THE SAFE ENERGY JOURNAL

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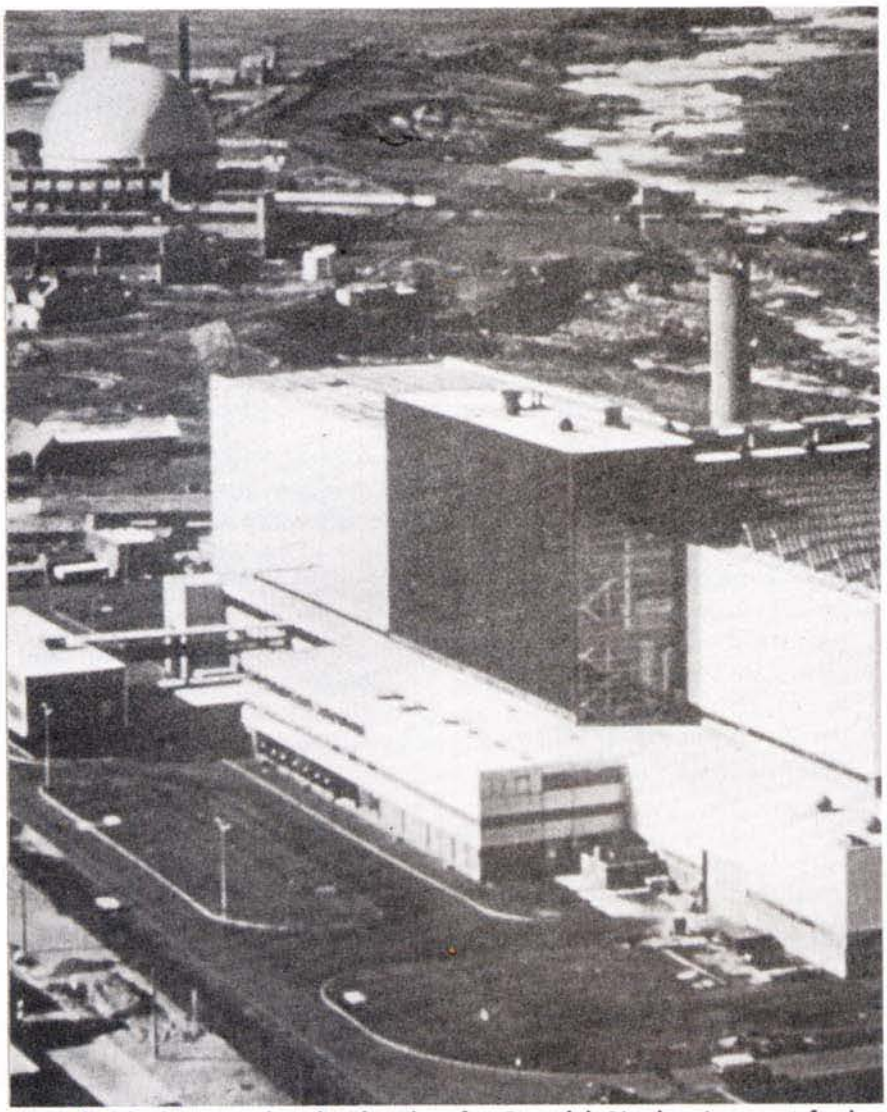

Sellafield, the surprise destination for Scottish Nuclear's spent fuel. Editorial p3, Nuclear News p7.

Scottish renewables order

• Graham Stein assesses the order for renewable energy in Scotland (p12)

Decommissioning nuclear submarines

• William Peden describes the dilemma the MoD has created for itself (p10)

Non-Proliferation Treaty failing

• Pete Roche reveals inadequacies as failure haunts the NPT (p16)

Vietnamese hydro schemes

• Dr John Green examines rural hydro schemes in Vietnam (p 8)

Breathing Wall technology

• Warren Canham on new building design for energy efficiency (P 15)

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Q Which company spends taxpayers' money to promote half truths and untruths ?

Q For how long does nuclear waste remain deadly?

- **A** Decades? ❑
- **B** Centuries? ❑
- **C** 240,000 years? ❑

A *Nuclear waste containing plutonium 239 remains deadly for at least ten times its half life – that's 240,000 years.*

Q Which of the alternatives to fossil fuels emits most carbon dioxide?

- **A** Hydro power? ❑
- **B** Wind power? ❑
- **C** Nuclear power? ❑

A *Using current technology, and including construction and fuel production, nuclear power emits about three times as much fossil fuel generated carbon dioxide as hydro and four times wind power for the same amount of electricity.*

Q How big was the government debt write-off given to Scottish Nuclear in 1990?

- **A** £13.7 million? ❑
- **B** £137 million? ❑
- **C** £1,370 million? ❑

A *In 1990 the government decided to write off the money Scottish Nuclear owed to the taxpayers — a total of almost £1.4 billion.*

Q What percentage of the UK government's energy research and development money has gone to nuclear power over the last fifty years?

- **A** 30%? ❑
- **B** 50%? ❑
- **C** over 70%? ❑

A *Despite all the other technolo gies —clean coal, oil, gas, wind, wave, hydro, tidal, solar, geothermal — nuclear power has taken more than 70% of the total budget. The precise figure is unknown because of the military links with civil nuclear power.*

Q What percentage of total electricity generating capacity in Scotland is nuclear?

- **A** 53%? ❑
- **B** 43%? ❑
- **C** 23%? ❑

A *Although around half our electricity currently comes from nuclear power, this is due to restrictive contracts placed on Scottish Power and Scottish Hydro Electric which forces them to take all Scottish Nuclear's output, even though they could use their own power plants at a lower cost. Only around 23% of Scotland's generating capacity is nuclear.*

Q How much does electricity from nuclear power actually cost?

- **A** Too cheap to meter? ❑
- **B** About the same as coal? ❑
- **C** Who knows? ❑

A *Nuclear power is more expensive than coal, gas or hydro. Scottish Nuclear is paid over 3p per unit of electricity — the actual price is 'commercially confidential' — andt he real cost is much higher once various hidden costs and the unknown costs of decommissioning are included.*

If the above has brought you down to earth with a bump, more information can be obtained from Safe Energy, Friends of the Earth Scotland, 72 Newhaven Road, Edinburgh, EH6 5QG.

A

Scottish uNclear

Scottish Nuclear fails to come clean

WHEN environment secretary John Gummer announced, on 21 February, that *"siting of drystores for spent nuclear fuel should be a matter for the commercial judgement of the operators ..."*, it was widely assumed that a drystore at Torness was on its way. Especially as the announcement had been made ahead of the nuclear waste review being undertaken by Gummer's department. It came as quite a shock, therefore, when one week later Scottish Nuclear held a press conference to announce the ditching of plans for on-site dry storage, and had signed a £4 billion deal with BNFL, for storage at Sellafield and increased reprocessing at Thorp.

During four years of detailed work and a public inquiry, Scottish Nuclear argued that dry storage was the best environmental option. It has now turned its back on the environment. Journalists and observers were left puzzled by the U-turn; the information revealed at the press conference just didn't seem to add up. What lay behind the phrase: *"Other details of the package are commercially confidential."* And why, when both companies are publicly owned, is such secrecy necessary or allowed? Further information has emerged, going some way to explaining the deal.

Once Scottish Nuclear's ambiguously worded press release was decoded, it became clear that the contract was primarily about reprocessing: 2,398 tonnes of spent fuel in all, including 700 tonnes from Hunterston A. And even the 1,044 tonnes to be stored at Sellafield under the deal may be reprocessed— James Hann, SN's chairman, is giving no assurances to the contrary.

Scottish Nuclear had made much of the fact that on-site dry storage would save the company £45 million a year compared to reprocessing at Sellafield. The new deal with BNFL will, it is claimed, produce similar savings plus *"other substantial benefits which will not appear immediately in the accounts"*.

James Hann has brought hard-headed private sector nous to the nuclear industry, and has played a clever game. Development of the drystore option, and a threat to go to Japan for fuel supplies, left BNFL with little option but to slash its fuel cycle prices in a desperate attempt to bolster Thorp, which recently had two reprocessing contracts from German companies cancelled. But there is no way such a deal was negotiated in just one week; many people, especially those who were involved with the public inquiry into the Torness drystore, and possibly even Gummer, feel used by SN; just pawns in a bigger game.

The deal comes before the outcome of the Department of Environment review. The statement by Gummer ran to just three paragraphs, covering only drystores — there were no supporting documents for the decision. There has been no decision on the merits or otherwise of wet storage, nor, crucially, on storage versus reprocessing. SN and BNFL have pre-empted any decision Gummer's review may reach.

Risk business

The deal has been presented as fixed-cost, but allows for cost over-runs, to be met by whichever of the two companies is responsible for the increased cost of the work. Where cost escalation results from changes in government policy or the like, a *force majeure* clause dictates that the additional costs shall be met by both companies. SN and BNFL tried unsuccessfully to get the government to underwrite cost over-runs.

Given the risks and uncertainties involved in the nuclear industry, and the under-insurance, it is possible that a major problem could, in the absence of government underwriting, bankrupt one or both of the companies. Leaving the taxpayer to pick up the bill anyway.

One part of the deal that Scottish Nuclear isn't publicising is that BNFL has bought the rights to SN's drystore design, which considerably strengthens BNFL's future negotiating position, giving it effective control over both reprocessing and storage. BNFL has, however, said that it will be offering Nuclear Electric a similar deal to that signed with SN. BNFL may try to sell the drystore in other countries, especially Eastern Europe, or the plans may be put in a filing cabinet in the basement ...

Even after uncovering several key pieces of the jig-saw, it still seems that we aren't seeing the full picture. BNFL and Scottish Nuclear are public companies and their deal merits a full investigation by the National Audit Office.

Whatever the reasons for Scottish Nuclear's deal with BNFL, environmental considerations count for nothing, making a mockery of SN's expensive and extensive advertising campaign which seeks to portray it as a "very environmentally responsible" company. ❑

"Whatever the reasons for Scottish Nuclear's deal with BNFL, environmental considerations count for nothing, making a mockery of its expensive and extensive advertising campaign"

The Safe Energy Journal is the international magazine of Friends of the Earth Scotland's Safe Energy Project. Views expressed are not necessarily those of FoE Scotland.

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Outcry over leper ship

AS we go to press: a British ship loaded with Japanese high-level waste from France's La Hague reprocessing plant has left the French port of Cherbourg bound for Mutsu Ogawara in Japan, amidst growing opposition from countries en route.

The ship, the Pacific Pintail, owned by Pacific Nuclear Transport Ltd, is not capable of making the journey without refuelling unless it uses the Panama Canal. This has led to an outcry in the Caribbean.

The Trinidad & Tobago foreign minister, Ralph Maraj, warned: *"We're going to make a loud noise about this . We don't want this in the Caribbean at all."*

> ***"We're going to make a loud noise about this. We don't want this in the Caribbean at all"***
> Ralph Maraj, Trinidad & Tobago foreign minister

The Philippines, which lies on an alternative route, has also issued a strong statement. President Fidel V Ramos has instructed *"the Secretary of National Defence, the Secretary of the Interior and Local Government, as well as the Navy, Coast Guard and Maritime Police to take all appropriate measures to prevent the entry of such shipments into Philippine territory."*

Having called upon the governments of France, Japan and the US, all of which are implicated in the transports, to conduct and publish an environmental assessment for the transports and having received no reply, a consortium of groups — the Citizens' Nuclear Information Group of Japan, Greenpeace International and the US Nuclear Control Institute — commissioned it's own study.[1]

In the report, published at the end of last year, Dr Edwin S Lyman of Princeton University in the US catalogues a number of serious safety deficiencies: *"The level of safety provided by current international standards governing the sea transport of vitrified high-level waste is highly uncertain; the maximum allowable storage and transport temperatures [for the waste] are too high and appear to compromise safety; the procedure for determining the maximum allowable [radioactive] leak rate [from shipping casks] is obscure."* Lyman believes *"there are enough serious questions regarding the safety of sea transport of vitrified high-level waste to justify a postponement of the first shipment."* Lyman calls for an independent review which he says should be carried out by one of the states along the route. ❑

1 "Safety issues in the sea transport of vitrified high-level radioactive wastes to Japan" Edwin S Lyman. December 1994.

Labour's nuclear policy

LABOUR will not be reversing its opposition to building new nuclear power stations, according to party leader Tony Blair, despite suggestions from the party's energy spokesman, Martin O'Neill that nuclear power be part of Labour's energy policy in the run up to the next general election.

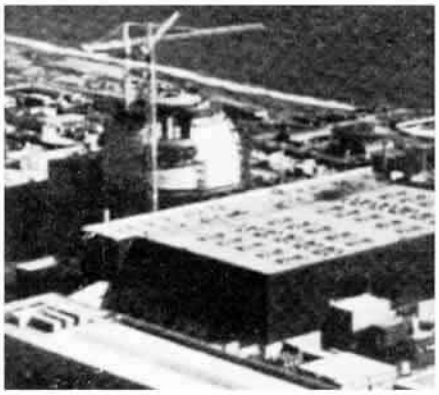
On BBC Radio, at the beginning of the year, O'Neill said that a committee reviewing the party's policy was considering a future role for nuclear power: *"Down the line, nuclear is a possibility, but it is a fairly remote one."* He warned: *"The energy choices we face four or five years from now are of a different order to the ones we had when we fought the last election."*

He said opposition to nuclear power was being undermined by limited prospects for gas-fired electricity and the declining role of coal stations caused by falling production and tighter pollution controls.

O'Neill's revelations added weight to fears that the party's resolve was weakening following the appointment, last October, of the pro-nuclear MP for Sellafield, Dr Jack Cunningham, as shadow trade and industry spokesman, with overall responsibility for energy.

At a meeting with six of the UK's largest environment groups — the Council for the Protection of Rural England, Friends of the Earth, Greenpeace, the World Wide Fund for Nature and the Royal Society for the Protection of Birds, — Blair, energy spokesman when Labour's anti-nuclear policy was agreed, gave assurances there would be no U-turn.

Greenpeace director, Peter Melchett, who attended the meeting, said: *"He made it perfectly clear that there was no going back on the policy of no new nukes ... He promised a major environmental speech soon. We look forward to it."* ❑



Sizewell B opens

FOR the first time in 40 years Britain has no nuclear power stations under construction. The opening of Sizewell B on the last day of January was hailed by environmental groups as the *"beginning of the end"* while the industry set out its Sizewell C stall in the 'City'.

Sizewell's operator, Nuclear Electric (NE), is trying to attract funds from the UK's private generators for a new reactor, arguing that it would be a good long-term strategic investment.

Optimistically claiming that the plant may provide a modest return, based on current market prices, NE stresses it would offer protection for utilities against a *"green shock"* — the possible introduction of carbon taxes or other measures to cut pollution from fossil fuels.

■ Meanwhile, the Tennessee Valley Authority (TVA) has stopped work on the last three nuclear power stations under construction in the US, one of which is 88% complete.

The publicly owned Authority says it can't afford to finish the reactors. Company director Craven Crowell said he was having one last look to find partners to fund the completion of the plant. However, he doesn't *"hold out much hope. It just costs too much to build a nuclear plant."* TVA is $26 billion in debt, $17 billion of which it attributes to its ambitious nuclear power programme which began in the mid '60s.

The decision was further prompted by the federal government's failure to establish a long-term storage site for the country's nuclear waste, leaving nuclear generators facing a large bill for interim storage.

TVA will now try to get its debt under control in anticipation of electricity industry deregulation. Crowell says that privatisation of the company is extremely unlikely because of its nuclear division. A familiar story. ❑

Protests over eastern promise

PLANS by the European Bank for Reconstruction and Development (EBRD), Euratom and the European Investment Bank to fund the completion of two Soviet-designed nuclear power stations in Slovakia have run into a storm of protest.

The two reactors — reported to be 85% and 90% complete — at Mochovce have become the focus for campaigns opposing the use of EBRD money to complete dangerous Soviet-designed reactors all over central and eastern Europe. The EBRD will vote in April on whether or not to contribute some £171.5 million towards the projected £540 million costs of finishing the plant.

While admitting the station would not be up to Western safety standards, much of the bank's case rests on a promise by the Slovakian government to close two dangerously decrepit reactors at Bohunice in exchange for completion of the plant, involving the fitting of western safety equipment.

In comparing completing the plant with building a new combined-cycle gas station the bank calculates the nuclear option is some £186 million cheaper over the lifetime of the station.

However, opponents of the plan, who include the Austrian government, the European Parliament (EP) and a horde of environmental groups, say the bank has failed to fulfil its obligations and that its economic appraisal of the project is seriously flawed.

Flexing its new political power as a member of the European Union (EU), Austria has threatened to withdraw its 2.3% stake in the EBRD if the project goes ahead.

Austria has further called for public hearings to be held in countries neighbouring Slovakia, as laid down in the EBRD's charter, before any decision is reached.

The EP's environment committee has called for a freeze on the project *"until the safety issues have been satisfactorily resolved."* Committee Chair Ken Collins MEP said: *"This is the first major loan for the construction of a nuclear power plant in central or eastern Europe. It will be a test case for the bank and it is therefore vital that there remain no doubts about the economic viability and the safety of the project.*

"However, there do remain some serious doubts ... given that it is Soviet-designed and could never, even with major upgrading, reach western safety standards."

In a letter to EBRD President Jaques de Larosier, Collins backed the Austrian calls for public hearings, arguing that *"The environmental impact statement issued by the Slovak government is not of the quality we in the West would usually expect. It is based on data which is unavailable and therefore cannot be checked."*

A report produced by the German Oko-Institut for Greenpeace highlights flaws in the EBRD's economic appraisal of the project. According to the institute: the gas prices used by the EBRD are considerably higher than those recommended by the World Bank and the European Investment Bank; different exchange rates were used for construction prices and fuel costs; and over-optimistic discount rates were employed in calculating decommissioning costs.

Environmentalists have further pointed to the lack of plans for disposing of the plant's radioactive waste.

Defending figures used in the economic appraisal, David Nelson of UK Consultant Puttnam, Hayes and Bartlett, main authors of the EBRD's cost analysis, said: *"The numbers we are talking about are small. I don't know if I would make this decision based upon economics, despite being an economist ... In terms of the economic argument Mochovce is not a clear winner nor is it a clear loser."*

Work on central and eastern European nuclear plant offers a lifeline to the beleaguered nuclear industry which is struggling to keep its head above water in a depressed western market.

Stuart Catchpole of the World Nuclear Operators' Association says: *"Of course Mochovce would offer encouragement to others. I think everybody realises that this is a key issue."* ❑

AGRs crack under the strain

NUCLEAR Electric (NE) has been forced to shut down a second advanced gas cooled reactor (AGR) following the discovery of cracks in steam pipe welds.

The closure of the two stations, Dungeness B and Heysham A, comes at an important time for NE which is trying to produce good operating results in anticipation of being privatised following the government's nuclear review.

In the late eighties the AGRs were amongst the world worst reactors. However, since NE was set up following the privatisation of the non-nuclear part of the electricity supply industry the reactors had climbed to the top of the nuclear league table. Many observers believe that the company had been pushing the reactors too hard and that it was only a matter of time before something like this happened. The closures are costing NE £1 million a day in lost revenue.

Hairline cracks were first discovered in the reactor pipe work over six years ago, but at that time were not thought to be serious. However, during routine maintenance over Christmas it was discovered that the cracks had grown.

NE says: *"The situation is serious but not life-threatening to the reactors. It is just a case of being absolutely sure everything is safe. We are not sure how long that will take."*

John Large, an independent nuclear consultant, who worked on the reactor design said: *"This could be a very expensive problem and difficult to cure. The problem is in the hottest pipes in the steam system under enormous pressure. The problem is visible in piping outside the core, but there is some inside that cannot be inspected.*

"The key weld is four or five feet inside the concrete pressure vessel and it is impossible to see. At the time they were built it was not believed that these would ever suffer cracks. The question is how can you convince anyone that these welds are not damaged without digging into the concrete." ❑

Radiation leaks show disarray at Dounreay

PRESSURE is mounting for a full-scale environmental audit of the Dounreay site, in the north of Scotland, following a series of recent pollution finds and an accident which could have showered the plant and the adjoining land with radiation.

The accident happened early on 11 February, when a sealed glove box for handling highly radioactive plutonium pressurised, ripping a glove from its seal and blowing some 20 megabequerels of plutonium dust into the room.

Although radiation alarms were triggered and the room was evacuated, it has emerged that the safety teams sent to check out the area wore no safety equipment. Workers have also told the local paper, the *Caithness Courier*, that clean-up teams wore only respirators when sealed airlined suits should have been issued.

It has emerged that the safety teams sent to check out the area wore no safety equipment.

Despite Dounreay's assurances that the release *"posed no risk"*, workers from the plant are saying that the only thing which prevented a major disaster was a fortuitous wind direction, which blew the radioactive dust out over the sea.

A spokesman for AEA Technology, who run the site, said: *"The amount discharged was under two per cent of our legal entitlement to discharge to the atmosphere and there were no implications for public health. I cannot really talk about a hypothetical situation."*

Seven workers were contaminated but only one had a positive 'nose blow' revealing that he had inhaled some dust. However, says AEA, analysis has revealed that his level of contamination is still within that allowed for nuclear workers.

The site has also run into trouble over the admission that it has been discharging illegal amounts of radioactive nitric acid into the sea for the last ten years.

Such discharges have been routine at Dounreay for over 30 years, but in 1985 new pollution legislation outlawed the practice, obliging the company to inform the Highland River Purification Board (HRPB) of dangerous discharges. This was not done until 1992, and as yet no action to stop the pollution has been taken.

HRPB said that when an application for discharges into the Pentland Firth were made there *"was no mention of acids or nitrates, only of metals. If they had asked to discharge acids we would have told them to neutralise them first."*

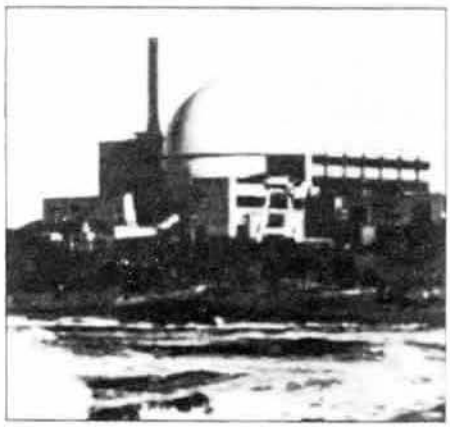
The nitric acid is used to dissolve spent fuel rods as the first stage of reprocessing. Legally the plant has two options: stop reprocessing or build a multi-million pound neutralising plant. However, it would be difficult to justify the expense of the neutralising plant as the site will have no more reprocessing work after it has dealt with the final core of the now closed Prototype Fast Reactor in 1998.

It also seems highly strange that as the HRPB has known about this problem since 1993 no action has been taken. Dounreay's illegal activities are being sanctioned by public watchdogs, making a mockery of pollution control legislation, say environmental campaigners.

Following revelations at the end of last year that since 1979 136 mysterious radioactive metallic particles have been found on the Dounreay foreshore, further contaminated areas on both the foreshore and within the plant have been identified.

The new affected area on the foreshore has been fenced off and access to the previously public beach has been restricted. Within the plant larger contaminated areas have also been cordoned off, while the smaller areas of *"fixed"* pollution have been marked with paint. The radioactive contamination is so severe in some areas that staff are required to wear radiation protection suits.

Once more, the site's management has invoked its safety mantra, claiming there is *"no health hazard either to employees or to the public."* The site director, John Baxter, said: *"You may rest assured that safety continues to be of paramount importance to me and to the management team as we continue our task of identifying and dealing with contamination arising from past activities at Dounreay."* ❑



North Korea questions US reactor deal

NUCLEAR tensions are once more beginning to build on the Korean peninsula as North Korea has said that it will not accept nuclear reactors from South Korea as part of a deal brokered by the US in Geneva for the destruction of the North's suspected nuclear weapons programme.

The deal, signed at the end of last year, committed North Korea to abandoning its high plutonium yield Magnox-type nuclear power stations and to allowing International Atomic Energy Agency inspectors to investigate its nuclear sites in exchange for two western-designed and financed light-water reactors. South Korea offered to provide over half of the $4.5 billion costs of the project provided that they supplied the reactors.

Now, however, North Korea has raised a number to objections to taking reactors from the South. It has cast doubt on the both the safety and operational specifications of the design which is licensed to the South by the American company Combustion Engineering.

It has further called upon the South to apologise for refusing to send condolences on the death of its President Kim Il Sung last year and for it to repeal the national security law which bans informal contact between the two Koreas.

South Korea's president, Lee Hong Koo, has tried to placate the North saying that he was not trying to hasten the state's demise and made it clear that he was willing to wait until the North changed its mind again.

However, he said there could be no compromise on the reactor question: *"If they don't want South Korean reactors they have to find another way to do it. But, that means the Geneva accord is gone."* ❑

Reprocessing or dry storage ...

IN a shock move, Scottish Nuclear (SN) has abandoned its plans for on-site dry storage and signed a £4 billion deal with British Nuclear Fuels (BNFL) for wet storage and reprocessing of its spent nuclear fuel at Sellafield.

The move was announced on 28 February, just one week after environment secretary John Gummer gave the go-ahead to dry storage in statement issued in advance of his department concluding its nuclear waste management review.

BNFL appears to have won the contract by slashing its fuel cycle costs, in a desperate attempt to bolster its Thorp reprocessing plant. Two German nuclear generators, RWE and HEW, recently cancelled contracts for reprocessing at Thorp despite having to pay BNFL some £100 million compensation. Their decision comes on the back of fundamental changes to German Atomic Law which no longer insists that spent fuel should be reprocessed.

BNFL said that the cancellations represented only about 4% of their £9 billion order book and that the cancellations will not affect the economic viability of the plant as both orders were for the second ten years of operation and that it still has a full order book for the first 'base load' ten years.

The SN/BNFL contract includes: reprocessing of 948 tonnes of spent fuel (previously proposed but not contracted), reprocessing of 200 tonnes (previously an option), and reprocessing of an additional 550 tonnes. A further 1,044 tonnes will be stored in existing ponds at Sellafield *"until the year 2086 or until a suitable repository is available"*, according to SN's press release; but neither company would rule out this fuel also being reprocessed.

Though not announced by SN, the deal also includes the purchase by BNFL of the rights to SN's drystore design. This puts BNFL in a very strong position in future negotiations over reprocessing and/or storage, but BNFL has said that it will be offering Nuclear Electric a deal similar to that signed with SN.

Nuclear Electric's Dr Brian Groom, as chair of a Nuclear Energy Agency fuel cycle study group,[1] stated at the end of last year that reprocessing is one and a half times more expensive than storage followed by direct disposal of spent fuel. ❑

1 "The economics of the nuclear fuel cycle", OECD. HMSO, 1994, £35.

Transatlantic nuclear trade row

TRANSATLANTIC civil nuclear trade will almost certainly be thrown into a state of chaos at the end of the year, according to Fred McGoldrick, the chief US negotiator in talks aimed at extending the US-Euratom Peaceful Nuclear Cooperation Agreement.

Euratom (the nuclear agency of the European Union) and the US have been locked — behind closed doors — in intense negotiations for the past two years aimed at producing a new deal before the current 35-year-old agreement ends on 31 December. Complicated US ratification procedures mean a deal must be struck in the next few weeks to avoid a lapse in continuity.

According to McGoldrick, two or three more rounds of talks will be needed *"before it is possible — not likely — but possible, to have an agreement."* Adding: *"It is not clear in my mind that we have a basis for agreement, though it is fair to say that both sides remain committed to reaching an agreement."*

He said that for too long the US did not fully appreciate the *"degree of mistrust the Europeans had"* over the Clinton administration's non-proliferation policies. There has been a "perceived attitude" that the administration is against reprocessing. Attempting to set the record straight, McGoldrick said the US *"doesn't discourage reprocessing, it just doesn't encourage it."*

The US is bound to insist that any new agreement conforms to its 1978 Nuclear Non-Proliferation Act (NNPA) which says it must have prior consent rights over all US origin nuclear material or material which has been processed using transferred US technology. This means that no such material can be reprocessed, refabricated or transferred to a third country without gaining US approval.

The US has offered to give long-term programmatic consent rights for the lifetime of the agreement — rather than on a case-by-case basis — but Euratom, concerned that future US administrations could unilaterally withdraw such approval, has so far rejected this approach. Instead, Euratom wants the US to issue a waiver on all consent rights, which is allowed for under the NNPA.

However, the US Secretary of State, Warren Christopher, has explicitly ruled this out: *"Given that Euratom has accepted consent rights in its agreements with other countries [Canada and Australia], we would find it impossible to explain to Congress their absence in an agreement with the US. I am convinced that Congress would not approve an agreement that waived the NNPA."*

Brussels is adamant that it should not be treated as a junior partner in the battle against proliferation. It argues that Euratom nuclear safeguards, which comply with international rules under the Nuclear Non-proliferation Treaty, are more than sufficient to keep track of nuclear material without unnecessary interference from Washington.

Failure to renew the agreement, as now seems likely, *"would be seriously prejudicial to the achievement of US non-proliferation objectives and would jeopardise the common defence and security of the United States."*

In a report issued at the end of last year, the US Centre for Strategic and International Studies' US-Euratom Policy Panel, chaired by former defence secretary James R Schlesinger, set out the major consequences of a lapse in co-operation:

- US relations with its most *"important friends and allies will be harmed and the strength of the Atlantic Alliance, still one of the bedrocks of US national security policy, will be weakened"*
- Without a viable deal *"well before"* the Non-Proliferation Treaty Review and Extension Conference in April-May opponents of a permanent extension *"may be able to use any appearance of disunity to disrupt the non-proliferation agenda at the conference."*
- The US supplies much of Japan's nuclear fuel and under the current US-Japan agreement would be *"compelled to veto shipments of spent fuel from US-origin materials to Europe."*
- An *"important"* US Non-Proliferation initiative converting highly enriched uranium from dismantled Russian nuclear weapons into non-weapons-usable low-enriched uranium nuclear fuel would be *"jeopardised"*. ❑

Small-scale hydro in Vietnam

Vietnam, a country rich in hydro power, is attracting the attention of several UK hydropower companies. *Dr. John Green* **reports.**

ALTHOUGH rich in natural resources, with an industrious and adaptive people, the Socialist Republic of Vietnam is considered to be one of the poorest countries in the world. An economic embargo against the country, from its reunification in 1975 until 1994, prevented virtually all forms of foreign investment and restricted its trading opportunities.

Since 1986 many bold reforms, known as *"doi-moi"*, or renovation, have taken place aimed at rejuvenating the country's economic system, yet Vietnam suffers from poor infrastructure and an energy supply crisis.

Energy resources

Vietnam is very rich in indigenous sources of energy, including excellent quality deposits of anthracite coal, extensive oil fields and large hydropower resources. However, commercial energy supplies are only about a quarter of the country's total energy consumption; biomass supplies around three-quarters. Four-fifths of the country's 67 million inhabitants live in rural areas, where wood is the most popular form of cooking fuel. This is compounding the problem of deforestation in some regions, with less than 9% of the country presently under forest, compared with a level of 44% in 1945. So, whereas fuel wood has historically been free, it is estimated that a family of six in mountainous areas, where wood is scarce, may now spend in the region of £1.80 per month on fuel wood (out of a typical monthly income for a Vietnamese farmer of £11). Several strategies are being implemented in order to limit the impact of wood usage on the remaining forest, including promoting higher efficiency cooking stoves and encouraging the planting of fuel wood, as well as a limited investment into micro-hydropower for mountainous areas and bio-gas for low-lying regions.

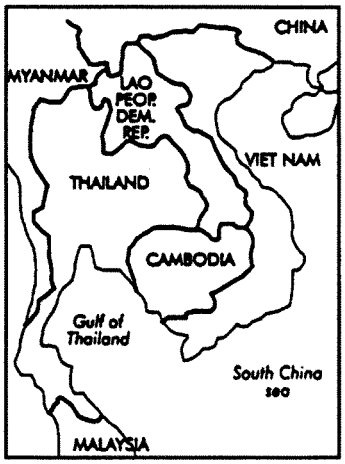
In rural areas the use of electric lighting is becoming more widespread and is perceived as a high priority by many people. This is particularly evident in the plains areas of the Mekong Basin where diesel generators are used to charge batteries, for a unit cost which at best works out to be equivalent to 21p/kWh. The long term aim of the government is to create a unified national grid, fed by large hydropower and thermal plants, and locally supported by small-scale hydropower schemes. At present, however, the generating capacity, and the distribution and transmission systems are inadequate to meet the needs of the rural or urban population. Rural electrification will in many instances be achieved most cheaply and sustainably by non-grid connected supplies. Forty eight million people live in areas where it is thought that a grid connected supply will be the most economical supply option, leaving over sixteen million people in areas where an isolated grid will be most economic. Shortages in electricity supply are acute throughout the country, especially in the South, where in the summer of 1992 there were up to four days per week where no power was available in Ho Chi Minh City (Saigon). These shortages have been caused in part by increased demand, due to growth in industrial production following the free-market reforms and expansion of the rural electrification network. By the year 2000 the government is seeking to invest over £2.6 billion into the electricity supply infrastructure.

Power from water has been utilised traditionally in Vietnam for hundreds of years for dehusking rice and for raising water for irrigation purposes using large water wheels. There are over 2,200 rivers in Vietnam longer than ten kilometres. The economic hydro potential of the country is estimated to be 18,000MW(1), of which 2,000MW is for sites of capacity less than 10MW.

With a total capacity of around 30MW, the 400 micro-hydropower (2kW to 200kW) and mini-hydropower (200kW to 2MW) schemes installed to date within Vietnam represent approximately 2.5% of the economically feasible sites below 2MW. Only two-thirds of the stations built are still producing electricity and the majority of those are producing less than their design capacity, operating inefficiently, or operating only periodically. The scarcity of funds for maintenance and the lack of consideration given to the supply of spare parts are considered to be the major problems affecting the reliability of these schemes. Also the poor quality of locally manufactured equipment produced during the 1980's and the inappropriate siting of turbines have been major factors.

For the development of small-scale hydropower schemes to be appropriate for rural electrification in Vietnam these failings need to be rectified. With so many sites now in disrepair, one of the most cost-effective ways forward will be to refurbish

Many people believe that Vietnam will become the next Asian "tiger", following in the footsteps of Taiwan, South Korea, Singapore, and Hong Kong. First, however, the country has to overcome a poor infrastructure and an acute energy supply crisis.



these sites and to establish an infrastructure for repair and maintenance. Thereafter, with the infrastructure in place, sustainable development of new sites could be undertaken. The Institute of Energy in Vietnam estimates that there are 2,500 economically feasible sites with capacities between 5kW and 100kW, and over 500 sites between 100kW and 10MW.

Small-scale hydro schemes are often used in conjunction with battery charging equipment to supply electricity for lighting and sometimes television. The promotion of other more productive end uses, such as directly driven mechanical rice processing, would benefit the community and help to pay for the supply, but this is seldom considered. As with many electricity projects worldwide, planning of individual sites is often top down and centralised, there being little liaison with the project 'beneficiaries', whose views are seldom taken into account. The drain upon the local economy of schemes which do not have a productive end use, coupled with the lack of involvement of the community in a project, has resulted in a lack of commitment to the projects, and in many cases their ensuing failure.

Small versus large

The problems resulting from the development of large-scale hydropower projects are well known. They include:

- the effects of the reduction in the silt content of water, affecting land fertility down-stream from the dam;
- the flooding of land and the displacement of people;
- reservoir induced earthquakes;
- the effects upon fisheries;
- increases in cases of river blindness and other disease.

Small-scale hydropower schemes on the other hand have been championed by proponents of appropriate technology as being suitable for rural communities as they have little environmental impact and they provide power for local consumption.

In extreme contrast to large scale hydropower developments, family-hydropower units are used by thousands of individual families in Vietnam and have little impact upon the local, let alone regional, environment. There are estimated to have been approximately 3,000 family-hydropower sets with capacities between 50W and 1kW installed within Vietnam. In the market places of many of the country's cities and towns, 100W units can be purchased for as little as £18.50. They come in two forms, one using a fixed blade propeller for low head schemes of less than two metres, and the other using an impulse turbine for hillier terrain with higher heads of up to 15 metres. Bamboo is often used as the penstock piping for the latter model.

Family-hydro units installed in an irrigation canal in Vietnam: three family-hydropower units used by four families for lighting in the southern province of Dong Nai. The land around is almost flat, being in an area of lowland rice cultivation.

Most family-hydro units are installed by the individual purchasers, and are predominantly used in conjunction with batteries to provide for lighting and sometimes television, radio and other low power equipment, in areas where there is no other source of electricity. Such machines are also used in the more prosperous lowland areas where it is possible to obtain a one to two metre head in the irrigation canals.

Before 1975 all the small-scale hydropower equipment installed in Vietnam was imported from abroad. During the 1980's the demand for turbines in the country rose dramatically, encouraging the rapid evolution of local manufacturing capabilities. Local manufacture of equipment reduces the need for scarce foreign finance, creates an industry capable of the repair and maintenance and generally produces equipment which is better suited to local conditions.

Vietnam developed its modern manufacturing capabilities by copying foreign small-scale hydropower equipment, mainly Chinese, and in some cases improving upon it. Vietnam presently has design and manufacturing capabilities for all components required for micro-hydropower and mini-hydropower schemes.

Every form of energy production has its drawbacks but small-scale hydropower developments for rural electrification cause minimal environmental damage and are often the least-cost electricity supply options. If the rural areas of the country are to receive an electricity supply, then small-scale hydropower can play a sustainable central role, if implemented appropriately. ❑

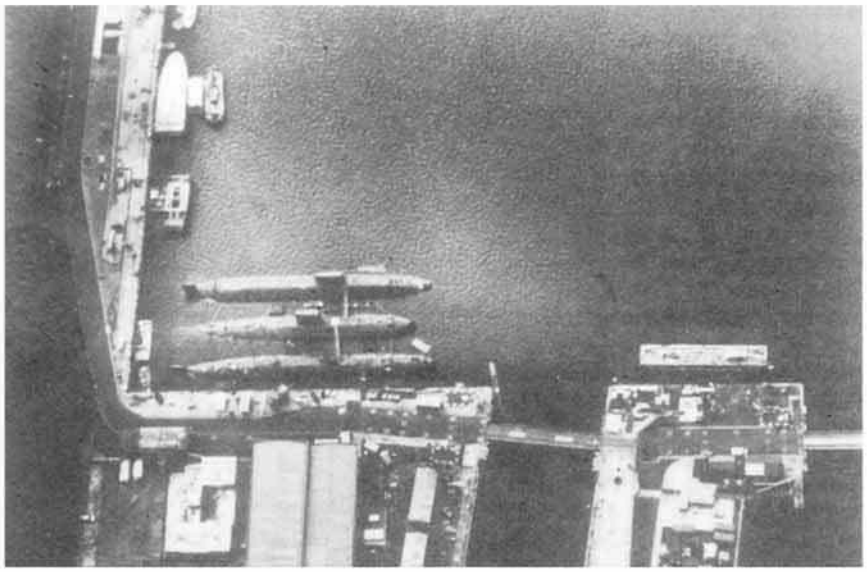
"Small-scale hydropower schemes can form the basis of a sustainable rural electrification network throughout the country, if implemented appropriately."

Reference.
1. The installed generating capacity in the UK is 65,356MW (March 1993).

A fully referenced copy of this article is available from *Safe Energy*, for £1 inc. p+p.

❑ John Green has a PhD in local manufacture of hydropower equipment in developing countries and runs Green Technologies, a renewable energy consultancy.

The Ministry of Dilemmas



Discarded nuclear submarines at Rosyth, Scotland. Rosyth now has five derelict submarines: HMS Dreadnought, HMS Swiftsure, HMS Churchill, HMS Revenge and HMS Resolution.

As the number of nuclear powered submarines taken out of service grows, the Ministry of Defence still has no answer to the problem of what to do with the radioactive hulks, *William Peden* reports.

TWELVE years ago HMS Dreadnought, Britain's first nuclear powered submarine, was withdrawn from service. It was tied up at the Rosyth dockyard, after being defueled and stripped of everything except its nuclear reactor, and there it remains to this day.

Little thought was given when the Royal Navy started building nuclear powered submarines as to what to do when they were retired. In the last five years a further eight nuclear powered submarines have joined the ranks of the deserted.

The Ministry of Defence (MoD) policy for these radioactive carcasses is to "store them afloat at their decommissioning location until a national decision about a long-term disposal route for such items has been taken."

It is still considering a "variety of options" for disposing of nuclear powered submarines. What these options are, nobody outside the selective and secret circles of the MoD knows.

A submarine nuclear reactor compartment weighs about 850 tonnes and is cylindrical with a length of around eight metres and a diameter of about ten metres. Each submarine is not a passive piece of scrap metal but 850 tonnes of radioactive metal, and nobody knows what to do with it.

The MoD is planning to retain areas of Rosyth and Devonport as Crown Property after privatisation to enable them to continue storing their submarines. Because they will be in Crown Property their upkeep will be immune from inspection and enforcement by agencies such as the Nuclear Installations Inspectorate NII) and HM Industrial Pollution Inspectorate.

The intended plan is to store these submarines afloat for at least thirty years, but they will not be regarded as being totally decommissioned during this period. After the storage period the MoD's present intention is to safely "dismantle and dispose" of these hulks.

The reactor compartment and what to do with is only one of the headaches the MoD has from operating a nuclear-powered submarine fleet.

Periodically, submarines return to Rosyth or Devonport for refit. The spent fuel is removed and sent to Sellafield. However, nobody knows how to reprocess submarine spent nuclear fuel. At Sellafield there is now spent fuel from more than 38 used reactor cores in storage. Each core contains between 200 and 250kg of highly enriched uranium.

Unsafe flasks

In 1991 a serious problem arose when the MoD was told by the Department of Transport that the flasks used to transport spent fuel to Sellafield were unsafe and new containers would have to be found. The International Atomic Energy Agency (IAEA) produced guidelines in 1985 for containers used to transport radioactive materials; the UK had until December 1990 to comply with these regulations.

The MoD chose to ignore the IAEA. While the Department of Transport licence to transport submarine spent fuel expired in October 1991, it was not until December 1991 that an invitation to tender for a new transport container was sent to Rolls Royce and Associates. These containers are not expected to be ready until 1997.

From October 1991 until recently no submarine spent fuel has been transported to Sellafield. In order to allow transportation of spent fuel to resume, Nuclear Transport Limited has provided two containers to fill the gap. The interim flasks, known as NTL3 flasks can only carry about a quarter of the fuel from a submarine. The now defunct UCTPs used to be able to carry twice as much. The new flask will only

be able to carry around a third of a core of fuel.

In order to remove the backlog of spent fuel, the Royal Navy is putting two NTL3 flasks on each shipment to Sellafield.

There have been at least three spent fuel shipments from Devonport with a further five movements required to remove the backlog. There will need to be at least five shipments from Rosyth to remove the backlog there, and two from Dounreay. The first shipment from Rosyth to Sellafield was made recently.

While the spent fuel lies rotting at Sellafield, awaiting its fate, another type of waste is accumulating and being stored at Devonport and Rosyth. Resin beads are flushed through the reactor to clean out the reactor pipes; the resultant waste cannot be disposed of as it is both radioactive and toxic. The contaminated beads are stored in either Resin Catch Tanks or old Magnox flasks and there are at present 23 containers at Devonport and 20 at Rosyth.

Nirex dump

The MoD hopes to use the Nirex waste repository for this waste if it can find a way to remove the toxins from the beads. The management at Devonport estimates that there will be 180 containers full of this waste in storage at Devonport by 2010.

A new process is at present being researched and developed at Winfrith and Aldermaston. If the research is successful the resultant radioactive resin with its toxins removed could then be sent for disposal.

Radioactive waste is not the only problem with running, maintaining and disposing of a nuclear-powered submarine fleet. Submarines are full of other nasty substances that have to be disposed of or stored when a submarine goes into refit or is taken out of service. Among the many items on board a submarine you have PCB-based lubricant and heat exchange oils from capacitors and transformers; CFCs within the refrigeration and air-conditioning plants; and huge numbers of lead acid batteries full of heavy metals.

With Polaris ballistic missile submarines, you have the additional problem of how to dispose of the missiles, the nuclear warheads and the missile fuel. The missile fuel is a solid propellant of powdered aluminium with ammonium perchlorate binding.

Despite the vast quantities of radioactive and toxic wastes produced and left for future generations to dispose of, the MoD has decided to continue with nuclear-powered submarines. Four Trident submarines are planned to be deployed by the turn of the century. A new batch of Trafalgar class submarines (nuclear powered, but conventionally armed) is also planned. The Royal Navy has 27 nuclear powered submarines, when you include the four Trident boats. Nine of these have been taken out of service already and they could be joined by a further half a dozen by the turn of the century.

Devonport is at present being expanded to accommodate refitting of Trident submarines. The NII has voiced concern that the proposed expansion of operations at Devonport, virtually part of Plymouth, is not consistent with its basic principle of keeping large nuclear installations as far away from centres of population as possible.

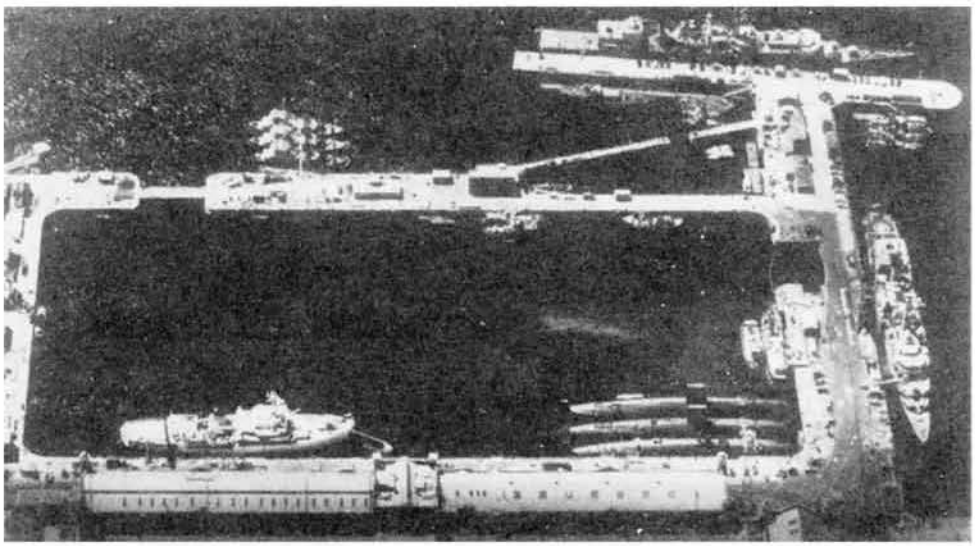
One has to ask the question: is it wise to continue building new nuclear-powered submarines when you don't know how to get rid of them at the end of their life and you don't know how to get rid of the vast majority of radioactive and toxic waste produced throughout their operational lifetime? ❑

❑ **William Peden is a nuclear weapons consultant to Greenpeace UK.**

"The Admiralty decided — God bless it — to go into nuclear propulsion for submarines in the early 1950s ... There were quite enough problems to contemplate at that time without thinking too much about what on earth we should do with it when we were finished with it."

J Peters, senior Civil Servant, MoD

"The progress of the Trident programme", House of Commons Defence Select Committee, HC422, session 1987-88 q.124.



Derelict submarines at Devonport, south coast of England. At Devonport there are four: HMS Conqueror, HMS Courageous, HMS Warspite, HMS Valiant.

Scotland's renewables

Graham Stein **assesses the recent UK government order for renewable energy in Scotland**

SCOTLAND, with probably the best renewable energy resource in Europe, finally has a programme to promote its development. The announcement of contracts for 76.5MW of new renewable capacity under the Scottish Renewables Obligation (SRO) was made by Ian Lang, the Secretary of State for Scotland, on 20 December 1994.

Lang made much of the fact that the order was twice the size originally planned because of *"the price and quality of the bids received."*

But even at 77MW it is a very small first step, about one twentieth the output of a typical nuclear power station. And even that supposes that all the schemes will be built.

The electricity regulator, Offer, which oversaw the bidding process, forecast that only around half of wind power schemes, and 80% of hydro and landfill gas projects would be completed. That would mean less than 50MW of declared net capacity (DNC); in reality the figure could be a lot lower.

Thirty schemes were awarded 15 year contracts:

- 12 wind farms totalling 45.6MW DNC at between 3.79p/kWh and 4.17p/kWh, averaging 3.99p/kWh;
- 15 hydro schemes from 3.24p/kWh to 4.15p/kWh, averaging 3.84p/kWh and totalling 17.3MW;
- one project of 9.8MW burning chicken litter, at 4.8p/kWh;
- and a two-phase landfill gas scheme totalling 3.8MW, at approximately 3.9p/kWh.

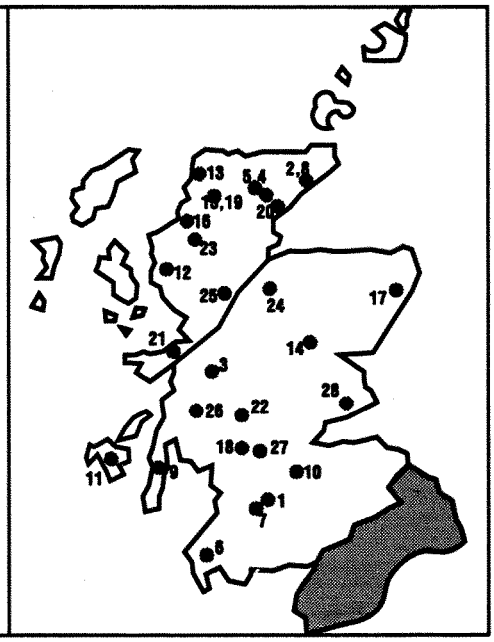
The successful projects were chosen from a total of 189 applications, 139 of which were deemed viable by Offer on economic, technical and planning grounds — the 'will secure' test. Of the 50 projects excluded, 22 were withdrawn by the applicants and another eight were considered too large. No projects were thrown out on the basis that they were in unsuitable sites unlikely to gain planning permission.

Lang largely followed the advice of Offer in choosing the cheapest projects, with only the chicken litter scheme above the 4.2p/kWh ceiling proposed by Offer. The inclusion of this project, and a reclassification of technology bands to combine landfill gas and waste-to-energy, gives the SRO at least one project in each of four categories.

The successful companies signed purchase agreement contracts with Scottish Power and Scottish Hydro Electric on 21 and 22 December. Although most of the projects are in Scottish Hydro's area, as with the Scottish Nuclear contracts 75% of each project's output will be bought by Scottish Power and 25% by Scottish Hydro.

However, the awarding of contracts is no guarantee that projects will be completed,

Band	Map No.	Proposer	Site name, location	MW (DNC)
Wind	1	Gallow Rig Windfarm Ltd	Gallow Rig Windfarm, Kirkcudbrightshire	4.21
	2	Micon Wind Turbines (UK) Ltd	West Garty Windfarm, Sutherland	5.13
	3	National Wind Power Ltd	Beinn Ghlas Windfarm, Argyll	3.37
	4	National Wind Power Ltd	Bendealt Windfarm, Ross-shire	3.79
	5	National Wind Power Ltd	Meall an Tuirc Windfarm, Ross-shire	3.37
	6	National Wind Power Ltd	Craigenlee Windfarm, Wigtownshire	3.37
	7	National Wind Power Ltd	Polwhat Rig Windfarm, Kirkcudbrightshire	4.21
	8	Renewable Energy Systems Ltd	Helmsdale Windfarm, Sutherland	4.30
	9	TriGen Ltd	Largie, Argyll	6.39
	10	TriGen Ltd	Hagshaw Hill (S10), Lanarkshire	2.12
	"	TriGen Ltd	Hagshaw Hill (S15), Lanarkshire	4.06
	11	Windcluster Ltd	Laggan Windcluster, Islay, Argyll	1.28
Hydro	12	MBM (116) Ltd	Russel Burn, Wester Ross	0.53
	13	Assynt Crofters' Trust	Loch Poll Hydro Project, Sutherland	0.23
	14	Highland Light and Power Co Ltd	Sheildaig Hydro Project, Ross-shire	2.10
	15	Norweb Hydro Power Ltd	Inverbroom Hydro Project, Ross & Cromarty	3.17
	16	Nadir Place Developments Ltd	Stanley Mills Hydro Development, Perthshire	0.99
	17	Hydro Energy Developments Ltd	Stoneywood Mill, Aberdeenshire	0.62
	18	Hydro Energy Developments Ltd	Antermony Loch, Stirlingshire	0.08
	19	Scottish Hydro Electric plc	Cuileig, Ross & Cromarty	3.00
	20	Novar Estate	Novar, Ross-shire	0.92
	21	Ardtornish Estate Company Ltd	Ardtornish, Argyll	0.66
	22	Edinburgh Hydro Systems Ltd	Auchtertyre, Perthshire	0.59
	23	Edinburgh Hydro Systems Ltd	Duror, Argyll	0.69
	24	Edinburgh Hydro Systems Ltd	Garrogie, Inverness-shire	1.94
	25	Bear Ellice Ltd	Garry Gualach, Lochaber	0.78
	26	Blarghour Power Company Ltd	Beochlich, Argyll	0.95
Waste-to-energy	27	Shanks & McEwan	Greengairs Phase I, Lanarkshire	1.89
	"	Shanks & McEwan	Greengairs Phase II, Lanarkshire	1.89
Biomass	28	EPR Scotland Ltd	Westfield Biomass Power Station, Fife	9.80



and the government has stated that its approval under the SRO *"is without prejudice to the planning process."*

Because of the cost-based selection process, there is a risk that many projects will be delayed or never built. Lower priced schemes are more likely to be in environmentally sensitive areas and/or be on the edge of economic viability. And projects may be delayed by companies hoping to win further contracts in future rounds of the SRO and the Non-Fossil Fuel Obligation (NFFO) in England and Wales, which would allow them to place bulk orders for equipment.

Lagging four years behind its English and Welsh equivalent, it is widely considered that the first Scottish Renewables Order should have been much better organised than it was.

The general impression from participants and observers was that the SRO was badly organised by The Scottish Office and Offer Scotland. Offer was under-resourced and its chosen (unnamed) consultant advisers reportedly inexperienced, with little knowledge of renewable energy.

At one stage in the vetting process letters were sent to all applicants approving their economic submissions but many projects were later told this was a mistake and their proposals were reassessed.

There was also confusion over the rate of return which the government would expect projects to achieve in order for them to be considered viable.

The difficulties of the tendering process were particularly felt by smaller companies making only a few applications.

Other concerns about the SRO include: rumours that at least one company had inside information on bid prices; the possibility that some wind data may have been computer generated rather than actually measured by anemometry; the dual role of Scottish Power and Scottish Hydro as both bidders and utilities giving grid connection quotations to rival projects; and the absence of a small wind power category like the one introduced in England and Wales.

It has been suggested by some developers that grid connection prices quoted by Scottish Hydro are 50% to 100% higher than experience from other countries would suggest is reasonable. And unlike in England and Wales neither Scottish Power nor Scottish Hydro will be giving credits for embedded generation — electricity production in remoter areas which saves on transmission and distribution costs.

There is also serious concern within the nascent Scottish renewables industry that many of the contracts in the largest sector, wind power, have gone to companies based outwith Scotland and that little has been done to help establish a domestic industry.

One of the most successful companies was National Wind Power (NWP) with 5 of the 12 wind projects, and probable involvement in a sixth. In England and Wales, the company was capped at ten large wind farm contracts, but is thought to be involved in at least another ten of the 21 successful projects put forward by other companies for large wind farms, and has won two further contracts in the small wind projects category (below 1.6MW DNC).

NWP is two-thirds owned by the UK's largest electricity generator, National Power, and it has been suggested that its ability to undercut the competition is due to a cross subsidy from its other activities through cheap financing. NWP was criticised by the Commons Welsh Affairs Committee last year for its "deplorable and unreasonable behaviour" in first agreeing and then refusing to supply, in confidence, financial information relating to its developments.[1]

The only other developer with more than one wind power contract in Scotland is TriGen — a joint venture between Cornwall-based Ecogen, Tomen of Japan and US company SeaWest. TriGen, which lost out in NFFO-3 is "very happy" to have won three contracts in Scotland, two at Hagshaw Hill, Lanarkshire, which already have planning permission from Clydesdale District Council, and one at Largie, Argyll.

Between them, NWP and TriGen are involved in projects with three-quarters of the total wind power capacity awarded contracts.

With smaller wind developers having fared so badly in this round, their future prospects under the SRO look bleak. The big players, with their existing sites, will have the possibility of making savings through bulk ordering of turbines when they choose to build their farms at some time in the next five years, giving them the chance to undercut competitors in the next two rounds of the SRO due in 1996 and 1998. In addition, they may choose to

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An Edinburgh Hydro Systems' run-of-the-river hydro scheme near Kinross, Fife.

"The general impression from participants and observers was that the SRO was badly organised ... little has been done to help establish a domestic industry."

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"There was no place for energy crops ... missing out on the chance to test the prospects for short-rotation coppicing in Scotland."

make applications to expand their existing sites, which would offer large savings in preparatory costs like gathering of wind data, and reduced costs for grid connection. They could also get by with a single planning application and environmental impact assessment by submitting proposals for more turbines than they currently have contracted under the SRO.

With development costs — for site location, anemometry measurements, financial appraisal, SRO application, etc — of around £20,000 to £30,000, almost regardless of wind farm size, and around £30,000 for a planning application and environmental impact assessment, it will be difficult for the smaller independent companies to beat the major players on bid price.

The contracts awarded for hydro power are less dominated by the larger companies. One of the main beneficiaries is Edinburgh Hydro Systems, a relatively small company which has been planning, designing and building small-scale hydro schemes in Scotland for a number of years. The company had three of its own projects awarded contracts under the SRO, and is involved in developing another five of the schemes; it is also involved in four NFFO-3 projects.

Short sited

Offer's *laissez-faire* approach to the 'will secure' assessment has left two utilities, Scottish Hydro and Norweb — through its subsidiary Norweb Hydro Power — fighting over the same site. Contracts have been awarded to both companies on the Cuileig river between Loch a Bhraoin and Loch Broom. It is rumoured that the away team, Norweb, will win — the key being which company can sign a deal with the landowner, who gave provisional support to both proposals.

Approval for these two mutually exclusive projects, representing 3MW and 3.17MW out of a total of 17.3MW of hydro power, demonstrates the inadequacy of the 'will secure' test and makes Offer's forecast completion rate of 80% seem optimistic.

The contracts awarded in the other two technology bands, waste-to-energy, and biomass/agricultural and forestry waste are not without controversy either.

Shanks & McEwan was successful in winning a contract for its proposed 3.8MW of landfill gas generating plant at Greengairs, but Monklands District Council with an adjacent landfill site felt that its scheme, priced at 4.87p/kWh (the most expensive landfill bid) should also have been approved. The Council and its partners UKPS, have rebid to the Scottish Office at a price of 4.2p, but there is no mechanism under the SRO for accepting such a bid. There is a strong environmental case for maximising the use of landfill gas, and Monklands argues that its original bid included an element to recoup the cost of gas extraction equipment already fitted — which flares off the methane. Further, the council points out that had rules similar to those in Germany applied, its bid at 65% of the utility selling price would have been accepted. But the original bid, if approved, would have meant electricity consumers subsidising Monklands' waste management.

Lang sensibly opted to include a project in the biomass category, rejecting Offer's recommendation that only bids below 4.2p be included. However, there was still no place for energy crops, with Border Biofuels missing out on the chance to test the prospects for short-rotation coppicing in Scotland.

Born out of environmental concern, the SRO has placed too much emphasis on costs and not enough on environmental impacts, diversity and the longer term. And it has failed to take account of the massive interest shown in developing renewable energy in Scotland— there were bids for over 500MW of wind power, hydro-electric and energy crops at or below 6p/kWh.

There is a glimmer of hope for the smaller developers who have been let down by the SRO. Many were able to bid at below 5p/kWh and, with transmission costs of around 1p/kWh, they are close to the point where they could supply direct to customers. Already customers with demand over 100kW can buy their electricity from any company with a 'second tier licence', and by 1998 the market will open up to include all 25 million UK electricity customers.

This raises the possibility of a 'green pool', with a number of independents grouping together to supply electricity from renewable sources. While they could, at least at present, be undercut by the utilities, there are likely to be many customers who would settle for a smaller reduction in their bills to get electricity from environmentally friendly sources rather than from fossil fuels or nuclear power. ❑

Reference

1. "Wind energy", Welsh Affairs Committee, HoC 1993-94, HMSO.

The breathing wall

An alternative approach to energy efficient buildings: *Warren Canham* describes the 'breathing wall', which uses insulation material made from waste newspapers.

ENERGY efficient building design has tended to encourage tightly sealed, insulated building fabrics to reduce energy demand for heating. However, this overlooks other important issues, such as the 'embodied energy' in the materials (from manufacture, extraction of raw materials and transportation), the ecological implications of materials used, and the health of occupants.

Timber frame 'stud' walls have long been recognised as offering many advantages over traditional brick and block design for the construction of energy efficient buildings. The ease of achieving higher insulation levels and air-tight construction, along with construction speed, low weight and lower overall costs has found favour with many builders, particularly in the relatively harsh Scottish climate. More recently, the lower manufacturing energy requirements of timber frame has been recognised as being increasingly important.

Conventional timber frame buildings use a polyethylene vapour barrier as an internal lining to seal the fabric against water vapour. In practice, however, it is very hard to maintain the integrity of the barrier, both in the reality of building site conditions and over the lifetime of the building. Without the vapour barrier, moisture generated within the house from cooking, washing and respiration can pass into the wall, cooling to form condensation. The high resistance of the traditional plywood causes a build-up of condensation which can cause fungal growth and ultimately structural failure.

The conventional design route also leads to other problems. Having sealed the building against air and moisture exchange, it is necessary to introduce controlled ventilation systems to remove stale air and particularly water vapour, usually by mechanical ventilation. This in turn consumes energy, is capital intensive and offsets some of the advantage of the highly insulated structure.

In looking for an alternative, the ideal building fabric will provide a high degree of insulation, be wind and water tight and aim to create a healthy indoor environment free from excessive moisture and condensation. For ecological sustainability, its production and construction should use minimal non-renewable resources and energy. The 'breathing wall' is an approach which reconciles these diverse needs. It utilises materials carefully selected for both their physical properties and their sustainable nature. Rather than attempting to prevent moisture penetrating the skin of the wall, it does away with the polyethylene vapour barrier and components are selected so that they allow water vapour to migrate from the inside to the outside without the risk of condensation.

The name "breathing" wall has often been misinterpreted: the method in fact creates a highly air-tight construction, reducing convection heat losses to give improved thermal performance. It uses cellulose fibre insulation,[1] manufactured from recycled paper (mainly newsprint), which can be used in walls, floors and ceilings of timber frame buildings, and for loft insulation in all types of construction.

The embodied energy in cellulose fibre insulation is much lower than alternatives. Plastic-based insulation products need high energy inputs for manufacture, using highly polluting processes, and mineral wool products require the mining and melting of diabas rock for production.

Scottish examples

The Findhorn Foundation, in North East Scotland, first developed the breathing wall construction method in the UK using Keystone Architects and has now constructed a large number of dwellings at the foundation using the principle.

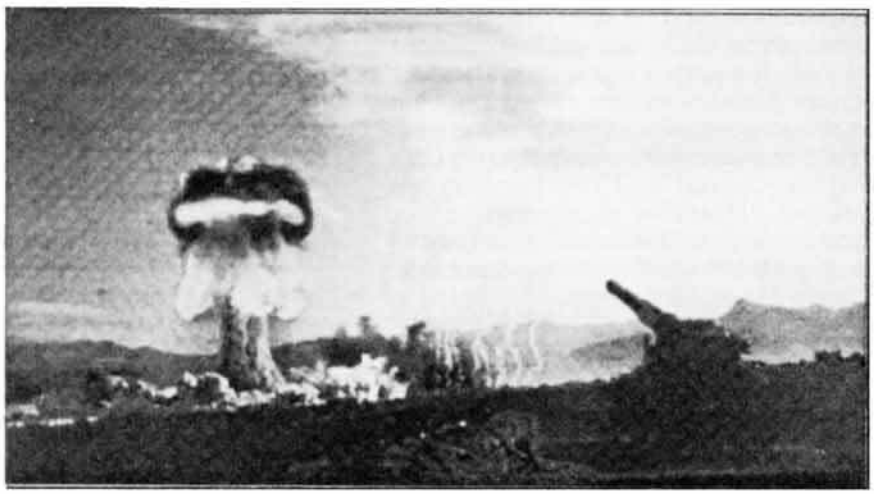
Now commercially available across Scotland, sustainable energy specialist Energy Unlimited has provided design advice for breathing wall constructions and installed cellulose fibre in a number of innovative projects. These include 62 flats for Cumbernauld Development Corporation, a new building for the Iona community and a visitor centre at Bennachie in Gordon district. The buildings have to perform in harsh conditions, proving that durable structures of natural materials can be constructed efficiently and cost effectively, with the emphasis on the origins and properties of materials rather than superficial appearance and short-term costs. ❑

Note

1. Marketed in the UK under the trade name Warmcel by Excel Industries Ltd, Ebbw Vale, Gwent, it has a thermal conductivity of 0.035 W/m^2K.

❑ **Warren Canham is Technical Manager of Energy Unlimited.**

UK ignores treaty obligations



With a review conference on the Non-Proliferation Treaty being held later this year, *Pete Roche* looks at the issues involved and the strong links which still exist between the civil and military nuclear programmes.

FIFTY years after Hiroshima it is high time the world got serious about ending the nuclear era. In April and May the future of the Non-Proliferation Treaty (NPT) will be decided in New York.

Originally intended as an interim agreement while nuclear disarmament took place, signatory states must now decide whether the treaty should be extended indefinitely or for an additional period or periods. Extending it indefinitely will remove all the incentives for getting rid of nuclear weapons. But a limited extension, with reviews every five years will keep the pressure on the nuclear weapons states to honour their commitments, so we can start putting the lid back on Pandora's Box.

The nuclear weapons states are calling for an indefinite extension, because, they argue, the agreement provides an effective block to nuclear proliferation. However, many non-nuclear states believe that indefinite extension would make permanent an agreement which has not even begun to free the world from the nuclear threat.

The treaty has failed to force the nuclear weapons states to disarm and by promoting nuclear power has fatally undermined its own objective of eliminating nuclear weapons. Growing stockpiles of plutonium generated by the commercial nuclear industry create regional concerns about proliferation and serve as both an excuse and a justification to develop nuclear weapons capability.

Indefinite extension would diminish incentives for further nuclear weapons reductions thus leaving British, Chinese and French nuclear forces untouched and in the process of modernisation; remove the major incentive for a comprehensive test ban treaty; and allow the continued growth of weapons-usable fissile material and possible diversion to military uses.

What follows is a catalogue of examples of where the UK has failed to live up to its responsibilities under the treaty, or has acted against the spirit of the agreement.

Article I of the treaty obliges nuclear weapons states: *"not to transfer to any recipient whatsoever nuclear weapons or other nuclear explosive devices or control over such weapons or explosive devices directly, or indirectly ..."*

The United Kingdom (UK) has received considerable assistance from the United States (US) for its nuclear weapons programme. The US has since 1958 transferred to the UK technical information, materials and components for its nuclear weapons programme. It has done so under a number of agreements including the 1958 US/UK Mutual Defense Agreement, which was amended as recently as 23 May 1994 and ratified by the UK government at the end of December 1994.

UK Ministry of Defence officials consider this cooperation to have been *"essential in order to implement the United Kingdom's nuclear weapons policy"*.[1] In fact the UK's ability to maintain its 'independent' nuclear arsenal would be questionable if it were not for extensive US support.

During the Parliamentary debate in December 1994, David Davis, Minister of State at the Foreign Office said *"we will not accept that [our deterrent] should be put into question by a procedural objection to the [1958] agreement that forms the basis of our nuclear defence co-operation with the United States of America"*.

The UK government was accused by the former head of the nuclear energy department at the Foreign Office, John Gordon, of ignoring its obligations By agreeing to *"the sale of Matrix Churchill machine tools to Iraq, which it was suspected would be used to help the Iraqi nuclear weapon programme"* the UK government *"ignored our obligations as a nuclear weapon state under Article I of the NPT"* This development had serious *"implications for our credibility as a depository power and leading international champion of the NPT."*

On 1 February 1989 William Waldegrave, Minister of State at the Foreign Office, learned that *"long-held suspicions"* of Iraq's proliferation ambitions had been confirmed. However, Waldegrave did not believe this should stand in the way of the licensing of Matrix Churchill lathes for export; he commented: *"Screwdrivers are also required to make H-bombs"*. It is clear, therefore, that the UK government authorised the sale of machine tools to Iraq in the full knowledge that they were likely to end up in nuclear arms' production.

Article VI of the treaty requires the nuclear weapons states to: *"pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to pursue nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective international control."*

There is no evidence that Britain has ever restrained its nuclear weapons programmes as a result of signing the NPT, and there are no signs of this situation changing. One Ministry of Defence official recently told MPs: *"...I do not think we would wish to find ourselves constrained at this stage by moving into an arms control process."*(2)

Britain's refusal to enter the Strategic Arms Reduction Talks (Start) process could seriously undermine future negotiations, now that it is replacing Polaris with Trident. As the US State Department points out: *"With Polaris, the British can hurt the Soviet Union badly; with Trident they potentially will be able to wipe it out as a functioning society. Thus Trident multiplies the third country problem in US-USSR arms talks"*.

Trident submarines will carry a maximum of 96 warheads per boat, compared to the maximum of 32 warheads carried on the Polaris submarines they will replace. Each missile will have twice the range and will be able to hit far more targets with much greater accuracy and explosive yield than Polaris. Trident's increased range means that almost any country in the world can now be targeted from the world's oceans.

Besides Trident, Britain also has a tactical capability — the WE177 free-fall bomb introduced in 1966. This was to have been replaced by the Tactical Air-to-Surface Missile (TASM). But now TASM has been scrapped and we are told that some Trident missiles *"will be fitted with a single smaller-yield warhead for so-called sub-strategic or tactical attacks. These could be a 'precursor warning' of a more significant strike against major powers or a suitable deterrent against lesser powers"*(3) But a single 'substrategic' Trident warhead is likely to have a yield of 100 kilotonnes equivalent to around 7 Hiroshima bombs. Some warning.

And whom might such sub-strategic weapons be fired at? In 1978 Britain, along with the US and USSR, gave assurances that it would not use nuclear weapons against non-nuclear signatories to the treaty. But in December 1993 Malcolm Rifkind implied that nuclear weapons could be used against countries attacking British troops deployed in the Third World, or countries suspected of attempting to acquire nuclear weapons, or even countries merely suspected of not adhering to the Biological and Chemical Weapons Convention. Even countries which launch only a conventional attack cannot be ruled out as targets.

By this logic, if Britain faces adversaries armed with any weapon, the government will seek to justify our nuclear capability as the only way to *"guarantee this country's future security"*.

The new Thermal Oxide Reprocessing Plant (Thorp) at Sellafield in the UK will supply some 40 tonnes of plutonium over its first decade of operation to western Europe and Japan. All of these countries will have increasing stockpiles of plutonium as a result. UK government policy is that provided the customer countries have placed their nuclear materials and facilities under International Atomic Energy Agency (IAEA) safeguards, it sees no reason why this trade should not continue.

This is certainly not the view of the US Department of Defense (DoD), whose Assistant Secretary Henry Sokolski said: *"...a growing inventory of separated plutonium from both military and civil sources [is] increasing proliferation concerns"*.

He continued by saying the US would not allow civil reprocessing because that would be tantamount to *"declaring that the proliferation risks posed by reprocessing — and separated plutonium under international safeguards are acceptably low. In the defense department's view they are not"*.

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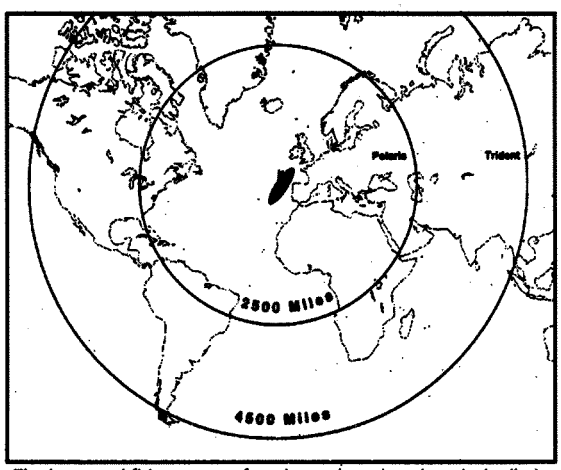
"The treaty has failed to force the nuclear weapons states to disarm and by promoting nuclear power has fatally undermined its own objective of eliminating nuclear weapons."



The increased firing range of nuclear submarines (nautical miles).

Cont'd from page 17

"The UK should play its part by stating clearly how it intends to phase out its nuclear arsenal; and assist non-nuclear weapons states with energy efficiency and renewable energy programmes"

One of the reasons which may have led the DoD to this conclusion is that, according to Marvin Miller *"the IAEA's safeguards detection goals cannot be met at large reprocessing and plutonium fuel fabrication facilities using conventional materials accountancy."*

British Nuclear Fuels plc (BNFL) make. no secret of its determination to promote its services worldwide. Thorp desperately needs to secure contracts for its second decade of operation, especially now that the German utilities are beginning to cancel contracts. BNFL is hoping to sign new contracts with countries in the Far East. One potential customer is South Korea, despite that country being listed by the Department of Trade and Industry as "sensitive" with regard to the export of nuclear materials and technology.

Even the IAEA's Deputy Director, William Dircks has acknowledged the potential destabilising effects of a world surplus of plutonium. The IAEA is the agency whose job it is to safeguard nuclear materials and prevent diversion to non-civil use.

Without explicit and universal constraints on reprocessing, it will simply be a matter of time before a large number of countries gain access to weapons-usable material. By allowing BNFL to continue scouring the world for contracts, the UK government could well be infringing Article I of the NPT.

Removal from safeguards

The nuclear weapons states still retain the right under the NPT to use civil nuclear materials, including plutonium, in their own nuclear weapons programmes. In January 1994 it was admitted in the UK parliament that on 571 occasions since May 1979 nuclear material had been removed from international safeguards control for 'national security' reasons. Of these 571 withdrawals, 70 were of plutonium, which the UK government claimed were either for analytical purposes, or only temporary withdrawals which *"did not involve the net transfer of any plutonium from safeguards"*.

However, the MoD would have been at liberty to swap isotopes of plutonium, retaining the plutonium with isotopic composition of high purity and substituting lower purity plutonium. In this way, even if the expected weight of plutonium is returned to safeguards, the MoD retains all the most valuable grade of material. History tells us that this is quite likely to have happened. Lord Marshall of Goring, when Chair of the Central Electricity Generating Board, stated that plutonium from civil nuclear reactors had *"... gone into the defence stockpile"*. In addition, plutonium from civil reactors has been sent to the United States for military purposes.[4,5] In 1977 the then US Energy Research and Development Administration declassified the information that the US had tested a nuclear bomb using reactor-grade plutonium in 1962 which resulted in a 'nuclear yield'. In 1994 the US Department of Energy revealed that the source of the reactor-grade plutonium for the 1962 test had been the UK.

Despite an official announcement in June 1986 that Euratom, the European atomic energy agency, would be given full access to Sellafield for its safeguard inspections, as required by European Commission directive 3227/76, subsequent questions in the UK and European parliaments have failed to receive an adequate response. Unless BNFL, the UK government or the European Commission gives a concrete reply with regard to the conduct of safeguards inspections at Sellafield, we can have no confidence that a genuine safeguard system is now in place.

The NPT should be extended for fixed periods of five years, while global denuclearisation — which should remain the paramount goal of the Treaty — is achieved. The UK should play its part by stating clearly how it intends to phase out its nuclear arsenal; assist non-nuclear weapons states with energy efficiency and renewable energy programmes; and halt the export of nuclear material. ❑

References

1. Memorandum by the Comptroller and Auditor General to the House of Commons Committee of Public Accounts, 29 October 1990, p.25, para 2.2.

2. Witney, N. Director Nuclear Policy and Security for the Ministry of Defence to the House of Commons Defence Select Committee, March 1993. HC 549 of session 1992-93 p16 q.1584.

3. Guardian Editorial "Your target for tonight" 26 November 19 94.

4. Much of the Sizewell Inquiry examination of the plutonium issue was devoted to this, as was the lead proof for the Campaign for Nuclear Disarmament (CND/P/1) by Dr R.V. Hesketh, a former CEGB nuclear fuel research scientist.

5. Barnham, Hart, Nelson, and Stevens, "Production and destination of British civil plutonium" Nature, Vol. 317, September 19, 1985.

A fully referenced version of this article is available from Safe Energy, £1 inc p&p.

❑ Pete Roche is a campaigner in the political unit of Greenpeace UK.

Industry and the monopoly effect

THERE has been much activity in the electricity supply industry in recent months. The old year ended with Trafalgar House bidding to take over Northern Electric. A move that upset the cosy world of the regional electricity companies (Recs) which had survived privatisation with little real change.

Directors of the Recs had seen privatisation as a chance to sack some workers, boost their share prices and pocket inflated salaries and share option profits. Even take-over bids, though unwelcome, benefit directors by boosting share prices.

Share dealing surrounding Trafalgar House's bid has come in for scrutiny. Northern Electric instituted a Stock Exchange inquiry into the steady rise in its share price which preceded the bid from Trafalgar. The increase in share prices, from 787p on 25 November to 910p on 14 December when the bid was announced, has been linked to a meeting between Trafalgar House, its advisers and the electricity regulator, Offer, on 25 November.

The Swiss Bank Corporation, which advises Trafalgar House, has also been criticised for its share dealing in Northern and other recs, all of which rose with the bid for Northern.

The pool and its principal players, National Power and PowerGen, have again come in for criticism. January saw half-hour pool prices spiking as high as 63p/kWh, but once again Offer backed off making a referral to the MMC as the price settled back down for a while.

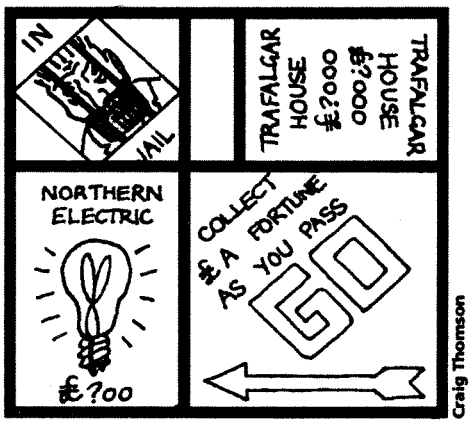
Chemicals company ICI has called on Offer to tighten the pool price cap which is meant to produce an average unit price of 2.61p or less. The call has been criticised by the Association of Independent Electricity Producers, which argues that a reduction in price cap would kill off any hope of independent companies buying up the 6,000MW of plant which National Power and PowerGen are meant to be selling off to promote competition.

Despite the performance of the English and Welsh pool, Offer Northern Ireland has proposed that the six counties adopt a similar system.

■ Offer published details of its proposals for *The competitive electricity market from 1988*, in January. Buying electricity from other than your local rec — or generator/distributor in Scotland — is restricted to sites using over 100kW of electricity.

It had been expected that Offer would reduce the limit to around 50 to 60kW in 1996, when further competition in the gas industry is planned. Instead, Offer intends only to introduce small-scale trials, including with domestic customers, to pave the way for removal of the 100kW restriction in 1998.

■ With the government having sold off the coal industry at the end of last year, it is now selling off its 40% stake in National Power and Power Gen. Of all the major energy sectors, this will leave just the nuclear industry — at least until after the nuclear review — in the public sector. The coal mines in England were sold to RJB Mining, Scottish pits went to Mining (Scotland) and Celtic Energy is the new owner of the Welsh mines.



Craig Thomson

■ National Power (NP) is planning to burn Orimulsion — and other emulsified hydrocarbon fuels — at its 974MW oil-fired plant at Pembroke, south Wales. Planning and environmental licences have been applied for to use this notoriously dirty fuel imported from Venezuela.

NP claims it is adopting *"a new approach to the burning of Orimulsion"* and will be fitting FGD (flue gas desulphurisation) equipment to remove 94% of the sulphur, boilers with special burners to reduce emissions of oxides of nitrogen, and electrostatic precipitators to remove dust and particulates from the flue gas.

National Power is also rumoured to be considering using Orimulsion at Western Europe's largest coal-fired power station, Drax. ❑

Climate change conference

THE signatories to the Climate Change Convention gather in Berlin on 28 March to discuss progress since Rio in 1992.

The key tenet of the convention is that industrialised nations reduce emissions of carbon dioxide to 1990 levels by the year 2000. One of the controversial areas to be considered by the First Conference of the Parties to the Framework Convention on Climate Change is 'joint implementation'. Under the convention, countries can meet their targets either jointly or individually. Plans by the US to plant trees in Central America rather than cut its own emissions is one of around 20 proposed deals. Germany is considering cutting emissions from Polish power stations as a cheap option than reducing its own CO_2 output.

The UK's programme to meet the 2000 target lies in tatters: VAT on domestic fuel and power pegged at 8%; the Energy Saving Trust chronically underfunded; new CHP installation well below schedule; and the government's own fuel bills up 18% in the first two years of a programme designed to reduce them 20% by the end of the century. However, the electricity supply industry's rush from coal to gas, together with lower than forecast energy demand from industry, may yet see the UK meet its target.

But already many countries are looking beyond 2000. One item for discussion in Berlin is a proposal, made last year, from the Alliance of Small Island States for a 20% cut in carbon dioxide emissions by 2005. ❑

EU Policy

CHRISTOS Papoutsis, the new European Commissioner for energy, has called for an energy chapter to be included in the EU's constitution at next year's inter-governmental conference.

He has said that the main elements of EU energy policy must include: energy efficiency, environmental protection, supply security, renewable energies, more energy-related R&D, a strengthening of the EU's external relations in the field of energy, and completion of the internal energy market.

Fellow commissioner, Martin Bangemann, has stated that the energy sector is proving one of the hardest to prise open to full competition, and he believes it is unlikely to open up fully in the next five years. ❑

Energy efficiency moves

HAVING been 'talked out' in the House of Commons in April 1994 and reappearing only briefly in November, the energy conservation bill is back on the agenda again.

Lib-Dem MP Diana Maddock, first in the ballot for private members' bills, has revived the bill proposed last year by her colleague Alan Beith.

Now called the Home Energy Conservation bill, it passed through second reading in January 1995, and after the committee stage will reach the third reading in late March.

If successful, the bill, which had majority support last year, would require local authorities throughout the UK to assess the energy efficiency of public and private housing in their area. In consultation with relevant local organisations, business and private sector interests, and community groups, each authority would then produce a local energy conservation plan. It is expected that the plans would estimate: the cost of achieving energy savings of 10%, 20% and 30%; the measures required to do so; the carbon dioxide savings; and fuel bill savings. The Secretary of State for the Environment would then look at the plans and consider funding for their implementation.

■ The government's Building Research Establishment has calculated that without improvements in energy efficiency standards between 1970 and 1992, CO_2 emission levels could have been 50% higher than they are.

■ Energy-saving products should be VAT rated at the same level as domestic fuel, according to the Association for the Conservation of Energy (ACE). When the then Chancellor Norman Lamont announced that VAT would be levied on domestic fuel at 17.5%, he argued that: *"For the first time, the rate of VAT on domestic fuel and power will be the same as that on goods which improve energy efficiency. This will bring to an end the current anomaly which makes a nonsense of any attempt to use the tax system to improve the environment."*

Now that Lamont's successor, Kenneth Clarke, has held VAT on domestic fuel at 8%, ACE has called on him to remove the 'anomaly' by reducing VAT on products such as heating controls, insulation and draughtproofing. The move would, ACE believes, expand the market for energy-efficiency goods. ❑

Hydro dams controversy

TWO huge hydro schemes, in China and India, are being built amidst growing controversy.

Work on the Three Gorges Dam project on the river Yangtze was officially inaugurated by Chinese premier Li Peng in December last year, with a scheduled completion date of around 2010. If built, at an estimated cost of $22 to $70 billion, it will be the world's largest hydro-electric dam with a capacity of 18,000MW and a reservoir 600km long..

As well as electricity generation, the dam is intended to protect some 10 million people from flooding — which has killed 300,000 people this century — and open the river above the dam to shipping.

Opposition to the project includes concern about disruption to the hydrology of the world's third largest river; the effects on wildlife including several endangered species; the displacement of up to 1.2 million people; and destruction of archaeological treasures.

Meanwhile, in India, where work is continuing on two large dams which are part the Narmada River project ("Dam shame", *Safe Energy 94*), a new report states that prime wildlife habitats will be destroyed affecting hundreds of species some of which may become extinct. The report was commissioned by the Narmada Valley Development Authority and undertaken by the Wildlife Institute of India.

■ Despite increasing concern about large dams, other Asian countries are looking to exploit hydro power with large-scale projects. In November last year the South-East Asian nations of Thailand, Vietnam, Cambodia and Laos signed an agreement, brokered by the UN Development Programme, to build a series of dams on the Mekong River, which is thought to have a possible generating capacity of 37,000MW. ❑

New wave

A novel wave power device using piezoelectricity is to be tested later this year by a small US research company, Ocean Power Technology (OPT).

The device will utilise the effect where electricity is produced through mechanical strain.

The idea is that sheets of plastic piezoelectric material, suspended between floats on the ocean surface and anchors on the sea bed, will be stretched and relaxed as the floats rise and fall.

OPT believes that the technology has the potential to produce electricity at below 2p/kWh.

A 1kW prototype, to be installed on an oil production platform in the Gulf of Mexico, will be used to charge batteries. ❑

Fuel cells

THE world's largest solid oxide fuel cell system, at 100kW, is expected to come on-line at the beginning of 1997. US company Westinghouse has the backing of several Dutch power companies and a Danish energy consortium for the development near Arnhem, Netherlands.

The $1.8m project aims to study an operational fuel cell plant which will be supplying electricity to the public grid and heat to a local district heating scheme.

■ US researchers are looking at the viability of using fuel cells to generate electricity from landfill gas. With high conversion efficiencies and modular design, fuel cells running on methane from landfill sites could generate around 6,000MW in the US, according to one study. ❑

Clean coal

TWELVE clean-coal technology research projects, together worth £10 million, have been announced by the Department of Trade and Industry, which will contribute £4.1 million.

The projects are part of a £50 million programme aimed at taking British Coal's advanced technology to the pilot plant stage.

Work on Air-Blown Gasification Combined-Cycle, is being undertaken by a consor-tium led by European Gas Turbines (EGT), a GEC subsidiary.

Other projects include hot gas cleaning, being carried out by PowerGen, and gas turbine combustion systems also being undertaken by EGT.

A recent government report ("Clean coal prospects", *Safe Energy 103*) forecast that up to 5,000MW of advanced clean coal generating plant could be installed in the UK early next century. ❑

Solar breakthrough

BRITAIN'S first photovoltaic clad building (pictured right) was officially opened by junior trade and industry minister Ian Taylor on 19 January. The £1.5m project, at Northumbria University, involved the installation of an integral photovoltaic (pv) facade on the south side of the university computer centre, a typical 1960's 'office' building, which required recladding.

It is one of the largest building-mounted pv systems in northern Europe and will become a major monitoring site for the performance of pv panels at higher latitudes.

The electricity generated from the 465 BP Saturn modules, with a maximum output of 40kW, will be used within the building, and at times of high insolation and low usage surplus electricity will be supplied through the University's internal distribution system to other campus buildings.

The performance of the project will be monitored by the Newcastle Photovoltaics Centre (University of Northumbria), and it is hoped to promote the technological achievements of the building to other potential users, architects, planners and students in the UK and around the world.

Backers of the scheme include the European Commission Thermie programme, the Department of Trade and Industry (DTI), Northern Electric and Greenpeace Environmental Trust.

Some of the installation costs in this project were offset by the costs of conventional recladding which would otherwise have been required. Even with such cost offset, however, the present cost of pv electricity is well above that from other sources at around 45p/kWh. But costs have been falling rapidly and some researchers believe with advances in the technology and economies of scale they could be economic in 10 to 15 years. The DTI has estimated that by the year 2020 there could be a UK pv resource averaging over 100GW between 9am and 5pm each day and suggested an achievable target of 12GW could supply much of the workday load in the UK from the facades and roofs of commercial buildings.

Photo: Ove Arup

■ Plans for a new factory to produce cheaper pv panels have been announced by two US companies, oil multinational Amoco, and Enron, a natural gas producer. The companies expect to sell 10MW of amorphous silicon cells annually, and will be targeting power companies which need extra generating capacity to meet peak demand. ❑

NFFO-3, incineration won

THERE were few surprises in the government announcement of NFFO-3 (third round of the Non-Fossil Fuel Obligation) contracts just before Christmas, which showed significant reductions in bid prices from previous rounds.

Though, at 627MW (DNC — declard net capacity), the order was larger than the 300-400MW planned, this takes account of the expected non-completion rate forecast by the electricity regulator Offer.

As in previous rounds, the municipal and general industrial waste technology band dominated, with 38.5% of the of successful projects. Whatever the merits of waste incineration, the burning of significant quantities of oil-based material is misplaced in a programme designed to promote non-fossil fuels.

The second largest band was wind power which was notable for the remarkable fall in bid prices from previous rounds, even accounting for the extended period of the premium price, the 1998 cut-off imposed in earlier NFFO rounds being replaced with 15-year contracts.

Wind power, previously lambasted by critics for receiving 11p/kWh, is now averaging 4.32p/kWh for the 31 larger wind farms totalling 146MW (DNC), approved by the Department of Trade and Industry (DTI).

In an interesting move, which had been called for by environmental groups and some developers, the DTI also included a sub-band for wind projects below 1.6MW (DNC). There were 24 contracts awarded in this category for 19.7MW (DNC) at an average price of 5.29p/kWh.

Eggar's choice

The most expensive bids given the go-ahead were in the energy crops, and agricultural and forestry waste category. It was widely expected that this band would receive preferential treatment given energy minister Tim Eggar's support for biomass. The band was divided into two sub-categories, those using traditional steam-raising and projects using modern gasification technology.

Traditional schemes — six projects totalling 103.8MW — will be paid an average price of 5.07p/kWh, but 19MW from three energy crop/gasification schemes, a largely unproven technology, will get 8.65p/kWh on average.

The DTI's inclusion of the energy crop/gasification bids at twice the average price is probably the most forward-looking aspect of NFFO-3. It follows a study,[1] published last year, by the DTI's Energy Technology Support Unit which identified an accessible resource equivalent to over 60% of present UK electricity demand.

Landfill gas projects, which burn methane produced from rotting organic waste, were awarded 42 contracts totalling 82MW at an average price of 3.76p/kWh.

The smallest band, hydro power, won 15 contracts for 15MW of capacity at an average 4.46p/kWh. ❑

1 "An assessment of renewable energy for the UK", ETSU; HMSO, 1994.

Climate change action chilled by the economy

HUMAN activity will almost certainly cause a doubling of CO_2 equivalents over pre-industrial times, leading to at least a 2.5°C rise in the earth's temperature, according to the predominant scientific view. The financial and human costs of this may become horrendous, but actions to prevent its extent have not yet been fully embraced, mainly because most models have predicted that any attempts to restrain CO_2 levels will result in high financial costs, leading to disruption of the economy, and introducing recessionary influences. Well, this book brings together papers from several economic researchers and attempts to predict the likely effects of CO_2 abatement policies, to demonstrate how such costs can be minimised, and describes how many of the models used to-date may be overestimating these abatement costs.

Being a part of the 'Global Environmental Change Series', it is aimed at the academic reader who is researching into the economic aspects of global warming and CO_2 abatement. It is a thorough academic book, with a lot of technical detail, well indexed, with a good introductory overview of the current state of thought concerning global warming. It is not, however, a book for the general reader!

Written principally by research staff, the twelve chapters which make up the main part of the text include many detailed equations for the analysis of energy elasticities. The first half of the book concentrates upon estimating energy demand elasticities and energy-economy interactions, with various models being explored. Several chapters attempt to assess the implications of CO_2 abatement policies, and the effects these are likely to have upon the global energy supply industry. The second half concentrates upon predicting the effectiveness of varying policies at enforcing an abatement of greenhouse gas emissions.

Global warming and energy demand; Terry Barker, Paul Ekins & Nick Johnstone (Eds).

Routledge; 1995, 336pp, £15.99 pb, £50.00 hb.

Overall, the point is made that a carbon/energy tax would have to be *"of considerable magnitude"* in order to have a major impact upon energy demand and stabilise CO_2 concentrations. This would be particularly so in the UK due to low price elasticities. However, it is stressed that if such tax revenue could be constructively recycled within the economy, perhaps by reducing other more distortionary taxes, then the recessionary effects of a rise in energy prices could be avoided. It is suggested that such a tax could in fact be a spur to growth, resulting in both a fall in unemployment rates due to the relatively higher labour intensity of the non-carbon-intensive sector, and a rise in GDP. Other ways of using the tax revenues are suggested, including the establishment of a fund for promoting energy-efficient technologies, although another chapter points out that *"the substitution of low-carbon fuels for high-carbon fuels may be more important than conservation of energy"*.

It is also argued that the level of economic disruption would be lower if a low-level tax is introduced first, and then increased in a predetermined way. Thus, a long period of adjustment would lead to lower costs, as infrastructure can be gradually replaced as it comes to the end of its natural life, rather than being scrapped when energy prices rise. However, the limitations of solely using a pricing mechanism are also highlighted, it being suggested that a more effective policy would be for price rises to occur in conjunction with structural changes, such as increased standards in buildings and appliances efficiency standards.

The book is fairly realistic about the limitations of its macro-econometric approach, which with its reductionist and linear nature, is restricted from addressing surprise or novel events, such as will result from CO_2 abatement policies. It points out that the future may in fact be such that the whole structure of production and consumption could change, apparently undermining many of the basic assumptions of the macro-econometric models discussed.

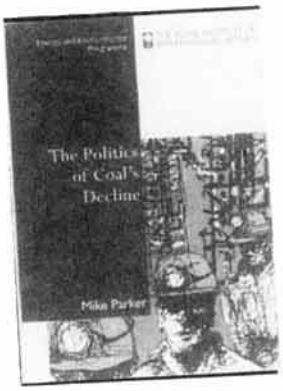
John Green

King coal: the decline and assassination!

MIKE Parker, formerly Director of Economics at British Coal, takes a look at the bleak prospects for coal production in Western Europe. The book is a follow-up to *The UK 'coal crisis'* (Reviews, *Safe Energy 97*) which explained the background to and aftermath of Michael Heseltine's announcement of massive pit closures in October 1992.

Between them, the UK and Germany dominate coal production within the European Union, with over 80% of the total output. But the contrast between the two countries could hardly be greater. In the UK the industry has been run down rapidly, in Germany it is being supported even though German deep-mine coal is three times the cost of the UK's.

Germany's federal government structure ahs ensured that coal-producing regions have had a say in coal policy. But the Constitutional Court recently ruled that the levy on electicity which subsidisses coal production will be illegal after 1996. The coalition government has yet to agree a unified stand in finding ways to continue subsidising coal production. In the UK policy has been dictated for fifteen years by the Conservative government's aim to break the National Union of Mineworkers; it was that objective which gave rise to Margaret Thatcher's plan for ten PWRs in the 1980s.



The politics of coal's decline — the industry in Western Europe; by Mike Parker

The Royal Institute of International Affairs/Earthscan; 1994, 76pp, £12.95.

Parker charts the trend in Western Europe of gradual but unrelenting decline in coal use, and the increasing share of this market being met through imports. He concludes that this is unlikely to be reversed.

"If there were another serious nuclear accident, if alarm about the security of Russian and Algerian gas supplies were to grow, if global warming were no longer important, then the politics of coal could be changed sufficiently to stimulate investment in new coal-fired generation plant, thereby sustaining coal consumption and slowing the contraction of the remaining EU-12 coal production," is as positive a prospect for coal as Parker can foresee.

Though only 76 pages long and pricey at £12.95, this book is crammed full of information about coal production and use, and also covers related issues like carbon emission targets and acid rain. An interesting read for anyone looking at energy issues in general, offering an insight into the politics and economics behind the decline of *"a once great industry"*.

Graham Stein

LBR strikes again

The curse of Little Black Rabbit strikes again. In *Safe Energy 101* and *103* LBR reported on Tory MP Phil Gallie's links with Scottish Power. The utility paid the MP for uncertain services, and supplied him with a company car.

Gallie was, coincidentally, the only Ayrshire MP not to oppose Scottish Power's plans for 65km of pylons through the area. The MP argued that he favoured the link but was stifled in speaking out because of his Scottish Power connections — as LBR reported, hardly a good deal for Scottish Power.

At the start of this year MP and utility parted company.

Insider dealing?

No surprise that the announcement of Trafalgar House's bid for Northern Electric sent shares up 100p to over 1,000p. More interesting was the movement in the share price prior to the announcement. After a period of gradual decline, from 25 November 1994 to the bid announcement on 14 December the shares rose day after day from a low of 787p to 910p.

There can surely be no truth in the rumours that there has been insider dealing, nor that it could in any way be connected with a private meeting between Trafalgar House, its advisers and the electricity regulator Stephen Littlechild, held on 25 November.

Just not cricket

The attempted take-over of Northern Electric by Trafalgar House caused much concern in the North-East of England, especially over jobs.

BBC TV's Newsnight covered the story, and the shipping and construction conglomerate put joint deputy chairman Sir Charles Powell in to bat against the spin bowling of interviewer Jeremy Paxman.

A few gentle deliveries from Paxman on employment prospects had Powell fending off with a straight bat and plenty of platitudes. Then came the googly: given that Powell was principal private secretary to prime minister Margaret Thatcher in 1990, when Northern Electric had been privatised at 240p per share, and that Trafalgar House was now valuing them at £11, was he wrong then or is he wrong now?

Clean bowled!

Advert disaster

Scottish Nuclear has been running an extensive advertising campaign on the marvels of nuclear power. Several newspaper ads — designed to look like feature articles — manage to avoid mentioning nuclear power until halfway through 22 column inches of text about all things environmental. Then comes the claim that nuclear power *"is actually very environmentally responsible."* No mention in the ad of the 240,000 year legacy of deadly nuclear waste.

And in an "Any Questions?" column comes:

"Q Is it true that nuclear power doesn't contribute to global warming?

A Yes. The generation of nuclear energy doesn't produce carbon dioxide."

This claim was too much for Friends of the Earth Scotland, and a formal complaint has been made to the Advertising Standards Authority.

LBR wonders why Scottish Nuclear, a public company, is using taxpayers' money to put out nuclear propaganda, given that the company's entire nuclear output has to be bought — at an inflated price — by Scottish Power and Scottish Hydro-Electric under contracts drawn up when all three companies were owned by the Secretary of State for Scotland.

More ads

The activities at Sellafield have long been a worry for its neighbours across the Irish Sea — the world's most radioactively polluted sea.

British Nuclear Fuels decided to produce a supplement for the Irish newspaper the *Sunday Tribune*: "Nuclear energy - time for the facts". BNFL tactfully told its Irish readers: *"On a one to one basis, the best Ireland can hope for is to be an annoyance."*

That's the way to win people over to your point of view.

Waste department

A recent phone call from *Safe Energy* to the Department of Environment press office to enquire about the department's decision on allowing dry storage of spent nuclear fuel elicited the response: *"I think you'd have to contact the Department of Energy about that."* Funny, LBR thought they scrapped that department in 1992, still it might be a good way of getting rid of the nuclear waste problem.

Early bills

Larger electricity customers (over 100kW) can now buy their electricity from companies other than their local utility. Eastern Electric has secured 15% of this market in England and Wales, but has had problems with collecting the £24 million plus annual revenue because of difficulties over installation of dedicated meters and data communication.

The company has denied suggestions that resultant cashflow problems have any connection with its recent practice of billing domestic customers up to three weeks early.

Sizewell story

Building Sizewell B on time and within budget was the nuclear industry's self imposed touchstone of its credibility. Nuclear Electric's plant was meant to have been up and running by August last year, but was almost six months late, and the bills are still being totted up.

So, is the industry admitting defeat? No chance! NE's house newspaper *Nuclear Times* reported in its January issue: *"The station is on schedule to generate electricity next month and full power should be achieve very close to the original target date."* *Atom*, the magazine of AEA Technology, went further, claiming completion was on schedule and within budget.

Sitting pretty

It was John, now Lord, Wakeham who as energy secretary salvaged the privatisation of electricity from the mess created by Cecil Parkinson by pulling nuclear power from the sell-off and announcing a moratorium on nuclear power station construction.

That neat political manoeuvre left the nuclear industry in a state of confusion and saddled the government with its 1994, then 1993, then 1994 again, and now 1995 nuclear review.

Wakeham was, under the circumstances, an interesting choice to perform the official opening of the one nuclear station to survive the moratorium, Sizewell B. His Lordship expressed confidence in the nuclear industry's future and uttered some reassuring words about the plant's safety: *"... the one thing you can be absolutely certain of is that it is pretty safe."*

LBR's dictionary defines 'pretty' as 'fairly' or 'moderately'.