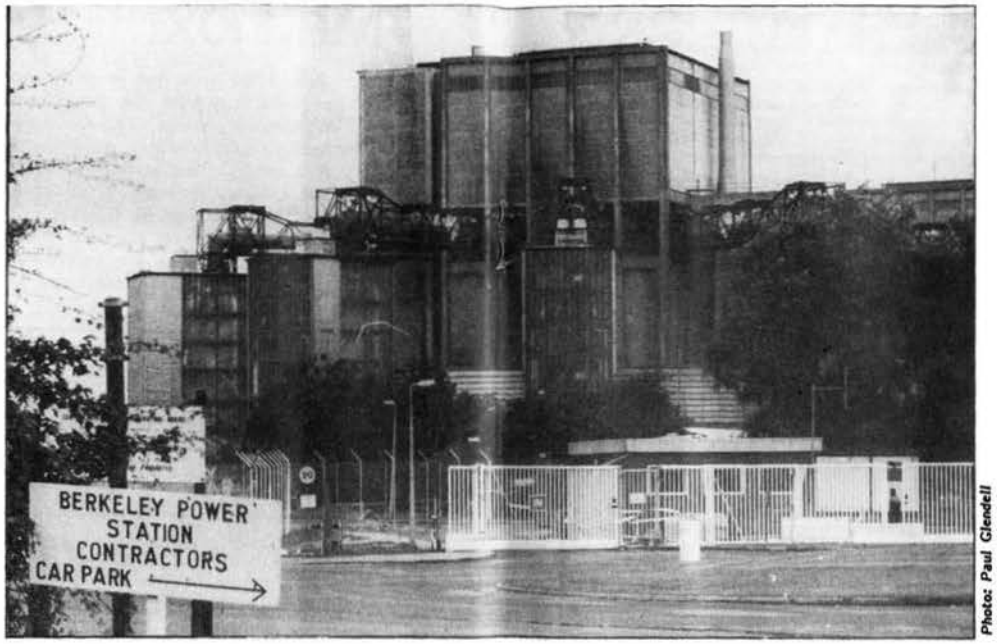


Photo: Paul Glendell

The CEGB's Berkeley magnox station - the first domino

In Lydney they were jubilant. Don Bradley, spokesperson for the Severnside Campaign Against Radiation, formed after the cluster was discovered, stressed, "It's only a pity that it wasn't done before. We look forward to the next one closing."

Jonathon Porrit, Director of Friends of the Earth, prophesised, "Berkeley's closure marks the end of the nuclear dream in the UK. The next years will be ones of contraction rather than expansion." He describes it as "a victory of common sense over nuclear dogma."

The next eight years also look like being extremely expensive for those 'brave' enough to invest in a privatised electricity industry. One of the first tasks of the new body will be to decommission seven clapped out civil nuclear stations, at a cost of at least £2.4 billion.

Doubts over the Government's plans for privatisation are shared by the House of Commons Energy Committee. The Committee's members, most of whom are Tories, said in a highly critical report published in July that the privileged role being given to nuclear power after privatisation, and the private sector's expectations of high returns on capital would work against the Government's aim of lower costs and prices.

The MPs felt the Government should think again before rushing ahead with ill-thought out legislation. However, they show no signs of doing so.

JAMES GARRETT is a freelance journalist.

The decision-making process for magnox decommissioning is complex. There are many factors to consider; and the final decisions on timing and method may include political dimensions. JOHN LARGE concludes that the nuclear industry do not know quite how to do it, when it will begin and end, and how much it will eventually cost.

The UK's stock of ageing magnox reactors, developed in the 1950s, are quite different to other reactor systems, and their decommissioning poses unique problems. These reactors were developed to refuel whilst on-load and because of this the containment design does not provide ready access into the active areas; little consideration seems to have been given to the need to dismantle the reactor islands.

The timing of decommissioning must relate to safety and economics of operation. As reactors age, station close-down may be held back by fitting additional safety systems, although their costs have to equate to overall economics of station performance. However, it is also necessary to match projected growth in demand to the rate of new plant commissioning, offset against plant closures. Therefore, strategic capacity considerations may necessitate delay in close-down, although political and public opinion is likely to ultimately dominate the eventual decision on when and how to dismantle.

It is important to be able to reliably predict and control the end of service of ageing plant: fossil-fuel plant life can be extended virtually indefinitely; but continued operation of nuclear plant is also subject to the judgement of the Regulator - the Nuclear Installations Inspectorate (NII). Embarking on a six PWR programme when the magnox stations are nearing the tail-end of their service life may place the CEGB's strategic plans in jeopardy.

THREE STAGE DISMANTLING PROGRAMME

The intended approach to dismantling reactors is well documented. It is likely to adhere to three distinctive stages: removing the reactor fuel, dismantling all non-active plant and removal off-site of active wastes, and then dismantling the biological shield and active reactor circuits.

Of interest is when these stages will occur; and how long each will last. A third aspect is whether the final dismantling stage will be undertaken or, indeed, if it will in a century hence be prudent to do so. Timing of this final stage could assert considerable pressure on NIREX to hasten the implementation of a radioactive waste repository.

The first stage presents serious but not insuperable logistical problems of fuel transportation, storage and reprocessing. For the second stage it will be necessary to package and remove large volumes of radioactive wastes accumulated during the station's operational lifetime.

The final stage of dismantling the reactor islands completely presents quite vexing radiological and timing problems that could dominate the economics of nuclear power station operation; that could impinge on past costs of electricity generation.

Commence the final stage too early then the radiological penalties will be severe; but delay for too long and the deficiencies of containment, together with what is likely to be a growing public impatience, may jeopardise the acceptance of a future nuclear programme.

UNCERTAINTIES INVOLVED IN COSTS

The major component of decommissioning costs arises from the final stage operations. This is sensitive to the length of delay before complete dismantling is undertaken. Essentially, the radiological protection measures necessary to implement final operations are costly because of the high activity of reactor components. These measures may necessitate limited exposure and/or the deployment of robotics.

This may be offset, to a limited extent, by simply delaying manual operations by 100 to 130 years, ie until the relatively short-lived activity has decayed. Beyond this extended period, further delay brings no radiological benefit since the activity is dominated by very persistent isotopes.

Since it is assumed that dismantling to green-field conditions will not occur for a century or more, overall costings have not been tackled in earnest. This reluctance stems from uncertainty over the mode of future operations and, to a great extent, a reliance on future technology to tackle final dismantling difficulties by radical innovation.

The CEGB's 1982 decommissioning costs range from £250m to £150m, decreasing with the length of delay assumed before final dismantling. Because of

changes in UK radioactive waste management strategy - the effective abandonment of sea dumping, and NIREX's withdrawal of proposals for a shallow land repository - these forecasts, particularly the costs of radioactive waste disposal, could result in a significant increase of the overall costs for a single magnox station. The 1982 CEGB active waste handling plant, waste disposal and land disposal site costs (converted to 1986 costs) amount to about £40m per station, when they should be more like £94m if the policy changes are taken on board.

A second area of cost uncertainty relates to reliance upon advanced robotics, should the final dismantling stage proceed early. Development and utilisation of such robotics might incur additional costs of about £115m per station according to Dr Paul Woollam, the CEGB's decommissioning research co-ordinator. The robots scuttling about within the bowels of Three Mile Island demonstrate that such machines are not yet up to the task.

ALTERNATIVE FINAL STAGE OPTIONS

Apart from strategic planning and political factors, moving towards the first stage decommissioning of Berkeley should not present the CEGB with any great difficulty. Second stage operations can be reasonably delayed until a final radioactive waste disposal method and site is developed, and it may transpire that much of the active circuit waste will be disposed of within the boundary of the power station site. It is the final stage of dismantling that confronts the nuclear industry with a dilemma that they prefer, so it seems, to pass to future generations.

The preferred option is to delay dismantling of biological shield, reactor vessel and inner components for 100 years or so - this may be termed deferred decommissioning. Its purpose is to allow the relatively short-lived isotopes to decay to a level where the overall radioactive inventory of the reactor hulk is dominated by persistent isotopes such as Cl-36, Ca-41 and C-14 from the graphite moderator core, and Ni-63, Ag-108, Ni-59 and Nb-94 deriving from the activated steel structures within the reactor. If these plans proceed then there is a dependency upon major advances in dismantling technology, automatic processes and identifying a sound and publicly acceptable route for radioactive waste disposal.

Of course the final removal of the reactor islands would be accompanied by radiation dose exposure to those decanting the reactor structures and, even with the best intentions, no doubt this would be a clumsy operation likely to contaminate members of the public. This additional radiological burden would simply be in order to remove radioactive waste from one site - the defunct power station - to another site - the waste repository.

The radioactivity of the reactor components would persist into the long term, so much so that the additional protection of packaging and burial would only serve to delay the entry into the biosphere a few generations, over which there would be little significant reduction of the overall hazard.

LONG TERM INSTITUTIONAL COMMITMENT

Far better, some would consider, to leave the 2000 or so tonnes of graphite moderator and accompanying activated steelwork on-site. If so, there would be opportunity to properly re-engineer the reactor island containment at future times to arrest deterioration of the concrete biological shields and, when and where necessary, substructures could be implemented to safeguard dispersion of radiotoxic matter to groundwater. If this alternative is adopted, then further development of long term containment is required and the in situ radioactive waste repository will have to be site-specific.

The first of these options is favoured by those immediately mindful of the environment and, perhaps, over-zealous and outspoken in their criticism of the nuclear industry - their dilemma is that eventually the radioactive wastes will have to be either stored or disposed of at some other locality.

The second option places a very long term and institutional management commitment on the power plant operator. For the critics this practicable solution is accompanied by a distrust that the operator will, at some future time, allow the reactor hulks to crumble releasing the radioactivity into the biosphere.

In the longer term the contents of the reactor islands must eventually disperse into the biosphere. For the repository disposal option this dispersion will commence when the packaging and/or containment systems break down. If they are maintained in situ dispersion will commence when it is no longer deemed necessary to maintain the containment intact.Of course, the containment of either option could fail due to some unforeseeable external event.

Whatever, maintaining the containment intact for 1000 to 1200 years will permit the natural decay of the medium life isotopes such as Ag-108, Ni-63 and Ca-41. Looking towards the very much longer timescales, it is the persistent isotopes of C-14 and Cl-36, both of which derive mainly from the graphite moderator, that will eventually disperse into the biosphere during any realistically foreseeable timescales. In fact, so persistent are these isotopes that the time period elapsing before containment failure contributes insignificantly to reduction of the eventual dose rate.

FAILURE TO FORESEE FUTURE DIFFICULTIES

When undertaking the design of early nuclear plant the industry concentrated on structures which tended towards absolute containment of the nuclear processes within, but for decommissioning unimpeded access is required to facilitate the operation. Furthermore, the original designers seemed to ignore the future need to dismantle the reactors and, moreover, to safely store or dispose of the radioactive wastes arising therefrom in that the goal of permanently isolating the persistent isotopes could never be achieved.

Not only did the nuclear industry fail to foresee these technical difficulties, but they also failed to grasp the eventual public hostility towards this developing technology.

Now and in changed times, the nuclear industry are confronted with a task for which they never properly prepared - on the matter of decommissioning, the nuclear industry face a dilemma whichever way they turn.

JOHN LARGE is a civil engineering consultant.

1992 and all that

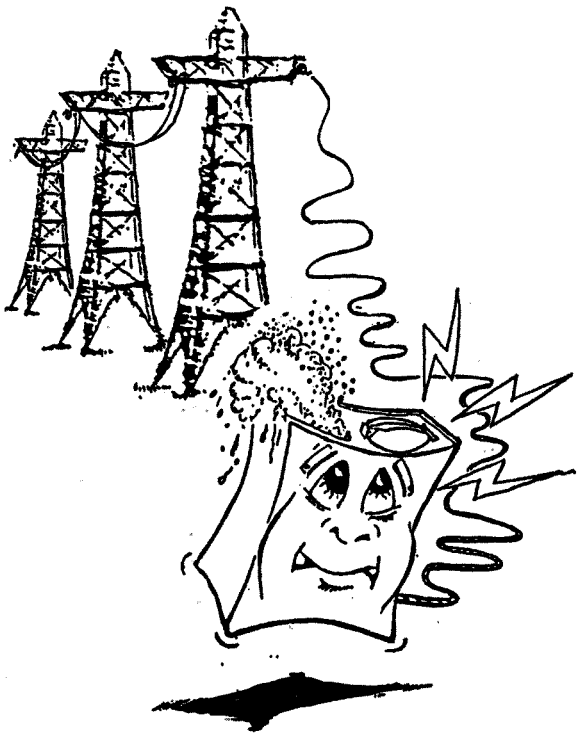
Setting up energy efficiency standards for domestic electrical appliances in this country has always been a bit of a Holy Grail. Here ANDREW WARPEN examines the American experience and concludes that although it is not directly applicable to this country, opening up of the European Market in 1992 may facilitate the setting up of Community-wide energy efficiency standards.

President Reagan has recently signed into law federal legislation which will set mandatory standards of energy efficiency for a wide set of domestic appliances. This will mean that henceforth items like refrigerators and washing machines sold anywhere in the USA will be at any rate reasonably non-profligate in the way they use electricity - if not necessarily up to the very best available standards.

For many years now there has been talk of introducing similar minimum standards here in Britain, but to date they have fallen foul of "if the market place wants super saver cookers, let the market place demand it" - thereby sloughing off any likelihood of progress. Such information is seldom made easily available to consumers, who inevitably have other considerations at the moment of purchase (size, colour, dimensions, the store's loan arrangements etc.)

In publicising fuel consumption figures at the point of sale, it is a chimera to believe that there will ever be a spontaneous uprising of prospective consumers, demanding to know the cost per kilowatt hour of their microwave, or that food freezer. Shopping just doesn't work that way in Europe, any more than it ever did in the USA. So how did the Americans come to pass this new legislation?

The answer to that was by playing the Domino Theory among the 50 states. This worked by exploiting the fact that each state is entitled to set up its own local codes for matters like providing details of energy performance on 'white goods' (as marketing jargon deems them). It was then a matter of persuading one major state legislature to pass such local legislation - in this case it was California - and then presenting the otherwise reluctant manufacturers with a conundrum: either manufacture especially for the Californian market, or bring all your commodities up to the Californian standard.



With other albeit smaller states threatening to follow California's lead, the manufacturers federation was eventually backed into a corner. They agreed to endorse a minimum energy standards bill, on the basis that without it other states might seek to leap-frog California by producing even tougher standards which they would then have to meet.

LESSONS FROM AMERCIA

I was invited to be present at the formal meeting in Congress back in 1986 which launched the Bill President Reagan has now endorsed. And, inevitably I was tempted then, as I am now, to consider whether we could apply this 'Lesson From America' in Britain. After all, there are known to be a number of large local authorities who are very sympathetic to the energy conservation message.

Couldn't we so arrange it whereby wasteful washing machines were banned from sale in Wolverhampton warehouses, or sloppy spin-dryers from Salford stores? The answer to that is sadly no. In Britain, councils simply do not have the powers - beyond their own purchasing requirements - to enforce such a policy.

But perhaps there is another approach, which could achieve the same end. The Government is currently spending substantial sums telling us that by the end of 1992, there will be true 'common market' of goods across the twelve European Community states. I am tempted to believe that this just could be the best way of achieving our objective of removing 'gas guzzling' items from Britain's homes. There is after all considerable evidence to show that white goods currently on sale in West Germany or the Netherlands are on average much more energy efficient than those on sale here, or in Eire.

All that could be required would be a formal tightening of standards in one of these more far-sighted countries. As a result manufacturers from other countries anxious to export would find themselves forced to develop more energy efficient equipment in order to trade in that country - all the time doubtless aware that the chances of other countries following suit on mandatory standards would be pretty high. The Domino Theory, which worked so well in the USA, just could be the answer to Europe's prayer too.

ANDREW WARREN is the Director of the Association for the Conservation of Energy.

Wind – Environmental Questions

After many years of struggling against the odds, wind power has finally broken into the realm of technical and economic viability. However it now has to gain environmental acceptability. MIKE TOWNSLEY examines possible environmental objections to its large-scale adoption.

Over the past fifteen years or so the wind power industry has pulled off a remarkable feat: they have taken the energy source from relative obscurity to a point where it can now be shown more economic than most other electricity generating systems, the most notable exception being water power.

Although it is agreed that wind power is now economic, there is still some disagreement about exactly how economic. The Central Electricity Generating Board (CEGB) believe their recently announced windfarms will generate electricity at about 2.8p/kWh, given a 5% discount rate, whereas wind power luminary Dr Donald Swift-Hook, former chair of the British Wind Energy Association, argues that wind turbines should be able to generate electricity at 1.7p/kWh, on good sites. Turbine manufacturers promote costs, given large scale aerogenerator manufacture, of 2p/kWh.

If we use good sites, and there is no denying their availability - the Cornwall Energy Project have identified 1500 sites, in cornwall alone, with a potential generating capacity of between 1200MW and 1500MW. Wind power, in conjunction with energy conservation, is the obvious choice to fill the CEGB's predicted energy gap, at the turn of the century.

ENVIRONMENTAL CHALLENGES

Having won the first battle in the war of attrition with incomparably armed nuclear industry, the wind industry must now rise to the next challenge: environmental acceptability.

"I wonder whether we want every beauty spot in the country turned into an electricity generating site with 100m blades making a noise like that of a landing helicopter every minute of the day." So says pro-nuclear Labour MP Dr Michael Clark. It is myths like this that are engendering public opposition to wind turbines.

The Network for Alternative Technology and Technology Assessment (NATTA) and the Charter for Renewable Energy commissioned a report - **Windfarm Location and Environmental Impact by Alexi Clarke** - "to dispel some of the myths that have grown up around wind turbines," and to provide an independent assessment of at least some of the options.

Although the report examines most aspects of the wind debate this article will concentrate on the environmental and public perception considerations.

The visual impact of wind turbines will play an important role in the debate. Concerns such as those expressed by Malcolm Ross MP are typical: "I too have reservations about peppering our countryside with 74ft high monster windmills. The prospect for the fens landscape is positively horrendous." The enormous windfarms in the US sometimes comprising hundreds of machines, may justify such fears. However such developments are not being considered in this country. It is more likely that farms involving tens of machines will be constructed here.

IMPACT CAN BE MINIMISED

However, the bottom line is, there is no way to make wind turbines invisible. But with careful planning - using established landscape architecture techniques for siting structures in the country - their visual impact can be minimised.

Wind turbines arranged in arrays will be required if wind power is going to make a significant contribution to the electricity supply industry. The way in which these turbines are arranged will effect their visual impact. For open landscapes a Swedish study found that windfarms with a visually ordered structure presented a less abrasive image to the viewer. Whereas for closed landscapes order was less important because fewer turbines are visible from any one point.

The design of the turbine itself is also important in minimising impact. Alexi Clarke comments that the "design of turbines themselves should form slender structures." And, as they can be over 100m high, they must appear stable, so tapering at the base is desirable. It is also a good idea to use light colours when painting the structure, so the turbine blends with the sky. The CEGB have already adopted this tactic, and are planning to paint Hinkley Point nuclear power station a "special shade of blue and mushroom," to blend in with the Bristol Channel.

Turbine blade rotation frequency can also have an effect: fast moving blades tend to aggravate the eye, but slow moving rotors, about 45rpm, have a restful affect.

A noise like a helicopter landing? Not quite. Wind turbines do generate a significant amount of noise, which could prove to be the main objection to their use. Unfortunately as with most environmental aspects of wind turbines, the funds and research have not yet been adequately applied to solving this problem. This situation is changing. Recent designs tend to make less noise and there is some prospect that a new generation of quieter aerogenerators is on its way.

Noise, along with safety and visual impact, establishes the need to create a 'buffer zone', the extent of which will depend upon several factors: ambient (background) noise, and neighbouring land use. Work on establishing international standards for buffer zones is being conducted at wind turbine testing centres all over Europe. They don't expect to reach an agreed standard for at least another 2 years.

Flickering shadow disturbance can create serious problems. When the turbines are close enough to housing, shadows cast into the house can attain a strobe frequency capable of inducing disorientation or even convulsions in the 2% of the population which is epileptic - this is an unlikely and extreme effect, and could be alleviated by using appropriate buffer zones, and must be bore in mind.

Wind turbines can interfere with electromagnetic

transmission, causing a scattering effect on the signal. This could cause a major public uproar, as television signals seem particularly susceptible to interference. They can also interfere with aircraft and shipping navigation systems. The shadow effect for interference is only effective at a distance of about 1-2km, so it is possible to site turbines in areas where they will not cause interference problems. The problem of TV interference can be circumvented by incorporating booster packs on receivers and transmitters, the cost of which is small compared to the cost of a turbine. Clarke stresses the importance of investigating the possible effects thoroughly "to prevent disruption of vital services and to avoid the unpopularity that TV interference causes."

Like all activities there is the possibility of an accident. The main risk here is that a dislodged piece of ice, or a fragment of the blade may be hurled some distance. In such an event the turbine fall-out could travel a maximum distance of about 800m. The probability of being hit by turbine fall-out is small, and is reduced even further by the use of an appropriate buffer zone.

The prospect of a barrage across the Severn has already raised the hackles of the bird lobby. This could also happen in some prospective wind turbine sites. The presence of a turbine in birds' flight paths could dissuade them from using it, and could alter the habits of local birds.

In the US there have already been several objections, on the grounds that they have adverse effects on bird life. In some cases developers have dropped proposals because of public concern for the safety of eagles and rare birds.

Studies into the effect on birds are being conducted jointly by the Hydro Board and the RSPB, on Burger Hill in Orkney, which is next to a bird sanctuary run by the RSPB. So far no adverse effects have been found, although one pair of Red Throated Divers has disappeared. Clarke concludes that "in view of the uncertainties, wind turbines should be situated at some distance from important bird reserves."

"PUBLIC ACCEPTANCE IS VITAL"

Public acceptance is vital to the full scale adoption of wind power. As Clarke points out, "unlike other energy sources, wind energy's main problems of acceptance are aesthetic (visual), and some nuisance value (noise)." The wind industry will need to rise to this new challenge. Analysing studies into public perception of wind turbines conducted abroad, he concludes that the main results are not directly applicable to the UK, but that public opinion was found to be changeable and dependent upon the views expressed by the electricity utilities, Parliament, and the media; none of which appear to be in full command of the facts, and would be well advised to read this report.

The overall electricity generation policy in this country has not made much of an impression on the public consciousness. Clarke believes this is mainly due to the "centralised and remote nature of decision making of the CEGB." This is a typical anglo-view of the industry, but his comments are equally applicable to both the South of Scotland Electricity Board and the Hydro Board. However it could equally be a result of, as many observers

Lord Marshall demonstrates the executive toy of the future to Michael Spicer.

believe, that the only UK electricity policy is one of no policy: how can a non-policy impress public consciousness?

Parliament also effects public perception, the position of which was illustrated in the debate on renewable energy sources (30:8:87). Michael Spicer, the Minister with special responsibility for renewable energy, and nuclear power, commenting on his trip to Denmark, said he found "tremendous controversy amongst environmental groups, some of which were vociferously for, and some vociferously against, wind power as an industry. There were some more informed speakers but on the whole the MPs were depressingly unprepared, opinionated, and prejudiced.

Most people derive their opinions from the media, who have also been found to be lacking in consistency and accuracy when reporting on wind developments. A positive and serious image needs to presented so wind power is viewed as a genuine alternative to conventional, global polluting, energy sources.

The message is clear. A choice needs to be made. Do we prefer to continue generating our electricity by conventional technology, and in the process destroy the global environment, just because their pollution does not appear obvious locally; or do we choose small scale local pollution which we can see, and hear, and take a 'soft energy' option, in a bid to preserve the environment? The technology exists, what is now needed is popular support: the political will should soon follow.

The Negawatt Resource

There is a growing realisation that the continued emission of carbon dioxide is seriously affecting the world's climate - the Greenhouse Effect. One way to counter it is to employ energy efficiency measures. DAVID OLIVIER explains what research is being conducted, and urges an investment in 'negawatts' rather than megawatts.

An international project has been underway for 18 months to examine urgently the reduction of CO_2 emissions to avoid the risk of devastating climatic change. Funded by the Dutch Ministry of the Environment, it involves an analysis of energy use in the five worst culprits of the EEC - the UK, West Germany, France, Italy and the Netherlands.

The project's final report will be published this autumn. A recent conference in Brussels - **Energy and Climatic Change: What can Western Europe do?** - which was funded by the West German and Dutch governments and organised by the European Environment Bureau, discussed the preliminary results of the report.

It concludes that the world must reduce its fossil fuel consumption by 80% or so in 40-50 years to limit climatic change; even then significant global warming is still in prospect. Renewable energy and some switching from coal and oil to natural gas (which only makes sense if energy is used more efficiently, otherwise gas resources would come under stress) can both contribute. However, by far the most important means to tackling the problem is more efficient energy use.

The report's authors examined nuclear costs from all European countries in detail. They concluded that nuclear power - superficially a way to reduce CO_2 emissions - costs too much, let alone the unsolved problems. To get the biggest CO_2 reduction from a given effort, the cheapest options must be pursued first.

ELECTRICITY EFFICIENCY REQUIRES URGENT ATTENTION FROM POLICY-MAKERS

In 1985-86, about 35% of UK primary energy consumption was used to generate electricity. This fuel consumption, predominantly coal, averaged 98GW and accounted for 35% of national CO_2 emissions.

End use	Average GW	%
Space heating	3.77	13.2
Space cooling	0.35	1.2
Water heating	2.22	7.8
Cooking	1.84	6.5
Lighting	5.96	20.9
Appliances	4.75	16.7
) <200C	0.32	1.1
Process heat) 2-400C	0.06	0.2
) >400C	1.01	3.6
Process refrigeration	0.22	0.8
Electrochemical	1.27	4.5
Motive power: Stationary	6.11	21.5
Vehicles	0.57	2.0
Total	28.48	100.0

Table 1 1986 UK electricity uses

Ten years world-wide experience shows conclusively that using electricity more efficiently is a direct substitute for buying new central generating stations. Deploying this hidden 'resource' of cheap new electricity 'supplies' is an effective means to reduce CO_2 emissions - perhaps the only way to reduce them sufficiently in the time available. It is a far larger and cheaper resource than the nuclear power programme being pursued in the UK and that undertaken by France until the overcapacity, and the high economic costs, forced a slowdown. As such, it requires urgent attention from energy and environmental policy-makers.

In 1986 about 59% of UK electricity was used for just three purposes - electrical appliances, lighting and industrial motive power - and an additional 31% was used for low-grade thermal purposes: space heating and cooling, water heating, cooking and low-temperature process heat and refrigeration **(table 1)**.

The best available lighting technologies now use 80% less electricity than the standard just five years ago, often at no greater initial cost; electrical appliances are available which use 80-85% less electricity than the existing stock; and more energy efficient industrial drives frequently save 40-50% of previous electricity consumption.

Appliance	Electricity Consumption (kWhr/yr) 1985/6 stock	Best Available Technology
Fridge/freezer (auto-defrost - 0.25m^3)	800	50-100
Freezer (0.25m^3)	1000	100-150
Clothes drier	790	260
Colour TV	340	110
Washing machine	70	40

Table 2 State-of-the-art appliances

Taking account of this potential for improved energy efficiency, using the best available technologies, at least cost, would reduce mean UK electricity demand by 70% from 28GW to 8GW, and UK peak demand would fall by at least the same proportion, from approximately 50GW to 15GW. By itself, this investment in efficiency improvements would both reduce CO_2 emissions and cost about 80% less than generating the same electricity from new central power stations. In effect, it amounts to 35GW of 'conservation power plants', which should be built anyway on simple economic grounds.

STATE-OF-THE-ART APPLIANCES CAN REDUCE ELECTRICITY CONSUMPTION BY 80-90%

This article just briefly examines domestic refrigeration equipment versus nuclear capacity. However, major savings are available throughout the UK electricity system, sometimes at even lower cost, especially commercial lighting.

In some areas, eg electrolysis, savings per unit output from a least-cost strategy would be less than 70%. However, the savings for some end-uses, especially thermal ones would be greater. Many of these tasks can be performed more cheaply by al-

ternative systems, eg combined heat and power/ district heating for space heating and hot water, and gaseous fuels for cooking.

The state-of-the-art is represented by fridges, freezers, and heat pump clothes driers which cost-effectively reduce energy consumption by 80-90% (table 2). Applying these to a UK household with full appliance ownership would reduce electricity costs from £200/yr to about £40/yr.

Appliance (* Prototype)		Consumption (kWhr/yr)	Consumption/volume (kWhr/litre)
Fridge/freezer	National (Japan)	456	1.1
	Arctic-Kold (USA) *	150	0.6
	Bosch (W Germany)	480	1.2
	Matsushita (Japan)	480	1.0
	UK average	700	2.9
Freezer	Woods (Canada)	470	1.0
	AEG (W Germany)	330	1.3
	UK average	610	2.4
Fridge	National (Japan)	100	0.5
	UK average	350	2.4
Larder fridge	(Denmark) *	85	0.4
	UK average	290	1.9

Table 3 Comparison between mass-produced refrigeration units on world market and average domestic equipment being bought in the UK in 1988.

(Fridges have one main door and a small freezer compartment for short-term frozen food storage; larder fridges only provide fresh food storage)

The best mass-produced units on the world market improve two- or three-fold on the average domestic refrigeration equipment being bought in the UK in 1988 (table 3).

Recent West German investigations show no significant price difference between the average refrigeration equipment, and the most energy-efficient. In the UK the average difference in price may be as much as £20.

An average 1GW could be saved at point of use over the next decade in the UK if new domestic and commercial refrigeration equipment had to match the most-energy efficient mass-produced devices, instead of the average - a 65% saving.

This 'negative load' essentially replaces base-load power. Taking account of 8% transmission and distribution losses and a barely 60% nuclear capacity factor to date, this is roughly equivalent to the output of 2GW of installed nuclear generating capacity. However, if the extra cost is £20 per appliance, or about £30 per household on average, the 'conservation power plant' would cost about £700 million, four times less than the central power station and with no running costs.

The other major electrical appliances, and lighting, would give the same basic picture. The constant development of better, cheaper energy-efficient technologies can only increase the potential.

PUBLIC PRESSURE HAS FORCED POLICY CHANGES

The last ten years' experience suggests that a public movement to force national electricity supply organisations to change direction is absolutely essential. This could be said to have happened to a significant extent in the US, to some extent in Denmark and West Germany, and rather less in the UK and France.

Experience also suggests that the structure of the electric utility industry has an influence. The key determinant seems to be less whether electricity supply is publicly- or privately-owned as whether it is self- or externally-regulated. Perhaps the extremes are France or the UK, versus Denmark or California. Countries where electricity generation and distribution is a nationalised monopoly - the UK, France and Italy - or where private, unregulated companies own part of the grid, eg West Germany, seem slow to accept that investment in electricity-efficiency could save everyone money.

The Danish electricity industry has an extremely complicated structure - municipalities distribute most of the electricity; regional consumer-owned co-operatives own most of the power stations and the national grid.

California has a mixture of regulated, investor owned utility companies, municipal utilities and rural co-operatives. Their public utility commission originally ordered private utilities to finance energy efficiency. Likewise, in regions of the US with municipal ownership, and in the Netherlands and Denmark, local governments seem able to force their utility departments to take account of the voters' wish for a change in policy.

Progress under these regimes has been somewhat greater, and has showed that efficiency improvements can be deployed extremely rapidly - as with the US municipal utility which gave away free energy-efficient light bulbs, on the grounds that this cost less than buying electricity from outside the town, and literally replaced 57% of its incandescent lamps overnight.

So far, the concept of competition between electricity suppliers and the vendors of energy-efficient technologies does not seem even to have entered the UK debate over privatisation of electricity. With the CO_2 problem looming even larger, it is inexcusable to impose a structure and regulatory regime which all but ignores the scope for more efficient electricity use.

The present privatisation plans are a missed opportunity. They needlessly introduce potential conflicts of interest, making the regulator's task more onerous. UK consumers' future electricity bills would be far lower if the new distribution companies had to contract for the supply and/or saving of electricity on the best terms, in order to provide electrical services at the lowest possible cost.

DAVID OLIVIER is Principal of Energy Advisory Associates, and consultant to the Open University.

Water Power Barriers

As small-scale water power is becoming more attractive, the institutional and regulatory obstructions to new installations are becoming more apparent. In his second article GEORGE CHAPMAN suggests how the unfair planning and tariff systems could be amended to the benefit of the private producer.

The 1963 Water Resources Act effectively nationalised water. However, no account was taken of energy users. The Act defined "abstraction" (of water from a source), but the definition has not yet been tested to specify water power use as "abstraction". In common sense terms, generally it is not. Some Water Authorities have insisted that it is, and have prevailed upon commercial users to pay per cubic metre used. Domestic and farm users thankfully are at present exempted.

In 1987, an appeal against Severn Trent Water Authority over water charges which might render a plant uneconomic was upheld. It is to be hoped that the next revision of water law (not necessarily at the same time as privatisation) will remove this imposition. The National Association of Water Power Users (NAWPU) is pressing for a system of registration for small abstracters not to impose unreasonable burdens.

Generally you will need Planning Permission and Water Authority agreement to your proposed hydro power scheme. Once it is completed, and you have sent the final postcard off to the Local Planning Authority, the Local Valuation Officer will appear to value it for rates.

UNFAIR DISCRIMINATION ON RATES

For years power generating plant has been assessed for local authority rates, as the machinery is seen as being 'part and parcel' of the property. The Association of Independent Electricity Producers (AIEP) and NAWPU see this as unfair discrimination - other manufacturers' machinery is not rated. The CEGB currently enjoy a special low rateable value of £1.16/installed kW, compared with up to £50/kW for a private hydro plant. After April 1990 the low rate should apply to independent grid suppliers, but those who don't supply the grid may continue to attract the high rate. If Government really believes in competition and promoting small business, then the political will must overcome the adinistrative 'wont' which is the present hindrance.

In England or Wales, if you have a surplus to sell you will find that you are paid rather less than the Area Board pay the CEGB. (The Scottish Boards also pay less.) There are complicated sums involved, but basically it is because the CEGB so arrange their Bulk Supply Tariff that the Area Boards have little option but to set low purchase rates for independently generated electricity. This discourages competition, and is being vigorously attacked by the AIEP and thers. However, independents tend to be paid more at peak periods, so if your system has a reservoir, arrange to supply the grid when the price is highest, and have your breakdowns at night!

The political battles to obtain a fair price for independent electricity, and a fair deal for water

power users, look like dragging on for a while yet: politicians are quick to speak but slow to act, and are usually restrained by civil servants who are equally reluctant to actually do anything.

A hundred years ago each mill was able to call upon a millwright for manufacture and repair. However, the design and construction of modern hydro plant requires specialised engineering knowledge and experience of a higher order, and although this will be less for a smaller plant, the cost of hiring competent consultants will be high in either case, and will be a larger proportion of the total cost for the smaller plant.

Added to this, the UK hydro power market is small and is positively hindered by governmental obstruction. So there are few firms interested in working on schemes under 100-200kW, 2 or 3 at most. This has resulted in many sites being redeveloped by their owners. Working or retired engineers are in a stronger position than absolute beginners, and several have occupied their retirement happily and usefully both for themselves and for others. Of the 4 or 5 UK firms making or marketing small machines, 2 or 3 will undertake complete installation.

There are also a couple of firms who restore old machinery and sometimes modernise hydro plant. And there are at least 3 organisations who offer a fully qualified consultancy service, at a price: Salford University, Northumbrian Energy Workshop, and the National Centre for Alternative Technology.

The best advice I can give is: visit existing sites; talk to turbine and wheel makers; find local people able to work as millwrights; and join NAWPU to obtain the benefit of contact with our members and experts, and to help in our quest for protection from governmental restrictions.

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Renewables Appraisal

Biomass is "one of the most relevant renewables for the UK," according to the recent report on Alternative Sources of Energy from the House of Lords European Communities Committee.

Although it offers the potential to contribute 10% of the UK's primary energy requirements, equal to 3 Sizewell Bs, its funding has been "modest", said the Report. It has attracted only 6% of UK renewables R&D funding since 1986, whereas the European Community expends 25% of their renewables budget on biomass.

The Lords also raised the question of whether the environmental benefits of biomass, especially in the case of landfill, mean that it should be treated differently from other renewables: "Exploitation of landfill gas should be considered mainly as a solution to waste disposal problems."

Tidal barrages also promise to make a significant contribution. However the Committee expressed concern that "although the technology itself is 'clean', construction of a major barrage might have considerable adverse effects on the environment," although they acknowledged that wider regional benefits may arise from tidal power schemes, but felt that more studies are required to establish the extent of possible benefits.

Geothermal energy also offers a significant contribution. Hot Dry Rocks (HDR) could, optimistically, provide 10-15% of the UK's energy needs, but "There can be no commercial investment unless a legal right to the the HDR is established," warned the Report. Every country using geothermal energy has drawn up special legislation, but until a sufficiently large resource is identified, the UK Government are unwilling to act. This is clearly a case of trying to put the cart before the horse.

The money required to identify a large resource will not be forthcoming from financial institutions until the legal uncertainties, concerning who owns the heat, are cleared up.

The Committee were slightly bemused at why the Camborne School of Mines project, recently granted £8.15 million, are concentrating their work at a depth of 2km, when no commercial exploitation is likely at such a depth. They concluded that, "the major extra expenditure needed to pursue work at a depth of 6km will have to be faced, to see whether commercial exploitation is viable."

Renewables should be compared fairly with other sources of energy, and the evidence received by the Committee suggests that this is not being done.

The Nationalised Industries Act instructs that the CEGB achieve a rate of return on investment of 5%. However in recent years they have achieved only 2.75%. Renewables, which the Government insist must be promoted in the private sector, require to meet the commercial rate of return of 12%. The Lords commented that applying the commercial rate to "nuclear and coal generated electricity claimed to be 3.1p and 3.4p/kWh respectively at the Sizewell inquiry, would more likely be about 4.5-5p/kWh."

"It is certain that in the long term fossil fuels are finite. Renewables would also become more attractive if nuclear energy was to cease to be politically acceptable. A further political factor is the risks of pollution from conventional sources," the report concludes.

	Potential Contribution to UK Energy Demand (Full Resource Extent) (per cent)
STPG (from Severn and Mersey Barrages alone)	6–7
Professor Salter (from wave energy alone)	25
Biomass	12
Geothermal (HDR)	10–15
CEGB estimates:	
On-shore wind	20
Off-shore wind	100
Tidal power	16

Wave Scandal

A consulting engineer has claimed that his report on wave power technology developed at Edinburgh University was significantly altered before being submitted to the Department of Energy (DoEn).

The report, written by Gordon Senior for engineering consultants Rendel Palmer and Tritton (RPT), was submitted to the DoEn just before they made their decision on continued funding of the Stephen Salter's 'nodding duck', which was designed to harness the considerable wave power off north west Scotland. Funding was cut to zero.

Senior alleged to the House of Lords European Communities Committee that his report had been altered after he had submitted it to RPT: "Most of the text of the report was as I had drafted, but the key conclusions had indeed been changed and even reversed."

Senior objected to RPT, demanding that his views be made known to the DoEn, but he was warned that this would not be done and that he was bound by client confidentiality to RPT not to reveal his disagreement.

However he informed the Lords that, "It was and still is my considered opinion that some of the conclusions in the report on the duck device as submitted to the DoEn cast unfair doubts on its long term viability."

RPT claim that Senior is "competent", but "no more so than some half-dozen other members of our team ... who all had longer standing familiarity with the engineering of Stephen Salter's ducks."

Salter believes the report was only one link in a chain of events which led to the Government's decision to cancel his funding.

The investigation into the economic viability of wave power was conducted by the Energy Technology Support Unit, who come under the wing of the UKAEA. Salter believes they are biased against wave energy because they fear that it undermines the case for nuclear power: "I think we need to have an inquiry to expose what happened over wave energy, so in future we can make better decisions."

The DoEn told SCRAM, that they are making "no comments" on the story, and that they have no intention of investigating the allegation.

Wind Doubts

The imminent privatisation of the National Engineering Laboratories at East Kilbride has cast a shadow of doubt over the future of the National Wind Turbine Testing Centre.

The Centre which is run under the auspices of NEL, who are in turn responsible to the Department of Trade and Industry, is a focal point for wind turbine R&D in this country.

However, not only do they provide valuable expertise to the fledgling wind industry in the UK, but they are also involved in international discussions to formulate safety standards for wind turbines in the European Community. George Elliot, the Centre's leader, believes that "it is vitally important that there is somebody independent of the commercial sector who can take a sound technical viewpoint."

Elliot is nervously optimistic that there will be a future, but he is unsure whether the Test Centre will be part of the sales package - it may be sold separately.

If the intention is to sell the Test Centre separately, Elliot is uncertain that there would be a buyer. Although the Government have always intended that the Centre should eventually become self funding, Elliot feels that they are "forcing the pace."

"In a privatised world we would need to get paid for our research. We would like to think that contracts would be forthcoming from the Government, or indeed the Department of Energy," Elliot told SCRAM. He believes the Centre will need to shift their focus of attention towards "activities you can get paid for."

The logic that industry should finance research centres is all well and good if all you are interested in is short term financial gain. However, if you bear in mind what is in the public interest, as government should, it would be folly to place the responsibility for research and development in private profit motivated hands.

Energy is a vastly complicated arena which requires planners to think at least 50 years into the future. This appears to be beyond the scope of industry in this country.

Greenhouse Fears

"Humanity is conducting an enormous, unintended, globally pervasive experiment whose ultimate consequences could be second only to global nuclear war," reads a statement issued at the end of the Toronto Conference on the Changing Atmosphere.

"The earth's atmosphere is changing at an unprecedented rate by pollutants resulting from human activities, inefficient and wasteful fossil fuel use, and the effects of rapid population growth in many regions," continues the statement, which was signed by 330 scientists and policy makers from all over the world.

The conference warns that unless action is taken now, the world's temperature will rise by 1.5-4.5° C. The results will be disastrous: flooding of many coastal areas and the loss of considerable areas of farm land.

The statement outlined an action plan to minimise the impact of the greenhouse effect. It includes a 20% cut in emissions of carbon dioxide by 2005, ultimately leading to a 50% reduction which the conference believes would be sufficient to stabilise the atmospheric carbon dioxide.

Conference delegates called on the United Nations to draw up a "Law of the Atmosphere", which could be ratified at the proposed Conference on Sustainable Development in 1992.

Unfortunately, as well as proposing greater reliance upon alternative energy sources to coal, they, perhaps predictably, suggest that the nuclear option should be revisited, provided existing safety problems can be overcome.

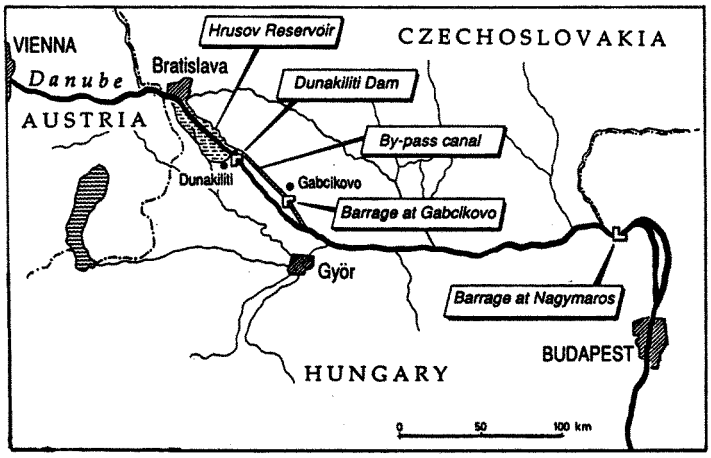
Danube Blues

Opponents of the planned Nagymaros dam and power station on the Danube (SCRAM 63) are preparing to make a final appeal to the Hungarian Government, armed with the results of a hydrobiology study which concludes that the project would result in an ecological disaster.

Within 2 years of the dam becoming operational the fish population of the river will be decimated, says the report. Environmentalists are concerned that the river's ecology will be severely damaged by organic and metal pollution currently filtered by the Szigetoz shallows, which will be by-passed.

Environmentalists, backed by almost 50 Hungarian MPs, have until October, when the Austrian contractors are due to start work, to force the Government to call a halt to the scheme.

In response to the report produced by the Laboratory for Fishery and Hydrobiology in Bratislava, which implies that the Government have been aware of the scheme's consequences since 1981, the Hungarian Environment Ministry have commissioned an independent study. The study is to be concluded in time for a Parliamentary Debate in September.



Although the Czechoslovaks are nearing completion of their section - the project is a joint venture, with a 769MW station being built in Czechoslovakia - the station cannot function without the dam at Nagymaros.

The newly formed Nagymaros Action Committee are organising a Conference, to be held in Budapest on 2 September, which has the support of the World Wildlife Fund, will be attended the Hungarian Academy of Sciences.

Following the conference the Committee will hold a series of public meetings culminating in a mass demonstration in the Hungarian capital on 12 September. Many observers feel this could turn into the biggest civil disobedience campaign Eastern Europe has ever experienced.

Hungary is now in an unenviable position. If they do not meet their side of the deal, not only will they be liable to pay over £600 million in compensation - £335 million to Czechoslovakia - but they could also suffer the flooding of the northern Hungarian plain.

Humber Barrage

A £60,000 pre-feasibiltiy study is being conducted into the possibility of siting a tidal barrage across the Humber estuary.

The project is being promoted by the Association of Yorkshire and Humberside Chambers of Commerce, who hope that constructing a barrage will help counter the effect of the Channel Tunnel in 1993, which they fear will result in even more commercial and industrial activity being drawn south. So far they have collected over £90,000 from local businesses, most of whom stand to gain from the construction of a barrage, such as Alfred McAlpine plc and the British Steel Corporation.

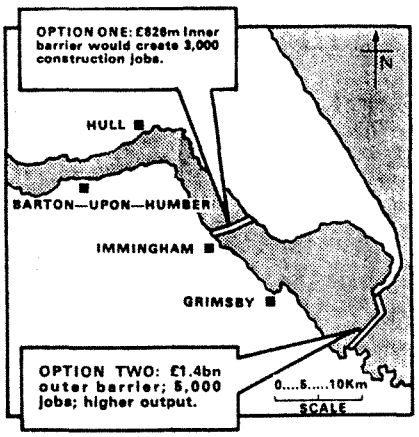
The barrage's promoters believe that the increased low water levels and reduced tidal currents would "encourage private shipping and industrial development at the area's four major ports - Hull, Grimsby, Immingham, and Goole - as well as any enterprising wharves along the rivers Trent and Ouse."

As yet no potential site has been identified , but they are considering two nominal barrages to give an indication of the costs involved - a four and a half mile £1,400 million barrage from Spurnhead to the east of Cleethorpes, and a smaller £826 million unit east of Immingham.

Electricity is not considered as the prime motivation, but as a "very valuable by-product." They estimate that between 3000 and 5000 jobs would be created during the initial construction phase, with a further 1500 to 2000 posts being created in the support industries.

A smaller but similar tidal barrage at La Rance in France attracts 250,000 visitors a year. The Association "anticipate" that their larger barrage could attract 500,000 visitors a year. They intend to exploit this potential to the full: "Boating, yachting and aquatic leisure industries would quickly expand in what would be one of the country's largest 'inland' lakes, adding to the tourist and environmental attraction."

The proposals for barrages across the Severn and Mersey have already raised the hackles of the bird lobby. Martin Davies, the East Midlands officer for the RSPB, has written to the Association on several occasions to stress the international importance of the estuary. Over 85,000 waders winter there each year, and 17,000 wildfowl also use the estuary.



"If this thing does go ahead, there are some serious implications for the Government," threatens Dave Pritchard of the RSPB's conservation planning department. "The UK are under more than one international obligation to protect the Humber estuary, and if its planning division does allow the barrage to go ahead it will be in breach of the European Community Directive on bird conservation, and there is also the Ramsar Convention," Pritchard told SCRAM. Both of these agreements apply equally to the Severn and the Mersey. The Directive is binding on the Government, and if they breach it the RSPB would not hesitate to take their case to the European Court of Justice.

Peter Hill of the Scunthorpe Chamber of Commerce, who first suggested the barrage, told SCRAM that he is more interested in "migrating people than migrating birds."

If the results of the prefeasibility study prove favourable, the Association hope to receive 50% to 70% funding towards the costs of a full £500,000 feasibility study from the Government and the EEC.

CHP: Newcastle

Tyne and Weir Development Corporation are studying plans for an £80 million CHP station near the centre of Newcastle.

The project, which has the support of the City Council, is being promoted on "an entirely speculative basis." No appeal will be made for public funds because it would slow the project down, according to Ian Burdon, an associate of Mertz and McLellan who are promoting the scheme with NEI, Sir Robert McAlpine and Press Construction.

The project would be "a showcase for the region," and "environmentally clean," said Burdon. "Visually we are looking to create something very striking which will enhance the area. It will be beneficial to the community, generate employment and bring work to local firms," he added.

The Corporation are expected to reach a decision on the scheme during September. If agreed, the plant could be operational by 1992.

Renewable Energy Development Agency

The second reading of a Bill calling for the establishment of a Renewable Energy Development Agency, proposed under the 10-minute rule, has been consistently blocked by the Government.

Frank Cook MP, the Bill's promoter and vice chair of the Parliamentary Alternative Energy Group, called on the Government "to establish an independent agency responsible directly to Parliament for the research, development, application, demonstration and monitoring of clean renewable sources of energy together with ways and means of proving and improving techniques of energy efficiency and fostering their positive adoption."

The Bill highlights the environmental problems of both fossil and fissile fuelled power stations as justification for increased effort into exploiting renewable energies.

In his speech to Parliament on 7 June, Cook also expressed his concern over the way in which the UK has pioneered both energy efficiency and renewable energy research, only to have the fruits of this labour wasted by the Government, and the spoils go to other nations. As an example he cited the successful Norwegian wave power programme which is using proven British technology.

Cook recognises that renewable energy's major competitor, in terms of a privatised industry, is nuclear power, and he compared their respective research and development spending in his brief speech.

ETSU, the Government body with responsibility for the promotion ot renewable energy, as a subsidiary of the UKAEA, are not in a position to promote renewable energy sources adequately, especially post-privatisation when nuclear and renewables will be in direct competition with each other.

Cook believes this question must inevitably be faced, and hopes opinion will come down in favour of setting up the Agency.

A Naval Nuclear Port: The Costs to Rosyth. Greenpeace. 36pp, £4 + 40p p&p.

Deadly Defense by the Radioactive Waste Campaign, 625 Broadway, 2nd Floor, New York, NY 10012. 169pp, $15.

Two campaigns, one here in the UK and one in the US, have recently launched attempts to alert the public to an important and often overlooked issue in the nuclear weapons debate - the environmental damage caused in the name of national security.

Greenpeace launched their report on Rosyth in July, closely followed by similar reports on the Clyde and Devonport.

Rosyth is used for refuelling and refitting of nuclear powered submarines. It is also the home of four Type 42 Destroyers which are capable of carrying nuclear depth bombs for use by helicopters. Rosyth is also the temporary graveyard for HMS Dreadnought, the first of Britain's nuclear powered submarines to be decommissioned.

There are many parallels with the UK civil nuclear industry, but the problem is that the military wing is shrouded in even more secrecy. The nightmare is that mobile nuclear reactors are frequently floating right into the middle of urban areas.

The Navy has 19 PWRs in its fleet, with another 3 expected to join by the end of the 1990s, as well as 3 research reactors. By the time one of these floating reactors reaches Rosyth for refuelling, it has a core full of dangerous fission products.

As well as reactor accidents, there is always the danger of a weapons accident. As with power stations, serious accidents are discounted as incredible; the emergency plans are totally inadequate, only requiring evacuation from the Rosyth site, yet independent studies have shown that thousands of casualties could result from an accident and Edinburgh, just across the Forth, might have to be evacuated.

Although routine emissions from submarines have not produced high concentrations of radiation in the Rosyth area, there is a high incidence of leukaemia and many workers have exceeded limits.

The report highlights the problem of decommissioned nuclear submarines. The UK Government would prefer to dump them at sea, but this would set a precedent for the 544 nuclear power reactors at present powering vessels at sea which will be decommissioned over the next 25-30 years.

Deadly Defense looks at the nuclear weapons factories themselves, "slow-motion bombs" which are polluting the US environment with radioactivity. This ongoing disaster has reached epidemic proportions - not the result of a sinister foreign power, but as a by-product of a secret and dirty programme to produce 3-10 new nuclear weapons every day.

The report is a triumph of effort which pulls together hard-to-find information on a massive industry that has operated in virtual secrecy for decades. At every nuclear weapons production site in the US, groundwater, soil and air pollution is the norm.

"Environmentally we cannot survive peace the way we are now practicing it - in perpetual preparation for war."

The pollution of the air can be stopped; irresponsibly dumped waste can be exhumed and packaged; but contamination which has leaked into aquifers is irreparable. Aquifer after aquifer throughout the country is at risk. The water supplies of whole cities are in danger.

Hopefully these two reports will raise public awareness on both sides on the Atlantic about the dangers of floating nuclear reactors and nuclear weapons production, and add the voice of environmental sanity to the growing international desire to rid the world of nuclear weapons.

PETE ROCHE

(For a full list of Greenpeace's Nuclear Free Seas Campaign material, write to 30/31 Islington Green, London, N1 8XE).

Our Common Future: A perspective by the United Kingdom on the Report of the World Commission on Environment and Development. 64pp. Free on request from the DoE.

According to this pamphlet, produced by the Department of Environment, "UK Energy Ministers took a leading role in developing environmental conclusions at a meeting of the International Energy Agency in 1985, which emphasised the need to give proper weight in programmes of research, development and demonstration to technologies to promote:

1) the more efficient use and conversion of energy;
2) the combustion of coal or its conversion to other forms of energy in an environmentally acceptable manner;
3) the safe disposal of nuclear waste; and
4) renewable sources of energy which are environmentally acceptable and economically competitive."

Nothing new in this, but it is interesting to see them laid out in this way. How far have we gone towards reaching any of these goals?

1) there is no real Government support for Combined Heat and Power/ District Heating projects, and the Energy Efficiency Office is no more than an under-funded joke;
2) the Government are not funding research and development into advanced combustion techniques;
3) the Government set up NIREX!
4) they closed down the wave power programme just as it was reaching the point of commercial viability - the annual Government funding of renewable energy sources is pitiful.

To look at all the fatuous statements made in this horrid little booklet would take up more space than this review has been allocated. It is perhaps suffice to say that this document does not instill me full of optimism for the future of the environment in this country.

By the way, readers will be interested to note that Mrs Thatcher endorses "the concept of sustainable development."

MIKE TOWNSLEY

Renewable Energy - An Educational pack for use by teachers and students. Jan Goldsmith, NATTA, 33pp, £2.50.

Whatever we may think of them, the new courses for 14-16 year old school students are with us both in Scotland and England. Bringing new courses into schools always means extra workload for teachers who are therefore keen to get ready made, well produced and presented teaching aids.

In this context Jan Goldsmith's booklet has been produced at just the right time. The competition from the nuclear industry and its friends for classroom time is intense. They have the resources at their disposal to make sure that their point of view is readily available for all students. Many science and technology teachers are looking for useful alternative sources.

It is unfortunate therefore that this booklet falls short of requirements. As it is due to be revised shortly I hope that the new edition will avoid some of the pitfalls into which this one has fallen. Teachers and and their students need attractively produced materials which are interesting and stimulating for the more able, and yet at the same time accessible and understandable by the less able students. Teachers, asked to teach about renewable energy perhaps for the first time, need back-up teachers notes to help them with background information, worksheet preparation, suggestions for extension material sources and so on.

NATTA say that the booklet is aimed at the 12-18 year age group which is perhaps too wide a spread. Concentrating on say, the 14-16 range would be more feasible, and the vocabulary and language style could be more carefully adjusted to the needs of the students. The allegorical kids story that forms the first part of the booklet may appeal to 12 year olds (though I personally doubt it) but will be off-putting and patronising to the least sophisticated 18 year old.

Science and technology teachers everywhere welcome the presence of NATTA in this area. Many must sincerely hope that the new edition of this booklet will appear in a more usable form. There is a large void here waiting to be filled and NATTA are the right people to do it.

TIM PUNTIS

EEC Environmental Policy & Britain, 2nd Edition. Nigel Haigh. Longman, 1987. 380pp, £25.

This is an update of the Haigh volume of the same name which was published in 1984. It covers all European Community environmental legislation, grouping them together by subject matter: water, waste, air, chemicals, wildlife and countryside, noise, and environmental impact assessment.

Those involved in the energy debate will find much of the information contained within this volume of great use, especially as European environmental policy seeks to supersede home grown policy, and unify environmental protection in the member states (just as the Community seeks to unify the trade market by 1992).

Each chapter tackles the different legislation from its origins, giving a brief description of the philosophy behind its need, and charts the often long and protracted debates within the Council of Ministers, on which each member state is represented. The workings of the European Community are complicated; and anyone wishing to understand the significance of any single piece of legislation will find this volume invaluable as a reference text, and a good place to start when considering any environmental problem.

This book is extremely well written and researched. It is certainly worth the money. Its insights into the complexities of agreeing common legislation provide information on the attitudes of the member states.

MIKE TOWNSLEY

The Realities of Nuclear Power: International economic and regulatory experience by S D Thomas. Cambridge University Press, 1988. 289pp, £35.

This is a book to give someone who has been in a coma for 10 years and missed the development of the nuclear debate. It is academic but not too jingoistic. It strives to be impartial but frequently uses sentences like "industry, utility and government sources have often been biased and have tended not to come to conclusions which might ... undermine the existing policy position."

Only 4 countries - Canada, France, USA and West Germany - are studied. Because "published information and in-depth analysis of the factors underlying Japanese decisions" was "difficult to obtain," Japan is not examined. This is unfortunate, since it results in the book dealing with what is easiest to find rather than breaking new ground.

The fuel cycle, reactor servicing and decommissioning are not central themes of the book: "It will not be until the first crop of commercially-sized reactors (over 500MW capacity) become due for retirement early in the next century, that the economic and environmental impact of decommissioning can be judged." Can we wait, I ask myself?

This book may help anti-nuclear lobbyists to talk to Electricity Boards in terms that objectify the argument into economic areas rather than the more usual "its centralised and dangerous" territory. On the other hand, the nuclear industry could use it to take a closer look at what they are doing, and whether they are actually learning in the process.

It is a readable survey of nuclear power in four countries which are not Britain, so may be used to broaden the knowledge of people on all sides of the debate.

LINDA HENDRY

We have been asked to point out that the book **Chernobyl, Law and Communication,** briefly reviewed in SCRAM 66, is more than "simply a collection of the full texts of the 23 international treaties covering nuclear acci dents with transboundary effects." As well as the texts, which are collected together for the first time, the book contains many pages of useful editorial comment, which outline each treaties' basic provisions and give some background.

The book will be particularly useful for anyone, with or without a legal background, interested in the affects of a nuclear mishap, who would wish the Government to honour its international commitments. It is available from Grotius Sales Dept, PO Box 115, Cambridge, CB3 9BP.

LITTLE BLACK RABBIT

Lord Marshall was in good spirits at the launch of the CEGB annual report, despite their reduced profits. He was still capable of embarrassing the Government.

He was asked for his thoughts on the future potential of combined heat and power/district heating. It would be successful provided two conditions are met: a) the disappearance of British Gas plc, and b) the abolition of democracy.

Little Black Rabbit wonders if this is the same Walter Marshall who, as chair of the 1979 CHP Group (Energy Paper 35), recommended that for CHP to be established "the gas and other industries (should) continue to offer their fuels on the same terms as ... if the CHP scheme had not been there," and CHP should be geared to "the Government's initiatives for the regeneration of inner-city areas ... since these initiatives could help minimise conflict on the issue of freedom of choice."

LBR is not quite sure what to think of soil scientists; after all they dig holes in places suitable for new burrows, making it harder for homeless rabbits to find accommodation. But Dr Barry Matthews is a friend.

Dr Matthews was sacked in 1980 from his MAFF-sponsored soil survey job, after a casual chat about radiation on the beach at Seascale.

He must have felt good to get back at the Ministry who had precipitated his unemployment when, in 1987, he drew their attention to the possibility of high deposition from Chernobyl in the Skipton area.

The Agriculture Select Committee heard that Dr Matthews believes MAFF were irresponsible not to seek his opinion after Chernobyl, even though they knew he had mapped soils and vegetation in Cumbria and the Pennines; and because they did not admit there could be existing contamination from other sources before the Chernobyl accident.

Are the councillors of the Nuclear Free Capital of Scotland aware that their eponymous warship is nuclear capable? On leaving the public meeting in Edinburgh City Chambers at which Greenpeace launched the public phase of their 'Nuclear Free Seas' campaign, LBR noticed a painting of HMS Edinburgh, a Type 42 destroyer, occupying pride of place at the top of the staircase.

Apart from the nuclear missiles we all know about, such as Trident and Polaris, Britain has between 140 and 150 torpedoes, depth charges and anti-missile missiles. The Rosyth naval base, just 15km across the Forth from Edinburgh, is home base for four Type 42 destroyers, ships which sometimes carry nuclear depth charges in peacetime.

LBR has discovered that the controlling Labour Group considered the status of the painting

but, when they checked, the Navy were unable to confirm or deny that nuclear weapons were on board. So the City Fathers let the matter drop ... until such time as they could confirm the presence of nuclear weapons.

According to a nice propaganda piece on Torness in the **Scotsman** in July no-one as yet has become contaminated at the station.

However, a health physics engineer at the station, Janice Newbigging, has experienced contamination in an earlier post with the electricity industry. But she's not worried: "You just wash it off. There's a laundry on site and you just leave your clothes there. They get a normal wash and when you get them back everything's fine."

Somebody should have told the Soviets: thousands of twin tubs could have been installed at Chernobyl to remove the radioactivity. It could have helped their economy too.

Stop Hinkley Expansion's Safe Energy Petition has been banned from Woodspring District Council property - by council officers. The Council have decided not to join the consortium of local authorities opposed to Hinkley C.

However, in July the Council played host to the CEGB's 'Fuel of the Future' exhibition marquee. Mr Moon, the Council's Chief Executive said, "We have allowed the CEGB exhibition here, which was simply an explanatory exhibition putting their point of view, and we felt in order to maintain our neutral stance on this we should allow the anti lobby the same facilities.

"In other words, they can put an exhibition up and explain their position to people, but we didn't want them to be pressurising people to take action, or to sign petitions, or make representations or anything of that kind."

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