

SAFE ENERGY

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**A case of
double
standards**

**Wasting
away?**

**A taxing
solution**

**Micro-hydro:
small is
beautiful**

**Manipulating
meanings**

**Down in
the dumps**

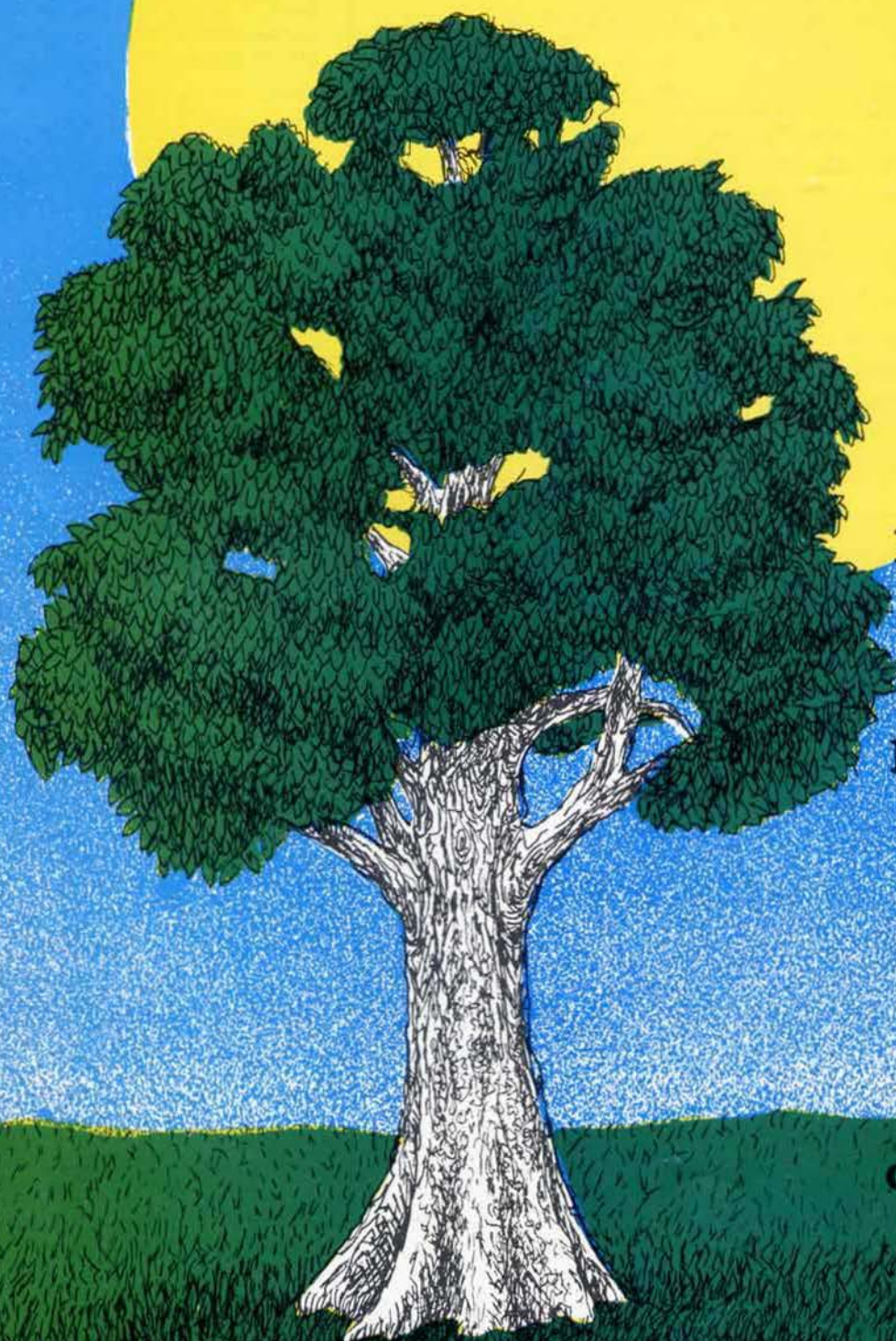
**False
greenhouse
claims for gas**

4 page

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COMMENT

XENOPHOBIA and nationalism are running high in Scotland as an army of foreign nuclear materials amasses at its border. It is easy to lose sight of the fact that opposition to the international transportation of nuclear materials can be found in every country.

Indeed the European Commission has called for a ban on such shipments. It is also easy to lose sight of why we are opposed to these shipments. It is not because they have another country's flag stamped on their underbelly, it is because spent nuclear fuel is highly toxic and presents twin dangers of nuclear proliferation and accidents leading to long-lived radioactive contamination.

Indeed, the proposed importation of radioactive materials to Dounreay is dwarfed by that planned for Cumbria when the new Thermal Oxide Reprocessing Plant is opened, or indeed that already piled up at Sellafield. There exists an active and vociferous campaign of opposition to these imports, highlighted by the 18,500 signature strong petition, delivered to the Dover Port Authority, calling for an immediate ban on importing spent fuel.

This is an issue which calls for unification of campaigners from both North and South of the border, not further fragmentation. Only by mounting a coordinated UK wide campaign of opposition, covering every square inch of land traversed by these highly radioactive cargoes can we hope to create political pressure sufficient to force an end to the idea of Britain becoming the 'world's nuclear laundry'.

FOR a number of years people have been arguing that the skills and equipment accumulated at Dounreay should be transferred to examining the potential of renewable energy sources.

However, the question must be asked. Can Dounreay actively promote renewables?

Pronouncements by Dounreay staff would suggest not, as they can regularly be heard expressing concern over public acceptability and the limited job opportunities of renewables. Such signals are important in gauging the sincerity of their new found interest in what is essentially a competitor industry.

Another factor in the equation is the nuclear industry's role in promoting renewables, given its easy access to vast sums of money, as its PR exercises spread far and wide - even to the underwriting of a renewables conference.

The present Government review of renewable energy sources must recognise the importance of a Renewable Energy Development Agency at this time, not least to provide structure and meaning to those working in the disparate field of renewables. The Agency must be given the authority and funding to implement a strategy of expansion for renewable technologies. The clear conflict of interest, as well as past experience, means that while the nuclear industry should diversify into renewables, it can in no way be part of the decision-making process.

SCRAM, *s* *Safe Energy* journal is produced bi-monthly for the British Anti-nuclear and Safe Energy movements by the Scottish Campaign to Resist the Atomic Menace. Views expressed in articles appearing in this journal are not necessarily those of SCRAM.

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to shut-down a nuclear reactor in an emergency.

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SAFE ENERGY

FEATURES

8 A case of double standards

The safety of air transport of plutonium has been raised by Nuclear Free Local Authorities in evidence submitted to the European Parliament. **Fred Barker** - a freelance writer and consultant on nuclear issues, and the author of the NFLA evidence - argues for a ban on current plutonium flights.

10 Wasting away?

From corner cutting on decommissioning to a new generation of 'safe' reactors, the nuclear industry is gearing up for the 1994 review. **Dr Ian Welsh**, Senior Lecturer in Sociology at Bristol Polytechnic, sees the choice of Sellafield for a waste dump not as a retreat, but as an integral part of the industry's preparations.

12 A taxing solution

European Community plans to introduce a carbon/energy tax by 1993 are explained by **Andrew Warren**, Director of the Association for the Conservation of Energy. The tax is designed to reduce energy consumption to cut carbon dioxide emissions.

13 Micro-hydro: small is beautiful

Small scale hydro power can provide electricity in remote areas with minimal environmental disturbance. Recent technological improvements could reduce maintenance and lower costs reports **Arthur Williams** of Nottingham Polytechnic Department of Electrical Engineering.

14 Manipulating meanings

Nuclear Electric's recent decision to drop a £7 million advertising campaign apparently followed pressure from the Government, who do not want nuclear power on the agenda in the run up to a General Election. **Dr Jaquie Burgess** of the Department of Geography, University College London, looks at the controversial topic of nuclear industry advertising.

16 Down in the dumps

NIREX's plans for a deep underground retrievable store for nuclear waste come under the scrutiny of **Dr Patrick Green**, Friends of the Earth's radiation and anti-dumping campaigner, and **Rachel Western**, their nuclear researcher.

18 False greenhouse claims for gas

Supposed advantages in switching to gas fuel for reducing CO₂ emissions are challenged by **Max Wallis**, a researcher in Atmospheric Science and Energy Systems at the School of Mathematics in Cardiff, and until recently a member of Friends of the Earth's Board of Directors.

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**Four page pull-out broadsheet:
WOODY BIOMASS**

Dounreay blitzkrieg

WITH the arrival of the first consignment of foreign spent highly enriched uranium (HEU) at Dounreay and the news that they are likely to receive HEU from Iraq, so-called research reactor reprocessing has moved up the political agenda.

26 fuel rods from the PTB research reactor in Brunswick, Germany, arrived at Dounreay on October 2. This was the second attempt by the nuclear industry to transport this shipment, in January Dutch dockers refused to handle the material when it arrived in Rotterdam and forced its return to Germany. The International Transport Workers Federation has advised its members not to handle any nuclear cargoes unless a purpose built ship is used.

Despite this advice, dockers in Duncraig were willing to load the material onto the roll-on roll-off ferry the Nord pas de Calais, in which it travelled to Dover. From Dover the material travelled to Winfrith by train, it was then loaded onto a 'low loader' lorry and driven to Dounreay.

The shipment sparked a mass of public and political protest which culminated in a temporary blockade on the Kessock Bridge in Inverness. Two cars which had been parked in a lay-by were driven into the middle of the road blocking the lorry's path. The protesters were quickly removed by the police, but not before gaining the national publicity they sought. They pledged to repeat the protest "until the Government finally listens to the demands of the local people for a nuclear free future."

Routine

AEA Technology who run the Dounreay plant were surprised by the hostile public response to the shipment arguing it "was routine and carried out under international transport regulations approved by the Department of Transport. Similar movements have been taking place for more than 30 years and have presented no hazard to the public." While declining to say how much the PTB contract was worth, they conceded that this was only the first batch and another 14 spent fuel rods are expected.

Dounreay are currently negotiating with a number of research reactors left 'high and dry' by the US decision to call a moratorium on HEU reprocessing (SCRAM 81). They include reactors in Canada and Spain.

The Canadian deal involves two oper-

ators. The first, Atomic Energy Canada Ltd (AECL), manages the fuel for a handful of Universities and Colleges running AECL 'Slowpoke' reactors with a capacity of 20kW each. Over the last 30 years they have been involved in about 212 shipments to the US; now, however, Dounreay have given AECL a quotation which is being given "serious consideration". The second operator is McMaster University, Hamilton, which operates a 5MW research reactor. The University is concerned about the potentially disastrous public relations of having 52 spent fuel rods on campus, and are said to be considering a deal very seriously. They would, however, prefer to continue sending the spent fuel to the US, which used to keep the waste; the products of reprocessing going to the US weapons programme.

According to Spain's recently released National Energy Plan, a deal involving three reactors is being negotiated with Dounreay: Argos, in Barcelona; Arbi, in Bilbao; and JEN-1, near Madrid. Both Argos and Arbi have been shut down since 1975 and are scheduled for decommissioning this year. JEN-1 is also believed to be closed down. An announcement on this deal is expected shortly.

Premature

Meanwhile, Dounreay have said "reports of this place's death are premature. These [reprocessing] plant are all under utilised, there's spare capacity, and we are planning to treble the plant we have in order to cope with the demands from various types of customers."

The use of HEU fuel in 118 research reactors in 34 countries is a cause for considerable proliferation concern. Reactors requiring HEU fuel can operate

on a minimum of 20% enrichment - 20% U-235 - which is exactly the same minimum percentage required for the manufacture of an atomic bomb. Many research reactors employ 93% or more enriched HEU. Today, about 4,000kg of HEU is contained in fuel elements for research reactors throughout the world.

Uranium which is enriched to 90% or above can be used almost directly to make a Uranium fission bomb, with a critical mass assembly of about 50kg. The lower the enrichment the higher the required critical mass.

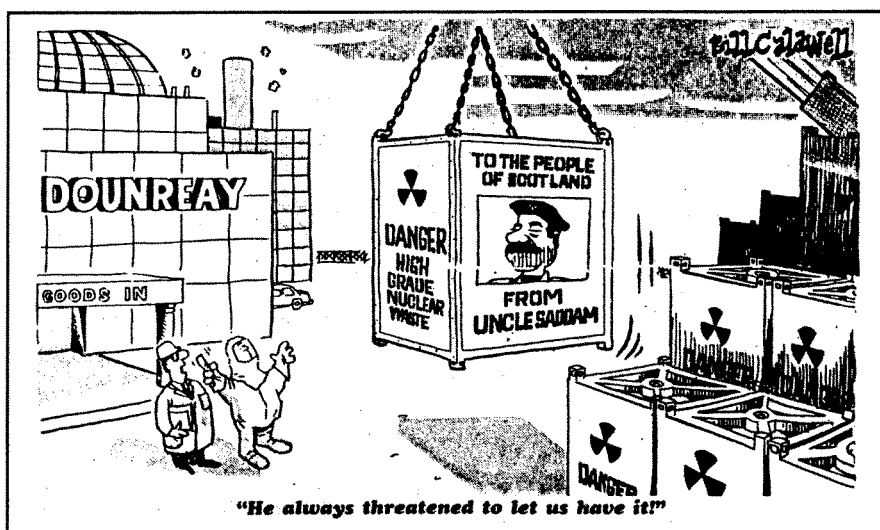
Proliferation

The spread of nuclear weapons should in principle be prevented by the 1968 Non-Proliferation Treaty (NPT). However, as Paul Leventhal, president of the US based Nuclear Control Institute, points out: "The most important lesson from the war of nerves between Iraq and the UN over Baghdad's nuclear weapons programme is the importance of nuclear explosive materials and the folly of a non-proliferation regime that waits for a nation to acquire a nuclear explosive device before the alarm is officially sounded."

"Iraq reminds us of the unalterable fact of life: with one or other of the two nuclear weapons materials - highly enriched uranium and plutonium - you can build a nuclear weapon."

Iraq had two small research reactors (SCRAM 81) at Tuwaitha Nuclear Research Centre. They were not built, developed or operated 'clandestinely', they were bought, fuel and all, from France and the Soviet Union under the business-as-usual 'peaceful atom' programme fostered by the NPT.

Under the treaty, Iraq as a signatory has the right to the peaceful benefits of the exploitation of the atom. And, under



Sunday Mail, October 6, 1991

Article II of its Statute (1957), the International Atomic Energy Agency, with over 110 member states, is bound to "expand and accelerate" the spread of nuclear technology throughout the world. Putting the IAEA in charge of proliferation safeguards is like putting Lord Hanson in charge of the Monopolies and Mergers Commission.

By simply not selling Iraq the components of an industrial/military complex, the inevitable sequence of events culminating in the bombing of the reactors during the 'Desert storm' offensive.

Now comes the question of what to do with the debris of the stricken reactors. According to the UN's inspection team it will cost about £20 million to clean up the sites, and the used and unused HEU fuel will have to be taken away. Who will receive this glittering prize? France and Scotland. While the French provided half of the fuel and are willing to take it back, the Soviet Union, responsible for the other half, appear ready to take the unused fuel but not the spent fuel. The most plausible reason given for this, so far, is continued opposition to the idea in the Russian Federation and the Ukraine - the only parts of

the former Soviet Union capable of storing the spent fuel rods.

This sparked the second political storm surrounding Dounreay's reprocessing facilities in a week. News of the possibility that Iraqi HEU was bound for the plant was not made public by the Scottish Office following the approach by the UN, but by a leaked draft memo, marked confidential, between the Scottish Secretary, Ian Lang, and the Energy Secretary, John Wakeham.

No little difficulty

The memo was in response to Wakeham's request of June 21 that Dounreay reprocess some of the spent HEU. Lang replied, "If you and Douglas Hurd judge that the UK's overall interests will be best served by agreeing to participate in ... the UN Security Council Resolution ... I should not want to stand in the way." Lang was not without reservations, especially over the "no little difficulty" such a development would cause, "especially with the SNP."

While press attention focussed upon the posturings of the various political parties, a number of questions concerning the Iraqi spent fuel remain unanswered.

The reactors were bombed, does this mean that the fuel is damaged in any way?

If so, will it have to be re-clad before being transported?

Why reprocess it? Reprocessing does not produce anything which cannot be obtained cheaper on the open market. Of the two main products of reprocessing - Uranium prices are very low, and the world is currently awash in plutonium.

Who will own the recovered material? Under normal contracts with Dounreay the HEU and plutonium are eventually to be returned to the owner of the spent fuel. However, with the Iraqi spent fuel this will clearly not be the case.

Under the US contracts, an amount of fresh HEU, said to be equivalent in economic value to the uranium and plutonium produced, was sent to the research reactor. The US used the products of reprocessing in their bomb programme. If the products of reprocessing are owned by the British government, they will almost certainly be used in the nuclear submarine fleet, which use HEU to drive their reactors, and for weapons production.

It would appear that the British Government's offer has less to do with 'resolving a danger to humanity' and more to do with being paid to manufacture fuel for its own submarines and produce plutonium for its bombs. □

Free 'gift'

FREE fuel from the ill fated German fast reactor at Kalkar (*Safe Energy* 84), secured by Dounreay in a deal sanctioned by the British Government, is central to the nuclear industry's plans to keep the prototype fast reactor (PFR) running beyond the 1994 cut off date announced by the Government in 1988.

The fuel which was fabricated for the SNR-300 fast reactor owned by the international consortium SKB has been offered on the condition of interim storage until 1996. If by then it has not been used, it will either be returned to Germany or passed on to the US for use in their Fast Flux Test Facility.

The Nuclear Utilities Chairmen's Group (NUCG) - involving Nuclear Electric, Scottish Nuclear Ltd, British Nuclear Fuels plc and AEA Technology - are trying to convince the Government that the free supply of £60 million worth of fuel makes keeping the PFR open an attractive proposition.

In a report submitted to the Department of Energy (DoEn) the NUCG are calling for a 3 year extension to the PFR research and development contract. They have also called for a corresponding 3 year delay in the construction of the European Demonstration Fast Reactor (EFR) pending the results of further work on the PFR. This would yield invaluable data for the European project

argue Nuclear Electric (NE), who are chairing the NUCG PFR sub-group. Starting the EFR in 1997 would be premature according to NE.

The extension would cover testing of instrumentation, reactor examination and subsequent examination of the structure components coming out of the reactor.

"The 3 years is not just a number we picked out of a hat", say AEA Technology. "We will reach quite definite milestones in that period. That timescale allows the information to be extracted and used in influencing the EFR design process."

Brian Eyre, chair of AEA Technology, believes "To pull out of completing the present fast reactor developments and substantially delaying commercial deployment would risk both losing the expertise and technology that has been developed at high cost and, more seriously, not being able to provide a secure electricity supply in a responsible way would be a grave mistake." Britain should be ready to place orders for commercial fast reactors between 2010 and 2020, several years before pressure builds up on the demand for uranium, according to Eyre.

The DoEn are "assessing" the NUCG proposals. However, any change in policy would represent a massive and sudden change of heart in view of statements made in their consultation document on nuclear research and development.

The Department is reviewing the £112

million it currently spends on nuclear Research and Development, including the £47.8 million earmarked for fast reactors. The document reiterates their commitment to cut funding for the PFR in 1994, and fund a "core" R&D programme of £10 million annually on the EFR.

"It seems unlikely that the capital cost of a fast reactor could be reduced substantially below that of a thermal reactor," argue the DoEn. They add, "There is now less concern about the provision of uranium supplies than there was 10-15 years ago. Large new deposits have been found and the predicted growth in nuclear-generated electricity has not occurred."

The OECD/NEA Red Book on uranium supplies estimates that there is enough uranium to last between 75 and 175 years at the anticipated 1995 world consumption rate. Should there be a significant increase in the use of uranium "then the resultant price increase would lead to increased exploration activity, in line with past experience in the oil and gas industry," say the DoEn.

With the consultation period now over, a policy statement stemming from the document - which was issued by a multi-Government Department committee - is expected to be published by the middle of next year. □

* "The Department of Energy's Nuclear R&D Programmes: a consultation document." DoEn, August 1991.

Magnox malady

DREAMS of running magnox reactors until they are 40-45 years old (*Safe Energy 84*) have begun to evaporate, the Nuclear Installations Inspectorate (NII) have told Nuclear Electric (NE) that unless a safety case can be proven 5 of the reactors will have to be shut down by the end of the year.

In a letter to Greenpeace, the NII said that the operation of Bradwell, Sizewell A, Dungeness A and Hinkley Point A are all suffering from dangerous levels of embrittlement in their steel pressure vessel welds. Trawsfynydd is also operating to the same deadline. Should the welds fail it would cause a "rapidly growing failure in the pressure vessel."

When a material becomes brittle in this way, it is impossible for engineers to predict when it will crack, and because of the inaccessibility of the pressure vessels direct inspection is impossible.

The problem was brought into focus by the publication of the NII's, 6 year late, Long Term Safety Review of the 26 year old Hinkley A station. The review said "New data from NE's research programme in late 1990

indicated that the transition temperature of the vessel weld material may have been underestimated so that some parts of the weld material may not have been ductile during reactor operation. Changes to operating procedure have been introduced to counteract this effect." However, the changes - running the reactor with increased temperature in the pressure vessel to ensure the welds are ductile (pliable) - have been accepted as proof that it can be run safely until the end of the year.

Meltdown

However, increasing the temperature solves the problem only when the reactor is operating normally. In the event of an emergency shutdown embrittled welds would be under increased stress. The main area of concern here focuses on the coolant duct welds situated at the top of the pressure vessel, if they should fail and block the ducts, the resultant loss of coolant could cause a meltdown in the reactor core.

NE have submitted revised safety cases for the pressure vessels in these Magnoxes, but the NII "has only had them a few weeks and are still working towards their conclusion." NE, however, are "con-

fident that the safety case we have put forward is a robust one. It goes without saying we would not run a reactor if we did not consider it safe."

The Oldbury and Wylfa Magnox stations run by NE have concrete pressure vessels and are therefore not subject to the same considerations.

British Nuclear Fuels two 4-reactor Magnox stations, at Chapelcross and Calder Hall, do have steel pressure vessels, but according to the NII they "are in a slightly different category. This is partly because it's recognised in the industry, and by us, that they have always operated under a more benign kind of regime," than NE's stations. This is mainly because their prime function has always been to produce plutonium for the military and not electricity generation.

Four of the five suspect reactors - Trawsfynydd, which is already closed because of corrosion problems, being the exception - lie in the capacity short southern half of England. Their closure could cause problems for the national grid company, it would be almost impossible to install new generating or transmission capacity in time to make up likely shortfalls during extreme winter conditions, according to *Power In Europe*. □

Transport troubles

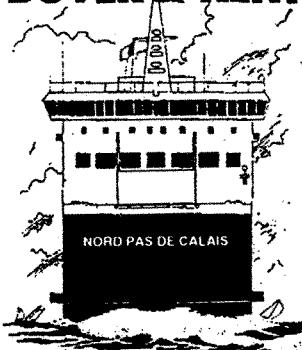
CLAIMS made by British Nuclear Fuels (BNF), that the French roll-on roll-off ferry the 'Nord Pas de Calais' is purpose built for the carriage of nuclear waste, have been condemned by the Merchant Navy Officers Union NUMAST.

NUMAST executive council member, and Labour's prospective parliamentary candidate for Kent and Deal, Gwyn Prosser said: "This train ferry, which is certified to carry up to 50 passengers and mixed cargoes, holds the same hazardous goods classification as any number of vessels using the Channel. They don't compare with genuine Purpose Built Nuclear Vessels [run by Pacific Nuclear Transport] which are built specifically for the carriage of nuclear cargoes. They are not allowed to carry passengers, they have specifically segregated holds to carry individual flasks, they have radioactive monitoring and advanced fire protection installations and their crews are trained to deal with nuclear incidents."

NUMAST cast doubt on the integrity of the waste flasks, which under international regulation must withstand an 800°C fire for 30 minutes, pointing out that the average temperature and duration of a sea board fire are 1000°C and 24 hours.

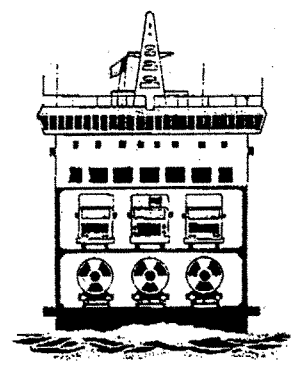
Prosser also called for the immediate resignation of John Maltby, chair of both the Dover Harbour Board and AEA Technology, which he feels presents a "clear conflict of interests". Maltby refuses to resign and a DHB spokesperson said "We have no comment. The two chairmanships are not connected."

ATTENTION DOVER & KENT!



THERE IS MORE TO THIS THAN MEETS THE EYE!

NUCLEAR WASTE IS TRAVELLING THROUGH YOUR AREA!



STOP THE TRANSPORT SIGN THE PETITION - SEE OVER

A leaflet delivered to homes in Dover and Kent

BNF have also announced plans for a nuclear waste accident exercise, in spring of next year. The exercise is being designed to show that the transportation of spent fuel through south east Kent is perfectly safe. The Dover Port Authority, BNF and British Rail will all cooperate in the mock accident.

This announcement is being seen as a response to an 18,500 name petition organised by Greenpeace and KARE (Kent Against a Radioactive Environment), calling for an end to the importation of radioactive waste through the Dover port. Further pressure has been brought to bear by Shepway District Council's decision to support the campaign.

Meanwhile, seamen working on Pacific Nuclear Transport's ships have been ordered to fill in a questionnaire about who they have been living with

for the last five years, or face the sack.

Following a change in Government policy, the new measures are required in the interests of national security, in particular to counter the threat of terrorist attacks, according to BNF.

The Rail, Maritime and Transport Union which represents the 130 ratings and officers, who work on the 5 vessels taking plutonium between Sellafield and Japan, are "aghast at this gross infringement of their civil liberties - they are not even government employees." The form demands details of current or broken relationships, even if the former partner is dead.

BNF said similar rules have applied to 15,000 of their workforce for a number of years, and that from October 1990 Government policy had changed to include contractors. □

Chapelcross PWR

LANDOWNERS in Dumfries have received letters from British Nuclear Fuels detailing the findings of a £3 million feasibility study into building a Pressurised Water Reactor at Chapelcross, threatening that the development could involve taking over some properties.

Of the study's findings, most concern is being expressed over the four options BNF present for supplying the PWR with the 26 million gallons per day of cooling water. They are:

- a huge mile long by half a mile wide pump storage reservoir between Creca and Kirtlebridge could flood Creca moss;

- flooding parts of the Milk and Dyfe of Ae valleys for reservoirs to augment the existing pumping station at Warmanbie;
- pumping extra water into the River Esk, from the Kielder Reservoir, for extraction at Netherby and Metal Bridge; and
- a supply from Kielder via a 95km pipeline.

The first phase results also show the need for a marine offloading terminal at Waterfoot or Seafield and for the construction of new roads. The new plant might also require a pipeline zig-zagging from Chapelcross to Newbie, were radioactive effluent would be discharged into the Solway. Skirting Outertown and Distillery farms en route, it is believed the pipeline will not be buried as this would lead to inspection problems.

While BNF argue that "absolutely noth-

ing has been decided. We have a number of options and this is part of the consultative process," they are now moving on to phase 2 of their feasibility study costing some £30 million.

The next phase will focus on environmental, technical and economic issues. Economics, admit BNF, will be the crucial factor.

The company still insist that this will be a purely commercial venture and is not tied to producing weapons material for the military. However, the question remains, when Chapelcross' Magnox comes to the end of its life, which may be sooner than BNF had planned, where will the UK get plutonium and tritium for its weapons programme? Some observers believe that BNF will switch from a PWR to a heavy water reactor at the 11th hour. □

Nirex vote loser

PLANs to build a nuclear waste dump at Sellafield will be a key issue in the general election, according to a Greenpeace opinion poll. The Copeland constituency MP, Labour campaign manager, Dr John Cunningham, risks losing his seat if he supports Nirex's plans.

The poll shows that 40% of Labour voters would be less likely to back a candidate who supports an underground dump. Cunningham has described a deep storage facility as the "logical next step in the development of nuclear waste management."

In an attempt to set out his position on Nirex, Cunningham issued a statement in July: "I have consistently supported the principle of a deep storage facility ... with

the nuclear material in a retrievable, monitored form ... But no-one should assume that I am going to support the Nirex approach ... I do not support any proposal for an inland repository." He believes "a repository deep under the sea bed with access from the Sellafield site would be the best alternative for ... monitored storage in a retrievable form."

Rather than clarifying his position, this further distances him from an acceptable stand. Emplacement deep under the sea bed precludes the options of monitorability and retrieval, as the geological formations considered for this are too deep under the sea.

In another poll conducted by the *Whitehaven News*, Copeland's local newspaper, 95% opposition to Nirex was registered.

Local feeling was given a public outing

during a recent visit to Sellafield by Energy Secretary John Wakeham. Where one protester observed: "He's cleared his back yard and wants to fill ours", referring to Wakeham's vociferous opposition to a dump in his South Colchester and Maldon constituency in 1987.

Protesters have been further enraged by British Nuclear Fuels' (BNF) - acting as agents for Nirex - application for planning permission to drill two exploratory boreholes within the Lake District National Park. Two 150ft high floodlit drilling rigs operating for 30 months are to be erected at Bleng Fell. BNF will then carry out tests and monitoring for 4 years, but want the site to remain available for up to 50 years. The plan will involve 200 lorries travelling to the site each day while the rigs are being erected. The construction of access roads will mean the destruction of ancient looning and standing stones. □

The fire next time

FIRE once again wreaked havoc at the Chernobyl nuclear power station, at the beginning of October, revealing the terrifying safety standards which still prevail at the site.

The three hour fire was caused by a fault in equipment designed to isolate reactor number 2 from the national grid while engineers carried out maintenance checks on the generator. The device failed, forcing powerful currents through the generator, over heating its wiring and igniting its insulation. Special seals leading into the generator also failed, allowing hydrogen gas coolant to flood into the chamber. The gas exploded, blowing a large hole in the turbine hall roof.

In this case, Chernobyl operators shut down reactor number 2 within 60 seconds

of detecting the fire, however, Viktor Hladush, the Ukrainian Minister of Industry and Transport, admitted that this latest fire revealed that safety standards at the station were still dangerously low. He said that no radiation had been released and that the situation is now fully under control.

Excessive secrecy will not be a problem this time, say the Ukrainian authorities, who have allowed western journalists to visit the site. While not entirely reassured by the sight of rain pouring in through the 2,300m² gaping hole in the turbine hall roof, the journalists have confirmed that there is no new radioactive contamination.

The accident has fuelled calls for the defective RBMK Chernobyl reactors to be shut down immediately. However, the region, which has some 15 Chernobyl-type reactors, remains committed to keeping the station open until 1995. □

Sizewell software safety

DOUBTS over the viability of computer software for protecting Sizewell B from serious accidents (*Safe Energy 84*) continue to plague Nuclear Electric, and threaten to delay completion of the plant.

Computer experts are worried about the new Westinghouse protection system, saying it is too complex to check. In response the Nuclear Installations Inspectorate has taken the unusual step of publishing details of the safety requirements it is asking NE to meet. Normally the NII keep their options open when deciding about a licence. The onus is usually on the operator to prove a safety case.

Critics are calling on NE to publish the results of their own internal safety assessments and those of independent consultants. The British Computer Society, worried about "the secrecy which surrounds the safety-critical software in the Sizewell B control and protection system," would welcome a chance to comment on the safety case for the system. □

Nuclear Free Local Authorities are urging the European Parliament to support a ban on the air transport of plutonium using existing packages. They also want the EC to intervene in the debate about the physical tests intended to ensure the integrity of plutonium packages in aircraft accidents. FRED BARKER, author of the NFLA evidence to the European Parliament, explains why.

A case of double standards

MOVING plutonium around is a tricky business. It is, after all, a highly toxic and long-lived radioactive substance, and then there's the problem of what might happen if the wrong people get hold of the stuff. Little wonder that local authorities – with their responsibilities for public safety and environmental protection – are concerned.

That concern has been heightened by disharmony in the international regulation of plutonium flights.

Most movements of radioactive materials, worldwide, are in accord with the Regulations recommended by the International Atomic Energy Agency (IAEA). These place great reliance on a set of physical tests, intended to ensure that packages are designed and constructed to withstand most accident conditions. Currently, the same tests apply irrespective of the intended mode of transport. Key tests include a drop test from a height of 9 metres onto an unyielding surface (reaching a speed of 13.4 metres per second), and a fire test of at least 30 minutes at a temperature of 800 degrees centigrade.

These IAEA tests are not as stringent as those in the United States. Since 1978, the US has had regulations for the air transport of plutonium – known as NUREG 0360 – setting out requirements which include an impact test of at least 129 metres per second onto an unyielding surface, and exposure to an aviation fuel fire for at least one hour. In 1987 even more stringent requirements were introduced for the transport of plutonium through US airspace from one foreign country to another. The so-called 'Murkowski Amendment' requires packages to be tested under stresses that would occur in a worst case accident. Impact test criteria based on such an accident require that a package be dropped so that it reaches a speed of 282 metres per second and hits a surface with the same properties as weathered rock.

By the late 1980s significant concern was being expressed about the disparity between the IAEA and US regulations, and the IAEA was forced to act to close the gap.

According to the IAEA Technical Committee, responsible for regularly reviewing the transport regulations, action had become necessary for a series of important reasons, not least that an "inadequate portion of foreseeable aircraft accidents are covered by the 9 metre impact test". Other reasons were stated to be:

- the lack of international harmony;
- the increasing volume of radioactive material shipped by air;
- the possibility that the International Civil Aviation Authority may act on its own;
- preserving the credibility of the IAEA; and
- an appropriate response to public concern.

It was in June 1987 that the Technical Committee (TCM) first recommended that a review of the risks of plutonium air transport be conducted. The IAEA's Standing Advisory Group on the Safe Transport of Radioactive Material (SAGSTRAM) agreed, and the review started in early 1988. In December 1988, the TCM recommended a revised impact test speed of 85 metres per second onto an unyielding surface, and a fire test duration of one hour. In April 1989, SAGSTRAM agreed that there should be special regulatory provision for air transport, and accepted the TCM impact and fire test recommendations.

Taking too long

It decided, however, that further consideration should be given to other types of tests. By May 1990, the TCM was in a position to make a comprehensive set of recommendations, including the impact test speed and fire test duration agreed by SAGSTRAM in April 1989. Of great significance was the recommendation that a new package type should be designated for air transport, to be known as an 'Air Qualified Package' or 'Type C' package. Finally, in December 1990, SAGSTRAM approved the TCM recommendations and agreed to seek comments from member states.

Although this review process has already taken over three and a half years, it is not the end of the story, SAGSTRAM's recommendations now have to be fed into the revision cycle of

the Regulations for further consideration. This will result in the publication of revised Regulations in 1995. These will then have to be considered for incorporation in the legislation of individual member states. This is likely to add a further five years to the process.

No doubt aware of the unsatisfactory nature of this timetable, SAGSTRAM itself has hinted to member states that they may wish to forbid the air transport of plutonium for commercial purposes pending development of new 'Type C' packages. The Nuclear Free Local Authorities (NFLAs) are highlighting this suggestion and urging the European Parliament to support a ban on the air transport of plutonium using packages developed under previous and current IAEA Regulations.

Unsatisfactory outcome

A major point of contention in the SAGSTRAM recommendations is the proposed impact test velocity of 85 metres per second. Although an improvement on the current test speed of 13.4 metres per second, it is still slower than the NUREG 0360 requirement of 129 metres per second, and falls far short of the requirements of the 'Murkowski Amendment'. The proposal will not, therefore, remove disharmony in the international regulation of plutonium transport – unless the US adopts the IAEA recommendations; a move which, no doubt, would be fiercely resisted.

So what is the basis for the proposed impact test speed of 85 metres per second? And of current IAEA, NUREG 0360 and Murkowski impact test speeds, come to that?

The current IAEA test requirement is based on work carried out by the UK Atomic Energy Authority in the early 1960s, when the dominant modes for radioactive material transport were road and rail. At that time it was argued that the 9m drop test was adequate since packages would either be unlikely to suffer higher drops on to very hard surfaces, or that a significant part of the impact during collision would be absorbed by the vehicles involved.

In essence then, a crucial part of the current regulatory requirement for the

design and construction of plutonium air transport packages is currently based on the road and rail conditions which existed in Britain in the 1960s. Staggering. And it took until 1988 for the IAEA to be concerned that an "inadequate portion of foreseeable aircraft accidents are covered by the 9 metre impact test".

In contrast, in the US, the choice of impact speed in NUREG 0360 is based on the Federal Aviation Authority Regulations, which say that the maximum permitted speed that aircraft can fly at altitudes below 10,000 feet in the US is 129 metres per second. As for the 'Murkowski Amendment' requirement, it is based on a political determination that plutonium packages will be designed to withstand worst case accidents.

The approach of the IAEA in producing revised Regulations is different. The stated aim is to produce a level of protection in air transport comparable to that already provided for road and rail transport (which some would argue is inadequate anyway). Apparently, an impact test speed of 85 metres per second would achieve the IAEA aim. Furthermore, the IAEA argues, studies show that an increase in velocity beyond 85 metres per second will increase only "insignificantly" the fraction of aircraft accidents protected against.

Ambiguous data

The NFLA submission to the European Parliament provides evidence which shows that these claims are not firmly based. First of all, it assesses available figures for the percentages of the different types of accident expected to be covered by the various impact test conditions. Data suggests that the current IAEA impact test at 13.4 metres per second covers 98-99% of road and rail accidents. However, figures for the percentage of aircraft accidents covered by an impact test of 85 metres per second vary between 60-90%, 90% and 98% - hardly conclusive confirmation that the proposed impact test velocity will provide a level of protection in air transport comparable to that which currently exists for road and rail transport.

Data on the percentage of aircraft accidents protected against by different impact test speeds is also ambiguous, with significant differences between the data from different labs, and wide confidence limits. The NFLA report argues that the data cannot be said to show conclusively that an increase in speed beyond 85 metres per second will increase only insignificantly the fraction of accidents protected against.



In these circumstances, the technical basis for proposing an impact test velocity of 85 metres per second remains unclear. At least the NUREG 0360 test speed has a readily understandable basis in terms of the US maximum permitted air speed below 10,000 feet.

As a result of this assessment, the NFLAs are urging the European Parliament to ask the IAEA to reconsider its proposed impact test speed, to look again at the US requirements, and to identify an impact test speed which can be fully justified

Air transport at stake

Significantly, SAGSTRAM itself acknowledges that with regard to test requirements "the Agency does not seem to base current decisions on an obvious and auditable path to a decision". Instead, it is argued, the proposals "reflect conservative safety oriented consensus views of what is prudent." The problem with such a claim is that in the absence of a clear and unambiguous technical case, views on what constitute prudent proposals are vulnerable to influence by a range of institutional and political interests.

Put at its starkest, as the majority of individuals participating in the IAEA review process are from the nuclear industry, or associated with its development in one way or another, they are unlikely to recommend test

conditions so severe as to jeopardise the successful development of a package. Participants in the IAEA review process will have been acutely aware of the difficulties posed by US regulatory requirements for package development programmes.

These difficulties have been severe. After the passing of the 'Murkowski Amendment', both the US and Japanese governments quickly realised the problems of meeting the new requirements, so in October 1988 US approval was given for plutonium to be shipped from Europe to Japan by sea. NUREG 0360 requirements "approach the upper limit" for a practical air transport package design.

Is it therefore surprising that the IAEA are recommending an impact test speed less than that required in NUREG 0360? After all, certain member states would oppose any proposals for requirements which "approach the upper limit" for a practical design of package, and which might therefore preclude the commercial transport of plutonium by air within Europe, as well as from Europe to Japan. □

* The International Transport of Plutonium Spent Nuclear Fuel and High Level Radioactive Waste: An Assessment of Safety, Security and Proliferation Issues. Available from the Nuclear Policy and Information Unit, Town Hall, Manchester, M60 2LA. £15.

Dr IAN WELSH, Senior Lecturer in Sociology at Bristol Polytechnic, sees the nuclear industry's choice of Sellafield for its waste dump not as a final retreat, but as a tactical withdrawal in preparation for the 1994 review.

Wasting away?

THE announcement that the nuclear industry wants to bury its waste in its own backyard might appear as another symptom of their retreat from the joint forces of public acceptability and privatisation. Far from this, it marks the start of a fightback which might even be regarded as something of a second coming by the hopeful.

True it has been a particularly barren period for the embattled industry. Attempts to bury nuclear waste in our backyards have been consistently repulsed throughout the 1980s. A Conservative Government, which championed the nuclear industry, remained faithful to its free market ideology, to the industry's cost. The shadow of Chernobyl is cast long into the 1990s. How then can the withdrawal to the laager at Sellafield signify the start of the long fight back?

To understand this seemingly unlikely proposition, one needs to adopt a perspective long enough to incorporate the lessons from Britain's nuclear past. This is not the first time that the nuclear industry has faced an apparently insurmountable crisis and survived. Nuclear power was born out of the war time bomb project and by the mid-1950s had become a major focus for national pride and prestige. It was presented as the means by which Britain would become truly great once more. The nuclear establishment promised a second age of Elizabethan splendour. Popularisers promised the spread of more and more atomic gadgets: 'Gamma Gets It Whiter', would end all wash day blues; atomic rockets, recently enjoying a revival in America, would take us to the stars.

The promise of a bright future was premised on a total commitment to the full nuclear cycle: from uranium mine, to enrichment plant; from fuel fabrication, to thermal reactor, to reprocessing, and the burning of plutonium in fast breeder reactors. In this sense the nuclear dream recycled fissile material and generated more in the process. It was the philosophers stone of energy supply. The only dead end in the cycle

was the waste arising. In this halcyon past the issue of waste disposal was sidestepped. It was a problem which would be solved by a concerted research and development effort when the time came.

In the interim, the British industry pursued a disperse and dilute philosophy discharging effluent from Sellafield and disposing of low and intermediate level waste at deep sea burial sites. Had a land disposal route been developed in this relatively untroubled period it would have established a precedent before the nuclear fuel cycle became a widespread object of public distrust and opposition. As it is, the proposal to establish one at Sellafield represents the first site selection which may prove politically viable. On this hangs the viability of the whole nuclear industry in Britain.

Crippling indecision

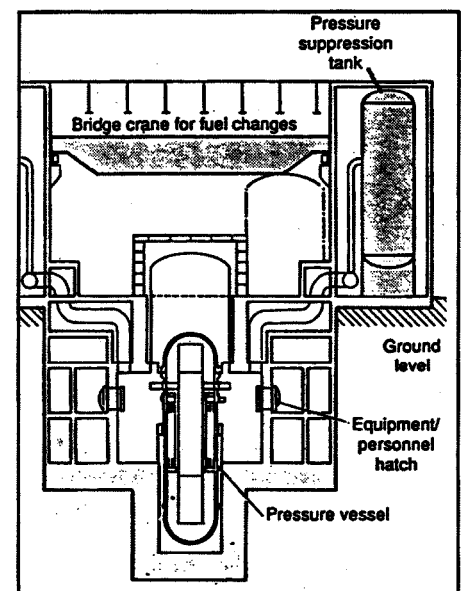
Since those heady days the British nuclear industry has survived numerous crises. In the 1960s came a period of crippling indecision over the choice of the second generation of nuclear reactors. When the decision came it was heralded as 'the greatest breakthrough of all time'. The British Advanced Gas Cooled reactor was claimed to have triumphed over its American water cooled competitors. It was a claim received with a scepticism which was subsequently vindicated. The initial AGR programme was a financial and technical disaster. Its supposed advantages disappeared in time and cost over-runs and down ratings on design output. Despite this, two further AGRs were ordered in the early 1980s to keep the beleaguered nuclear industry intact whilst the decision to adopt the controversial Pressurised Water Reactor was taken. This decision was vindicated by lengthy public inquiries at Sizewell and Hinkley Point.

By the mid 1980s a viable thermal reactor programme based on light water appeared on the verge of delivery. The end of British isolationism in reactor design appeared at

hand. But this also marked the beginning of a deeper set of simultaneous crises for the industry. Government funding for the Fast Reactor Programme ebbed away and public opposition to waste disposal mounted. The coup de grace appeared to be the private sectors unwillingness to accept the financial risk associated with nuclear power.

Decommissioning

This risk was comprised of several elements. Key amongst these were the cost of decommissioning nuclear power stations, uncertainties about the cost of reprocessing fuel at Sellafield, and uncertainties about the cost and viability of waste disposal. This last concern was particularly crucial as, at the time of privatisation, there was no concrete proposal for a final waste management strategy. There was little to base sound financial estimates on. The financial sector was not prepared to make the final act of faith required to ensure a nuclear future in the UK. The Government's response was to withdraw nuclear generating capacity from the privatisation and retain it as a state monopoly. The Hinkley Point Inquiry was informed of the decision to make no further nuclear orders pending a review of the viability of the technology in 1994. This is why the



The 'Safe' Integral Reactor

Sellafield proposal represents the start of a nuclear fight back.

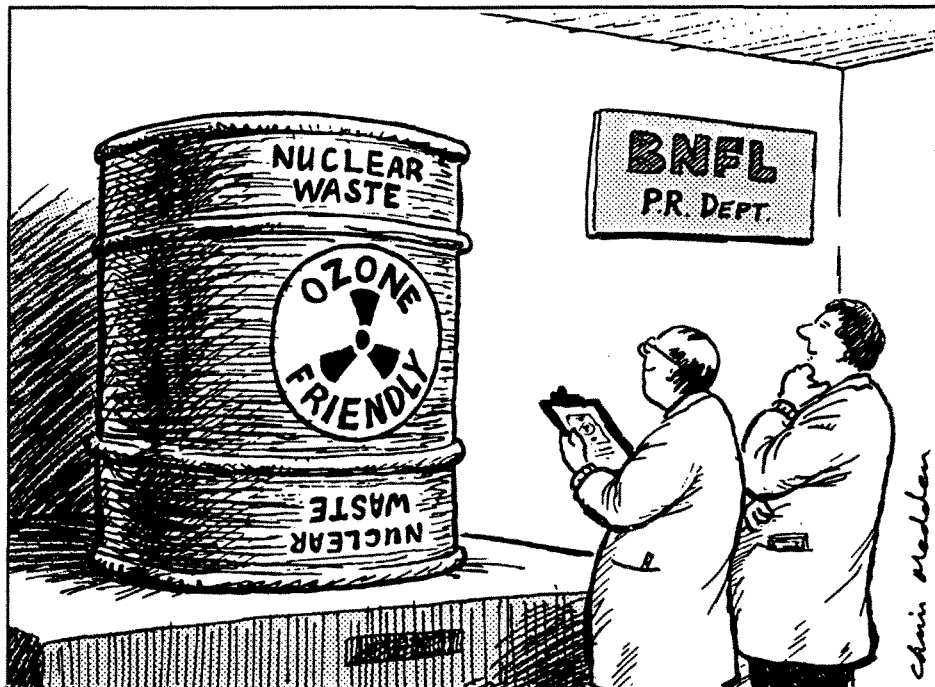
The industry intends to table a proposal in time for a Public Inquiry in 1992. The consequence of this is that by 1994 the technical and economic viability of such a disposal facility will have been tested at inquiry irrespective of whether it is built or not. The establishment of the viability of a disposal route to the satisfaction of Government and the financial sector must be the primary concern of the industry. The fact that the industry intends to cater for between 700,000 and 2 million cubic meters of waste indicates that its planning includes the continuation of a nuclear option beyond 1994.

The Sellafield proposal is the only one likely to reach a Public Inquiry within this time span. It is thus vital to legitimate the industry's waste disposal strategy in time for 1994. The nuclear enterprise may have been driven into its own backyard but with all eyes fixed firmly on the review date it is a retreat which is part of a wider strategy to win future approval.

Mounding

Other elements of this strategy can be seen in the recent climb-down on the decommissioning of nuclear reactors. Under the CEBG there was a firm commitment to the complete dismantling and disposal of reactors. Throughout the 1980s considerable efforts were expended on the development of remote control cutting equipment to effect this task. Whilst technical feasibility was generally established, the costs remained prohibitive in commercial terms.

Nuclear Electric has since announced that it now intends to demolish the major buildings leaving the reactor cores in situ. These would then be sealed and covered by earth mounds. This would reduce the immediate costs and remove another of the markets reservations about the viability of the nuclear option. In a quite extraordinary piece of publicity the residual heaps were likened to the Megalithic Barrows left by our ancient ancestors throughout Great Britain. The technology, once described as the cathedrals of our times, thus becomes a reflection of an even more primitive past. The potential for theme parks is considerable.



Source: *ECONews*, December 1989

Perhaps the most significant sign of long term revivalist thinking relates to reactor technology, however. The contribution of fossil fuel burn to the greenhouse effect has provided a ready made hook upon which to hang an environmentally friendly argument for nuclear power. Electricity produced this way does not directly produce greenhouse gases.

The argument itself is flawed by the fact that it would require a phenomenal programme of nuclear build to significantly reduce emissions within the relevant time scale. Such a heroic construction programme would be a crippling financial burden. This factor alone makes it an unviable fantasy though this does not stop proponents of the nuclear enterprise advancing the argument.

Small reactors

It would appear, however, that the industry is about to attempt to hijack another environmentally friendly term - 'Small is Beautiful'. The epithet could so easily be applied to one of the flag ships for the future - advanced small reactors. Such reactors have many claims made for them. These include the incorporation of passive safety features, factory produced in large numbers, and high levels of availability over a long life time. As a long term option they are seen by the industry as a means of placating public concerns over safety. They also have the advantage of meeting insurance concerns over the risk of a single accident wiping out very

significant investment. Nuclear Electric sees a coming renaissance for nuclear power based new evolutionary or passively safe reactors to be built from the year 2000 onwards.

This then is the context within which the decision to opt for a waste disposal site at Sellafield makes strategic sense. This is not a sign of the nuclear industry's rout. It is part of a tactical withdrawal. It is a withdrawal from which the industry will emerge fighting. It will be fighting on the grounds that all the significant issues which have led to the loss of public and financial confidence have been resolved. It will be claiming to have a viable waste disposal strategy, an affordable decommissioning policy, and the ability to deliver a new generation of safer reactors. It is far too early to write off the nuclear future which the industry has held faith with for the best part of fifty years.

What is vital is the form of the review undertaken in 1994. The crucial factor here is that any such review should not just be a review of the viability of the nuclear option. What has been needed since the 1950s is an integrated national energy policy. It is something which Britain has never had and which privatisation has made more distant. In terms of efficiency of supply and the elimination of irrational supply options, it is something which is desperately needed. □

A European Community-wide energy/carbon tax is due to be introduced in 1993, in an effort to reduce energy consumption and carbon dioxide emissions. ANDREW WARREN, the Director of the Association for the Conservation of Energy, outlines the EC's environmental initiative.

A taxing solution

THIS summer the European Community has taken the first formal steps towards the introduction of a tax intended to build into the price of energy extra charges for the environmental costs imposed on the community by its extraction, consumption and disposal. This is the first time in history that such a large economic block of nations has attempted to incorporate such externalities into their economies.

The spur has inevitably been concern about climate change. A new Community Strategy has been drawn up by the European Commission. It is intended specifically to limit carbon dioxide emissions – the main gas causing climate change – and caused predominantly by fossil fuel consumption. Significantly, the title of the Strategy states clearly how it is planned to limit emissions: it is a "Strategy To Improve Energy Efficiency".

Within a decade, CO₂ emissions within the Community are likely to grow by between 14 and 27%. Although there has been little increase in such emissions overall across the last 20 years, between 1986 and 1990 there was a 4% growth as "efforts towards increased energy efficiency have slowed", as the EC Strategy document dryly observes. In the UK during 1990 alone emissions rose by 1.6% – even though GDP actually fell by 1.8%. To achieve continuing stabilisation, forecast emission growth will need to decline from the anticipated 863 to 728 million tons of carbon each year.

Efficiency

How is this to be done? The programme concentrates almost entirely on the introduction of energy saving technologies: "a strategy aimed at an overall improvement of energy efficiency is likely to be economically efficient ... the stabilisation objectives by 2000 could be achieved by implementing just those energy efficiency measures which imply a net economic benefit for every Member State."

What does this mean for the energy conservation market? The programme assumes that market-induced energy efficiency investments, plus the new SAVE Programme type energy

efficiency measures (mostly new laws setting minimum standards) will save 60 million tons of carbon per year, almost 50% of the target. Fuel switching is expected to show substantial contributions only after the year 2000. In an annex, it shows that the buildings sector is expected to provide some 11.5 of the 18.4 (or 62%) million tons of the carbon savings to be stimulated by the SAVE Programme.

Energy conservation is therefore to be boosted by an "effective mix of regulatory, voluntary and fiscal measures". Scandinavian programmes, like the Danish home energy survey scheme, offer "encouraging results for insulation and double glazing and heating improvements in existing buildings ... the Community could exert a stimulating role in this area."

Energy tax

Throughout, the issue of low energy prices sending incorrect signals to the market is emphasised. Therefore a new combined energy/carbon tax on fuels is proposed, partly determined by energy content, partly modulated according to carbon content. The argument for the former tax – which unlike carbon taxes, would cover nuclear power – is that the latter causes other environmental damage separately from the climate change issue.

The exact level of the tax is still under discussion, although most commentators reckon it will reach \$10 per barrel of oil (a 50% hike on current prices). It needs to be so high simply because of the lack of price responsiveness in the market. The revenues obtained would accrue to national governments, not to the EC. It will be for them to decide whether they will earmark these revenues for specific energy and environmental expenditure, or go for fiscal neutrality by substituting this tax for an existing one.

The Commission "invites" Member States to devote particular attention to promoting energy efficiency and clean technologies – precisely what those countries which have already initiated special energy taxes (like Denmark and The Netherlands) are doing. However, their current taxes are more a carbon levy than a tax, a small percentage on consumption intended to provide funds for energy saving programmes.

This is the stance taken by the British Labour Party too, which argues against using carbon/energy taxes to solve climate change problems because of the social upheavals which might follow pushing prices up to high. The EC also recognises that such pure use of 'market signals' could cause – as they delightfully put it – "temporary adaption problems" for heavy industry. However, their Strategy paper emphasises that "for most industries, negative competitive effects are limited, since energy generally constitutes less than 5% of costs".

Enhancement

Throughout, there is constant emphasis upon how much the international competitiveness of European companies will be enhanced: "an energy efficient production process creates direct economies, and also contributes to an increased independence with regard to fluctuations in energy prices".

Much stress is laid upon the "first mover advantage", developing energy saving technologies which could then be sold on world-wide markets. "The first signs of this effect can already be observed in Germany and Japan", where both countries' governments view the development of their energy efficiency industry as potentially vast exporters.

Special allowance is made for economies catching up – in the EC, Spain, Portugal, Greece and Ireland – a dry run for the negotiations with third world countries. It is acknowledged that levels of CO₂ in those countries may rise as their economies expand considerably. However, they would have a considerable interest in the establishment of an energy efficient capital stock. They can thus avoid using inefficient technologies and building methods. As such, a policy to stabilise emissions can "improve overall resources allocation".

The present timetable is set for an introduction of carbon/energy taxes at the start of 1993. Over the next few months, the arguments about them will undoubtedly rage. But one thing must remain clear: the main objective is not to raise money for the Treasury. It is to save energy. □

Small-scale hydro power use in rural areas has been promoted for over 15 years by the charity Intermediate Technology, whose founder was *Small is Beautiful* author Dr Fritz Schumacher. ARTHUR WILLIAMS of Nottingham Polytechnic Department of Electrical Engineering, reports on recent technological improvements which reduce maintenance and lower costs.

Micro-hydro: small is beautiful

HYDROELECTRIC power plants on a very small scale – 'micro-hydro' – can provide energy for remote villages in the developing world, with minimal environmental disturbance. For more than 15 years the charity Intermediate Technology has been supporting research and development into 'micro-hydro' schemes.

In countries such as Peru, Sri Lanka and Nepal there are now several workshops manufacturing water turbines and installing generators to provide electricity for people in mountainous areas.

Unlike conventional hydroelectric plant, which require a large storage reservoir, micro-hydro schemes use as little imported materials and technical skills as possible, and are often based around the traditional system of irrigation channels. Such schemes are under the villagers' direct control, and most of the maintenance can be carried out by a local operator.

Micro-hydro can also be used for remote hill farms in industrialised countries, providing a quiet, pollution-free alternative to a diesel generator. Equipment costs are generally much lower than for an equivalent wind turbine and generator.

Several years ago, Akal Man Nakarmi, a Nepalese inventor, began adapting standard industrial motors for use as 'induction generators' for his micro-hydro plants. For sizes below 30kW, these adapted motors are much cheaper than synchronous generators (alternators) which are normally used. Motors are also much more widely available than alternators and require less maintenance, since they have no brushes. Research work recently completed at Nottingham Polytechnic will lead to further reductions in the cost of micro-hydro systems, and improve their reliability.

The main difficulty with the use of induction generators has been the problem of controlling their speed and voltage while appliances are switched on and off. A small kit of electronics, known as the induction generator controller (IGC) has been developed by Nigel Smith, a researcher at Nottingham Polytechnic. The IGC keeps the total power output of

the generator constant by varying the current fed into a ballast load – a large heating element which can be used for water-heating or crop-drying.

Over the past twelve months, the IGC has undergone extensive field trials at sites in the UK and Nepal. Demonstration installations have been set up at a farm in Devon, a watermill in Derbyshire, and at two village sites in Nepal. More recently, a scheme using a standard electric water pump unit, running in reverse as a turbine and generator, has been installed at a farm in the Yorkshire Dales.

Low cost

Pump units are produced in large quantities in the UK and in many developing countries. They provide a low-cost alternative in any country where water turbines and generators are imported. A demonstration scheme using this equipment has also been installed in the north of Pakistan.

During June and July, five engineers from Mexico, Peru, Sri Lanka, Nepal and Pakistan, who are all involved in rural development, came to Nottingham to train in the design, manufacture and installation of induction generator systems. They are

now in a position to assemble the controller in their own countries, and to train other people in the maintenance of these low-cost micro-hydro systems.

Further development of the system is anticipated in order to provide a cheap battery-charging unit. In countries such as Sri Lanka, where many people live in areas remote from the grid supply, it is common place for villagers to carry car batteries many miles to get them recharged. Even so, they provide a more suitable energy source for home lighting than using kerosene lamps, especially as they can also be used to power a radio or small TV. Using induction generators for very small systems (less than 1 kW output) will provide a low-cost unit which can be installed at many localised sites; cutting the cost of transporting batteries, and providing rural employment.

It is intended to run further courses for those wishing to install induction generator systems. Enquiries have already been received from several African and South-East Asian countries. There has also been interest in the system from a number of farmers requiring generators at remote locations in the North of England. A commercialised system for installation in the UK will be available in 1992. □

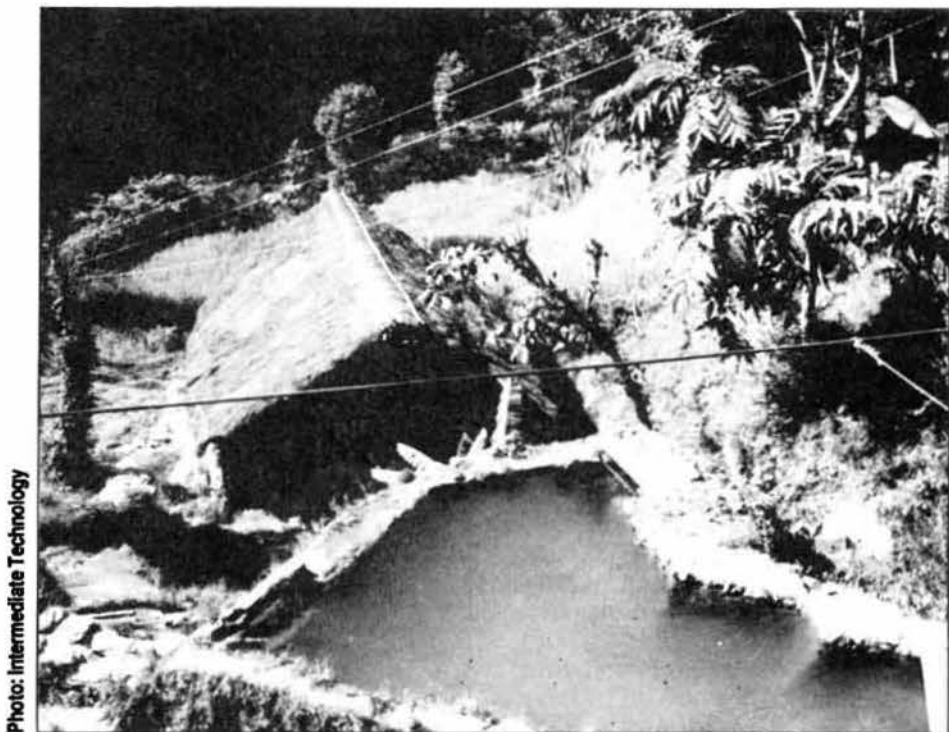


Photo: Intermediate Technology

A Nepali micro-hydro scheme

Nuclear industry advertising is becoming more and more frequent, and is often controversial. Dr JAQUIE BURGESS of the Department of Geography, University College London, considers the content and impact of recent campaigns.

Manipulating meanings

NUCLEAR ELECTRIC has decided to drop its latest £7 million advertising campaign. Apparently, the State-owned industry was put under pressure from its 'shareholder', the Secretary of State for Energy, because the Government do not want the issue of nuclear power put back on the public agenda just before a General Election.

Since it came to power in 1979, the Conservative Government has changed fundamentally the concept of public information. It has done so through the extensive use of advertising agencies to promote many different elements of Government policy, not least of which have been the privatisation campaigns.

Estimates of the amount of money spent on advertising the sale of the electricity supply industry in 1989-1990 were in the order of £28 million for National Power and PowerGen; plus an additional £50 million for the 12 area distribution boards.

And yet, in its submission to the Widdecombe inquiry, which considered local authority public relations, the Government argued that "the unregulated use by any public authority of highly developed media techniques, particularly for persuasive purposes with a strong political undertone, is perceived as a dangerous trend in a democratic society."

Sellafield

What about the regulation of private sector organisations who might be said to have a political dimension? BNFL, for example, won a public relations industry award in 1989 for their campaign to attract tourists to the Sellafield plant; and have used advertising campaigns in an attempt to convince the general public that nuclear power is safe, clean and environmentally-friendly. Could their campaigns not be said to have used "highly developed media techniques ... for persuasive

purposes with a strong political undertone?"

Advertising is a social process of communication, where certain groups work to encode a set of meanings in an advert, and other groups work to decode or transform those messages into meanings which are relevant to them.

Adverts are probably the most determined and tightly constructed forms of communication in our culture. Every single element of the advertisement – words, images, colours, tone, calligraphy, positioning – is designed to create a particular meaning for the product in the minds of potential customers. The successful advert will persuade the reader to make positive associations between

the product and other valuable or desirable objects and traits.

The point to emphasise is that there may well be differences between the two sets of meanings. What was intended by the producers may not be interpreted in that way by the consumers. Meanings may be ignored or misunderstood, subverted or actively resisted.

BNFL have unwittingly provided a marvellous example of how certain meanings are encoded into advertisements and how they can be resisted. The example also reveals the sensitivity of the company to adverse comment and the rapidity of their response.

Readers will probably remember the

The Greenhouse Effect.

- 1. THE SUN'S RAYS**
The sun's rays pass through the glass of the greenhouse and hit the ground and the plants inside.
- 2. HEAT TRAP**
The heat from the sun is trapped inside the greenhouse by the glass, making it warmer than outside.
- 3. THE PROBLEM**
If the sun's rays were not trapped inside, the greenhouse would be too cold for the plants to grow.
- 4. THE SOLUTION**
The solution is to use a material that allows the sun's rays to enter but traps the heat inside.
- 5. THE RESULT**
The result is that the greenhouse is now warm and the plants are growing.
- 6. THE ANALOGY**
The greenhouse is an analogy for the Earth's atmosphere. The sun's rays enter the atmosphere and hit the ground, which then radiates heat back into the atmosphere, trapping it.
- 7. THE PROBLEM**
If the atmosphere were not there, the Earth would be too cold for life to exist.
- 8. THE SOLUTION**
The solution is to use a material that allows the sun's rays to enter but traps the heat inside.
- 9. THE RESULT**
The result is that the Earth is now warm and life is thriving.

How BNFL's advert portrayed the Greenhouse Effect



BNFL's view of nuclear power



The 'more realistic' amendment

1989 'Greenhouse Effect' campaign. BNFL offered newspaper readers two views of the future: one 'if the greenhouse effect' is allowed to continue unchecked; the other with 'a secure source of clean energy'.

There has been much debate and anxiety expressed about the ways in which science is communicated to the public. The appropriation of scientific knowledge in the BNFL advert is no less disturbing. Hypotheses are presented as certainties. The certainties are catastrophic in terms of their consequences.

Dismal scenario

The images of 'The Greenhouse Effect' give meaning and a concreteness to these, abstract, scientific processes. Although global in terms of the 'causes' of the greenhouse effect, the representations suggest, cities at the height of the industrial revolution. The largely unseen chemicals which penetrate the upper atmosphere are visualised as a dense cloud of black smoke.

This 'dismal scenario' as the copy puts it, is contrasted with an

alternative future based on nuclear energy - 'We have the power to help prevent it.' The second illustration forgets the globe, and plays instead on English cultural values by envisioning a pastoral, Arcadian landscape which represents a nuclear future through an Eighteenth century past.

The two page advert was published in the middle-market popular papers and the broadsheet press. The Guardian carried it on 15 May 1989 and published immediate, responses from readers in its letters page three days later.

That by Mr Turnbull from London provides a marvellous example of an oppositional reading. He was quick to point out the absences from the text - a nuclear power station on an inaccessible hill; no transmission lines; no rail lines for transport of hazardous materials; no water for cooling purposes; and sheep to convince the public that all is really well, after all. "Good grief" he wrote, "do these people never learn."

Well, yes, they do, BNFL moved very quickly to reduce the possibilities of

oppositional readings. The following Sunday, the same two page advert appeared in the Mail on Sunday - with a pylon sketched delicately on the Arcadian skyline!

Who's green?

By September, this campaign was replaced by another which kept some of the text but replaced these contestable images with a bland picture of shades of green on a paint card. The slogan was 'Just How Green Are You About Nuclear Power?' An unfortunate turn of phrase, perhaps. Taking the greenhouse example and research by John Corner on how audiences read television programmes about nuclear power, the answer most people would give is probably - "not daft enough to be fooled by your campaign." □

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When is a dump not a dump? When it's a nuclear waste deep underground retrievable store, backfilled with 'soft' concrete. Dr PATRICK GREEN, Friends of the Earth's radiation and anti-dumping campaigner, and RACHEL WESTERN, their nuclear researcher, examine NIREX's plans.

Down in the dumps

RETRIEVABILITY in a nuclear waste 'repository' is the ability to recover the radioactive waste. It requires the waste to be monitorable and recoverable. An explicit intention to do so, if necessary, is a fundamental requirement of any environmentally responsible approach to radioactive waste management.

Within any radioactive waste management system, retrievability would allow damaged waste containers to be repaired, the leakage of radioactivity to be controlled, and mistakes made in the design and siting of the facility to be rectified. This might seem blindly obvious. However, UK NIREX Ltd and the nuclear industry are now attempting to hijack the concept and argue that its deep underground dump is really a retrievable store.

The public demand for retrievability was first highlighted in response to NIREX's 1987 consultation exercise. The responses to the NIREX report, *The Way Forward* demonstrated the public demand for a flexible approach to radioactive waste management that incorporated retrievability. RWMAC, the Government's Radioactive Waste Management Advisory Committee, commented that, "safety was judged to be the paramount factor by respondents". However, it also stressed that the ability to monitor and retrieve the waste were perceived to be a "key aspect of safety assurance".

The crucial importance of the ability to be able to retrieve the waste has also been acknowledged by a number of institutions involved in radioactive waste management. For instance, the Swedish National Board for Spent Nuclear Fuel has commented that "it is difficult to see how we can decide on a method of final disposal which is irreversible". Similarly, in 1986, the Institution of Geologists said that the, "principle of reversibility should apply to all aspects of radioactive waste management".

The Department of the Environment has specifically defined waste disposal as a system in which the waste is emplaced with no intention of retrieval: "there will be no intention of recovering the wastes at a future date, and that represents the essential distinction between *disposal* and *storage*".

Even the International Atomic Energy Agency (IAEA) has distinguished between dumping and storage: "Storage, as opposed to disposal, implies that the waste itself is not abandoned; it is accessible for inspection, monitoring, recovery, reconditioning etc, and there is an intention to carry out such work".

However, the nuclear industry has suggested that there is no essential distinction between disposal and storage and that a "retrievable disposal" facility could be built. The Atomic Energy Authority has commented that: "As a further precaution, though, the site will be designed so that the waste can be retrieved should the need arise".

The (limited) safety case that has been put forward by NIREX for its deep dump, however, assumes that the waste will be sealed underground within a number of natural and artificial barriers.

The NIREX dump

This is the so-called "multibarrier approach". It relies on the use of different natural and physical barriers to limit the concentration of radioactivity that will leak from the dump. The facility, as originally, proposed, is not designed to allow for repair or retrievability and its long term safety is dependent on siting and design.

The basic flaw in this approach is that once the waste has been finally sealed in, and the main shaft has been filled in, then it will be effectively impossible to retrieve the waste should the need arise. Furthermore, as most monitoring equipment is not designed for longevity, once the dump has been sealed there is no way on knowing what is actually happening to the waste.

NIREX would have you believe otherwise. It has claimed that: "Disposal of the waste does not mean that the waste cannot be retrieved". More cynically it has stated: "If future generations are unhappy with the safety they could always dig it up".

In 1986, a report was prepared for the Department of the Environment that specifically examined the technical feasibility of building retrievability into

disposal facilities. It argued that it is extremely important to incorporate retrievability at the design stage, otherwise the recovery of the waste would not only be expensive, but also extremely hazardous.

The report identified a number of factors that would require consideration if retrievability were to be incorporated into the design of a dump, including:

- **Maintenance of Support System:** The equipment used for ventilation, water pumping, power supplies and instrumentation, "would require a rolling programme of replacement with likely lifetimes of 10 to 30 years".
- **The Life of Monitoring Equipment:** The sophisticated equipment necessary to ensure continuous monitoring would have an average expected lifetime of the order of 30 years and would require replacement.
- **The Life of the Construction Materials:** Structural modifications may be needed to ensure the integrity of the dump. This could double the cost of the construction materials used.
- **Backfilling:** To aid retrievability it would be better not to backfill the waste.
- **Access for Inspection, Monitoring and Maintenance:** Space would need to be kept clear between the waste and the roof of the dump to allow access for recovery, inspection and monitoring equipment. The waste caverns would need to be bigger than if retrievability was not intended.
- **Maintenance of Waste Handling Cranes:** The crane systems should be installed in such a way that it would be possible to repair or replace them.
- **Maintenance of Conveyance Equipment:** The remote equipment used for conveying the waste should be repairable or replaceable.
- **Decontamination:** A decontamination facility would be required.

The report concluded that the additional cost of incorporating these features would be similar to the cost of above-ground storage. In other words,

if you want storage it is simpler, safer and cheaper to do it above ground.

NIREX has also admitted that there is "no technical" reason for the waste to be put underground.

NIREX's 1989 preliminary safety report (PERA) discusses the specific measures that have been taken to incorporate monitorability and retrievability into their proposals. Three different levels are considered:

(1) No contingency plans are made at all.

(2) The second "enhanced" level would include backfilling of the waste, but would keep the roof spaces open to leave the handling and monitoring equipment in place. However, no mention is made of the long term maintenance of this equipment.

(3) The third level, which would allow immediate retrievability, would require a "significant change in design". The PERA report does not specify what changes would have to be made.

Although, NIREX intends to monitor the repository "for as long as is felt desirable", without adequate retrieval facilities such monitoring serves very little purpose. The Chief Chemist of the British Geological Survey, Dr J D Mather, stated in 1988 that, "monitoring would not solve the problems that developed and should not be regarded as a magic solution. Monitoring needs to be accompanied by practical proposals for dealing with problems and could not [be] viewed in isolation: it [is] much better to be prepared than have to engage in a fire-engine activity when difficulties developed".

There are many reasons why it may be necessary to recover the waste after it has been disposed of. The possibilities were outlined in a report prepared for the DoE in 1986:

- **Change in Policy:** Scientific or social developments may lead to a change in regulatory policy.
- **Unforeseen Natural Processes:** The dump may become unstable due to the occurrence of "new, unknown and unexpected" natural events or processes in the environment of the repository.
- **Damage During Construction:** Unpredicted effects arising during the construction of the dump or laying down of the waste may lead to geological and hydrogeological response which damage the performance of the dump.
- **Packaging Failure:** The waste packaging may behave in an

unpredictable way.

- **Design failure:** The design of the dump may be inadequate and inoperable.
- **Intrusion:** The dump could be disrupted by malicious or inadvertent human intrusion.
- **Wish to examine the waste.**

Consequently, a waste management system that did not allow for the recovery of the waste could only be contemplated if there was complete confidence that no mistakes would be made and no unforeseen events would occur.

NIREX has made many confident predictions about the long term safety of deep dumping. In 1989 it claimed: "after many thousands of years, residual amounts of long-lived radionuclides may reach the biosphere but their low concentration will ensure that their impact on any individual in the human environment is small".

Magic concrete

To date, NIREX has yet to come up with a detailed description of how waste could be retrieved from its dump. However, at its recent London press conference announcing Sellafield as its preferred site, it stated that a specially designed 'soft' concrete would enable retrievability to take place.

This option, it seems, it being pursued at the expense of engineered changes to the design of the dump. In other words, NIREX have no intention of changing the nature of the dump. It simply hopes that its magic concrete will enable retrieval to take place.

Its claims are completely misleading and will not allow for immediate retrievability. NIREX argues that by using a soft grouting as backfill, if the need should arise then the waste can easily be drilled out.

However, it has yet to release any details of the composition of this "magic" concrete. Furthermore, NIREX also admitted at the London press conference that retrievability, even with its soft concrete, would be difficult, if not impossible, once the main shaft had been filled after the 50 year operating life of the dump. It also acknowledged that, post-closure, it does not envisage a need for retrieval.

However, in response to a Friends of the Earth press release accusing NIREX of misleading the public, a NIREX spokesperson was quoted by the *Whitehaven News* as arguing that its soft concrete would allow retrieval without the need for blasting!

Consequently, there are only two radioactive waste management options: dumping (and hope that nothing goes wrong) and above-ground, monitorable and retrievable storage (and retain the ability to address any problems that could arise). There is no in-between. This means that there is no such thing as deep underground storage. This leaves the Copeland MP, Jack Cunningham, in an interesting predicament. Does he support waste dumping or storage? Cunningham has stated that he is against NIREX's dump, but is in favour of deep underground retrievable storage. Given the problems, outlined in the 1986 DoE report above, that must be addressed if anything dumped underground is to be considered retrievable, this position is just as untenable as NIREX's misleading claim that retrieval is possible from its dump. Sooner, or later, Jack Cunningham is going to have to state exactly which method of radioactive waste management he favours.

In the run-up to the 1994 review, the nuclear industry desperately needs to be able to show that it has solved the problems of radioactive waste. Deep dumping is not a solution and represents nothing more than a quick political fix. The outgoing chair of NIREX has even commented that if the industry fails to dump its waste then you can say good-bye to the nuclear industry. This means that NIREX, and the industry, will stop at nothing in an attempt to convince the public that their plans are safe. Claims that its soft concrete will allow retrievability are part of this process. NIREX has no intention of retrieving the waste, it simply wants you to believe that it has.

Did someone say lies, damn lies and NIREX's retrievable dump? □

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Switching to gas fuel is an option favoured by official agencies and some environmental organisations as a strategy for CO₂ abatement. The wisdom of this policy is questioned by MAX WALLIS, a researcher in Atmospheric Science and Energy Systems at the School of Mathematics in Cardiff, and until recently a member of Friends of the Earth's Board of Directors.

False greenhouse claims for gas

AT the Hinkley Inquiry, Tim Jackson, on behalf of Friends of the Earth (FoE), gave a relative assessment of energy saving and supply alternatives – a novel and ambitious study ranging over low energy lighting, city-wide CHP, domestic cooking, renewable energies, etc. The measures were compared on the basis of cost versus savings of CO₂, leading to the merit order reported in *SCRAM 75* derived from the subsequent FoE publication.

It's easy to show that switching from electricity to gas end-uses like cooking and central heating save CO₂ emissions. Gas cooking costs less too, as probably does gas central heating. It's also easy to show that nuclear energy supply is far more costly and produces more CO₂ than energy-saving measures, and probably involves more CO₂ emissions in the hardware manufacture. But the finding that electricity supply from gas turbines (CCGT) is preferable to efficiency improvements in water heating or domestic space heating (including insulation) caused me some alarm. It also led to FoE's reluctance to oppose the huge CCGT projects at Wilton, Killingholme, etc.

One question concerned leakages of methane (CH₄) to the atmosphere via the production and distribution processes. Leakages of natural gas from UK distribution mains and service pipes, principally from the aged cast-iron mains, have been put at under 1% by British Gas. Greenpeace, however, believe that the leakages could be as much as 11% of total supply. Methane is, by some 50 times, a more potent greenhouse gas than CO₂. Jackson extended his assessment to cover methane, apparently finding little difference. However, the Greenpeace study found that methane leakage significantly increases the total greenhouse effect of gas usage – and may contribute more than the post-combustion carbon dioxide.

Using British Gas costings, I have recalculated the median case of the Greenpeace study to find that the discounted cost of accelerating the renewal of mains and service pipes is £0.50 or less per tonne Carbon Dioxide Equivalent (tCDE). Such costs are very low compared with Jackson's £25/tCDE, based on an unreal replacement cost. They are also very low compared with typical values

£5-10/tCDE for his other estimates for greenhouse gas abatement technologies. The total achievable saving via pipe replacement comes to 90 million tCDE and nearly 3 times that achievable from energy-efficient lighting as given in *SCRAM 75*.

To consider the supply side options for domestic consumers, I have also compared electricity supplied by modern coal-fired (PFBC) or gas-fired (CCGT) plant with domestic coal or gas boilers for water and central heating, taking into account relative efficiencies and methane leakages (in coal mining, gas production and gas distribution). The resultant CO₂ and methane emissions per GJ are shown in the Table (below), with their aggregated measure in the final column (shown as a "Greenhouse Tax", assumed for illustrative purposes at £5/tCDE). While coal-fired electricity comes out worst in the Table, the domestic coal-fired boiler does better than the CCGT for both CO₂ and methane, and better than the domestic gas-fired boiler for the two gases combined. The ordering of coal and gas boilers is uncertain, but on these figures coal-fired boilers have the lowest overall greenhouse effect, contrary to common assumption.

The price of off-peak UK electricity is currently £7/GJ ('Economy 7'). For domestic gas and coal-fuelled boiler output at £5/GJ, electricity via the CCGT comes out more expensive. In comparison, the various efficiency measures considered by Jackson (thermal insulation, secondary glazing, draught-proofing, condensing boilers, improved controls) range between £1.6

and £4/GJ (at 10% discount rate) and involve little greenhouse emission in production. Evidently these measures should be ranked above all the supply options. In particular, domestic efficiency measures take priority over CCGT power supply, both in low cost per GJ and in greenhouse gas production.

The gas industry is a big contributor to the UK's CO₂ emissions. Burning 18bn therms contributes 100 Mt CO₂ per year, amounting to one sixth of the UK total. But the avoidable leakage contributes to the global greenhouse almost as much in CO₂ equivalence - 90 MtCDE - on the median figures and possibly 2 or 3 times higher. It appears that this avoidable leakage can be saved at very low cost and that accelerated replacement of service pipes could even save money for British Gas. Even if gas leakage were at the much lower level claimed by the company, so that pipe-replacement saves only 15-20% of the amounts I calculated, the costs at under £2/tCDE are less than most alternative measures for greenhouse gas abatement (apart from those efficiency and technology improvements which save money).

The gas industry's regulator Offgas is taking the leakage problem seriously, and has received one response from British Gas to the Greenpeace study, but have challenged the company's reconciliation figures. British Gas's programme for replacing pre-1969 gas piping, would take over 30 years for gas mains and 15 years for services at current rates. The case for accelerating this programme on global pollution grounds is surely very strong. □

Domestic Water and Central Heating Alternatives
(all numbers are per GJ of delivered energy)

	fuel cost	tCO ₂	kgCH ₄ ^c	tCDE ^d	G.Tax ^e
Off-peak el. PFBC ^a	£7.50	0.292	0.924	0.046	£1.69
Off-peak el. CCGT ^a	£7.50	0.138	1.028	0.051	£0.95
Dom. Gas boiler ^b	£5	0.088	1.53	0.076	£0.82
Dom. Coal boiler ^b	£5	0.129	0.30	0.015	£0.72

Notes: (a) CO₂ coefficients of 90.3, 55kg/GJ and generating efficiencies of 39%, 50% for PFBC and CCGT, but reduced by system (15%) and boiler (9%) losses. (b) Assuming 66.7% efficiency. (c) CH₄ is methane; assumes leakage of 2% from well-head to power station, 5% from well-head to domestic outlets; methane from coal at UK average 0.71kg/t. (d) The Carbon Dioxide Equivalent of the emitted methane (factor 50 in mass terms, uncertain to a factor of 2). (e) Sum of CO₂ emission and the CH₄ equivalent, multiplied by £5/tCDE 'Greenhouse Tax'.

Danish wind takes to sea

OFFSHORE wind power became a reality in September, when 11 450kW Bonus turbines were erected off the Danish coast near the aptly named Vindeby.

Components for the aerogenerators were assembled on the quayside before being floated on flat-bottom barges to their final site, 2 kilometres west of the island of Lolland. Floating cranes were then used to hoist the machines on to concrete foundations.

The project went without a hitch, all turbines being located in place over 10 days, early in July. A month later, the last machine was put into operation. Final commissioning took place at the end of September.

As with any pathfinding scheme, costs for the plant are high. The offshore foundations cost \$250,000 each compared with \$17,000 for normal foundations. Operating and maintenance costs are also expected to be double those for on-land wind farms.

On the plus side, Bonus are expecting to recoup valuable information from the offshore site and possibilities for savings are being found all the time. More tangible obstacles have been avoided already, since it was the difficulty of finding onshore sites that originally stimulated the plant owners, Elkraft, to go to sea. They now expect output of the 5MW plant to be 50% greater than if it had been located inland, enough they believe to meet the domestic consumption for 3,000 homes. □

Ecogen wind plan

A packed and largely enthusiastic public meeting in Newton, Powys, organised by Newton Friends of the Earth on September 10, heard details of no less than 5 planning applications for wind farms currently before Montgomery District Council, writes Philip Pool.

The principal focus of attention was the 103-turbine farm proposed for Llandinam by Ecogen - a spin-off company from the Centre for Alternative Technology. The site is the flat top of a large steep-sided hill which allows the turbines to be placed so as to be almost completely invisible to all but hillwalkers and agricultural workers. □

Cemaes wind go-ahead

WELSH Secretary, David Hunt, has accepted the recommendations of a favourable Inspectors report on the proposed Cemaes wind farm (*Safe Energy 84*) which covered important aspects for future planning applications.

No objections were accepted on the grounds of noise, electromagnetic interference, nature conservation interests, safety or access. The sole remaining issue of environmental concern was visual impact from the surrounding area and the near-by National Park. The comprehensive examin-

ation of this issue, by the Inspector, led to the finding that it would not materially damage the many fine views and attractive landscapes, nor unduly harm the visual amenity of the National Park.

Curiously, the report promotes the Government's strategy in favouring renewables as non greenhouse gas emitters, adding that wind turbines strengthened the rural economy, aiding diversification. Significantly, the wind farm also avoids the status of an industrial development with no people, houses or fences regularly on-site. A move which takes wind farms out of the Countryside Commission's blanket opposition to industrial develop-

ment in rural areas.

Conditions attached to approval are that: all cables should be buried; access roads are to be removed after construction; a dressing of topsoil is to be added; and the turbine colour is to be matt. If the farm fails to produce power after 6 months, it will have to be removed. A clause designed to avoid repetition of California's experience where some turbines were simply abandoned and left to rust.

The Inspector noted that only 1.3% of the land would be made sterile and that the site could easily be returned to a green-field status after decommissioning - noted as a distinct asset. □

Two barrages

A further £1.2 million is being made available by the Government to extend the feasibility studies on the 700MW Mersey Barrage tidal power scheme (*SCRAM 78*). The Mersey Barrage Company (MBC) will put £300,000 towards the studies but remain £8m short for the next stage of the project.

To be carried out over the next 15 months, the studies will cover: effects on shipping, the environment and sedimentation as well as more detailed energy modelling. This new delay could result in the scheme missing its original November 1992 target for parliamentary approval. However, MBC still hope to produce electricity from the barrage within the original timescale of 1999.

■ Central Regional Council are considering a proposal for the construction of a tidal power station on the Forth Estuary in tandem with necessary upgrading of road and rail crossings according to the Region's structure plan.

The scheme, which would provide power, control flooding, and create a water recreational facility has been put forward to the Scottish Secretary, Ian Lang, who has yet to respond.

Predictably, concern has been expressed by wildlife conservation groups over the loss of mudflats, a habitat recognised to be of national significance. □

Plymouth Sound

AN array of oscillating water column devices (OWCs) across Plymouth Sound could be Britain's first commercial scale wave power station. The 30MW station, proposed by a consortium of consulting engineers, would generate 100,000MWh/year at around 6p/kWh.

The proposals are for concrete modules containing OWCs, similar to a National Engineering Laboratories device, to be incorporated into Ply-

mouth breakwater, which is in need of refurbishment.

The consortium includes Hoare Lea and Partners (civil and construction engineers) and Coventry Polytechnic who had been previously involved in the Sea Clam device.

The station, conceived by Jeff Chadwick of Chadwick and Associates (electrical consulting engineers) over 2 years ago, would cost around £35m to build but must first obtain £250,000-£500,000 for a nine-month feasibility study from the Energy Technology Support Unit. □

Board 'sees the light'

EAST Midland Electricity has issued long-life light bulbs to 150 households in Great Gonerby, Lincolnshire, in an attempt to avoid costly upgrading of the local transmission substation.

The gesture, part of a joint venture with Neighbourhood Energy Action (NEA) and the District Council, is costing the company £3,000 (2 bulbs per household) whereas the upgrading of the substation would have cost £15,000.

NEA conducted free energy surveys,

and the Council met the costs of work to properties ineligible for grants. Efforts were made to ensure houses were adequately draught-proofed, and had lagged pipes and insulated lofts.

This tentative 'toe-in-the-water' move by East Midland is based on financial incentives and is a long way from 'least cost planning'. However, if local authorities follow the lead given by councils in East Anglia recently, in refusing planning permission for upgrading and new plant on the grounds that it is unnecessary, the response from the Electricity Boards, starting with Eastern Electricity, will be awaited with interest. □

Renewables targets

AS the Department of Energy's (DoE) Renewable Energy Advisory Body meets for its "fundamental and far-reaching" review of renewables, pressure, backed by a recent Energy Technology Support Unit report and 2 opinion polls, continues to mount for a favourable outcome.

In July, an ETSU study*, not available in the UK, reported to the European Com-

mission that it is technically feasible for the UK to generate over 50% of its electricity from renewables within 20 years. The DoE aim for only 2% by 2000.

Meanwhile, both FoE and Greenpeace met with the Advisory Group, on its first day of business, armed with opinion polls. Both are calling for an immediate increase in the renewables target to 10%.

Greenpeace point out that households in the UK pay, on average, an extra £17 a year on their electricity bills to subsidise nuclear power, but only 40p for renewables. British

Market Research Bureau found only 4% wanted the nuclear subsidy increased, while 67% would pay an extra £7 per year to promote renewables to the 10% target.

FoE's Gallup Poll found 87% in favour of increased use of renewables, with 77% wanting more renewable power despite any extra cost. □

* "CO₂ Crash Programme: Cost-effective analysis of CO₂ reduction options. Part II" Report for the Commission of the EC, DG XII.

Costing the Earth

WIDE ranging plans on energy and the environment are proposed in the latest Liberal Democrat policy paper*, including an energy tax to reduce energy consumption, and grants and subsidies to promote energy efficiency and conservation.

Passed unanimously at their Conference, it reiterates commitments to phasing out nuclear power by 2020, and abandoning of Sizewell B and THORP. The Energy Tax, to be levied on primary fuels according to their levels of pollution, might be around 10% per year for fossil fuels. To achieve an "environmentally sustainable economy" their proposals include establishing an Environmental

Protection Agency, Energy Auditing, Tradable Emission Licences, Pollution Taxes, environmental grants and subsidies, extending and increasing the Home Insulation Grant and Home Energy Efficiency Schemes, and removing VAT from energy efficiency/conservation materials and equipment.

They believe the market will respond by using energy and other resources more efficiently, reducing pollution as a result.

Renewable energy is given a prominent role, with a number of proposals aimed at their promotion: no energy tax; open ended extension of the NFFO for the first twenty years of each new project; 20% electricity generation from renewables by 2005; a prototype off-shore wind farm and evaluation of wave and wind power resources;

early construction of a Severn Barrage.

They are committed to an immediate doubling of the renewables R&D budget to £40.6 million, less than generous when set against the savings that will be possible from the £102.1 million spent on fission R&D.

While there is implicit action on fuel poverty, through energy efficiency/conservation grants and subsidies, the measures to "mitigate" the effects of rising fuel costs on the poor, mainly through the benefits system, do not appear to address the scale of the problem, with 6.4 million fuel poor households in the UK. □

* "Costing the Earth"; Liberal Democrat Publications, 8 Fordington Green, Dorchester, Dorset DT1 1GB; August 1991, 36pp, £4.25 (plus 20% p&p).

EC energy tax

EUROPEAN Community Environment Ministers have accepted, in principle, an energy Tax plan aimed at cutting carbon dioxide emissions.

Based on both energy consumption and carbon content, the European Commission Tax would result in cost increases of: 60.6% for coal, 5.9% for petrol, 9.6% for diesel and 14.6% for household fuel bills by the end of the decade. The tax will be phased in, 30% in 1993 and then 10% each year up to 2000.

Raising around Ecu53.5bn (£37.55bn), it would be collected nationally and offset by cuts in other taxes. Industries vulnerable to international competition eg steel, paper and chemicals could be exempt.

EC Environment Commissioner, Carlo Ripa di Meana said, "All studies suggest that taxation is the fairest and most effective way to reduce energy consumption. The tax will send a signal to consumers and European industry that environmental costs must be included in their bills. This is the first time we will be using the market to preserve the environment."

The draft directive must be agreed by a joint Environment and Energy Ministers' meeting in December, probably then by one of Treasury Ministers who have already given provisional approval. No one is opposing the concept at this stage, although a UK Government official believes it would pose "certain difficulties". □

UK CHP failure

BRITAIN has failed to make the most of Combined Heat and Power (CHP) to reduce its emissions of carbon dioxide, and should look to Europe for instruction argues a new report* by the CHP Association (CHPA).

CHPA highlight crucial differences between the UK and other European countries. UK governments have been reluctant to intervene through regulation and incentives, and have not allowed a greater role for local and regional authorities in energy planning

- hallmarks of initiatives elsewhere.

Following the 1973 oil crisis, Denmark adopted a plan to generate 24% of its total heating requirement through CHP by 1985 - by 1989 it had achieved 41%.

Local and regional government in Germany, Denmark and Finland have powers to analyse energy needs, including the potential for energy saving. They can compel new generators to comply with local and regional plans. Local authorities in the UK have no such powers. □

* 'Climate Change - The role of CHP'. From CHPA, telephone 071 828 4077.

Dutch lessons

BRITAIN'S investment in energy conservation is drastically low compared with some of its European partners, particularly the Dutch, according to the Association for Conservation of Energy's (ACE) latest report*.

Dutch Government initiatives contrast strongly with the lack of action in Britain. It has more than doubled expenditure on energy conservation and renewable energy sources this year to £203m, with about £145m for conservation. The Dutch spending per capita is some 13 times the UK's.

Environmental concern is the prime motive, they have set a series of targets aimed at stabilising carbon dioxide emissions at 1990 levels by 1995 - a full

decade ahead of Britain.

Subsidies of between 10 and 30% on energy saving investments are available from Government through the power distribution companies, using funds raised for the purpose by a levy on energy consumption set at between 0.5% and 2%.

70% of boilers installed this year will be ultra-efficient gas condensing boilers, with grants covering the extra cost over conventional boilers. Such efficient boilers have only 2% of the British market.

A 15% subsidy on a pack of 4 compact fluorescent lightbulbs, via a heavily promoted coupon discount scheme, and insulation grants of up to 30% are available. □

* "Lessons from the Netherlands" available from ACE, 9 Sherlock Mews, London, W1M 3RH; £15.

Watt houses

SCANDALOUS levels of depravation and ill health exist in the UK due to the poor quality of its housing stock, Professor Tom Markus told delegates at the Watt Committee conference on Building Energy and the Environment.

Speaking in Strathclyde, he pointed to a number of features which conspire to seriously affect the most vulnerable: the lack of insulation, excessive uncontrolled air change, the absence of economic whole-house heating systems, and limited fuel choice.

Typically, within 48 hours of a cold spell, there is a dramatic increase in hospital admissions of the elderly, chronically sick and housebound, in other

words, of those not experiencing exposure to the outside. The excess mortalities in the UK are far higher than in Scandinavia or Canada which have harsher climates.

Under these circumstances, the property can no longer be defined as a house as it fails to protect and shelter from the external climate. The situation is exacerbated by fungi which thrive in the damp conditions, their spores severely affecting the health of children. Together, these conditions make the internal environment far more hostile than outside.

In the private sector, market forces make it inevitable that the lowest quality houses are the most difficult and expensive to heat and are occupied by the poorest sector of the population. Something like

market forces also operates in the public sector to the same effect.

Markus said action was needed and called for:

- £16 billion to upgrade buildings;
- subsidy for the most vulnerable - related to household needs;
- Home Energy Rating all housing stock;
- building regulations which recognise current standards to be applied to older houses.

During another session Professor Carbery of OFFER, from the floor, claimed new sources of electricity would cost between 2 and 3 times more than existing sources. He said this would put to the test those who stated they would be prepared to pay more. Adding that those people he represented would be unwilling to pay the difference. □

Cold weather credits

TWICE as many people die from cold-related illnesses in Britain compared to any other European country, according to the newly launched Campaign for Cold Weather Credits.

A national alliance of statutory, voluntary and other agencies opposed to fuel poverty, the Campaign seeks the urgent introduction of credits to replace last years severe weather payments system. Weekly credits would be available to people on Income Support, Family Credit, Housing Benefit and Community Charge Rebate, and be paid automatically from December 1 to March 31. They would vary from between £3 and £6 per week according to regional climate variations. For example, it costs at least 35% more to heat a house in Aberdeen than one in Bristol.

This differs from last winter's Department of Social Security system of £6 per eligible week, available to people on income support who: were over retirement age; had a disability premium; or had a child under 5 years of age in the house. An eligible week was seven consecutive days where the average daily temperature in a local area was 0°C or below, measured at designated places in each area. Only 20% of those eligible applied for the payments.

Apart from 2 weeks last February when the triggering mechanism was by-passed during exceptional weather, the system operated infrequently. In Strathclyde it was only triggered once.

A Campaign spokesperson said: "The major difference with the Cold Weather Credit is that they would be financed by the Department of Energy as an interim measure until all housing in the country has adequate heating and insulation. This will not be a



social security benefit and shouldn't be seen as such. It's a recognition that the Government must act now to ensure that everyone has the right to affordable warmth." □

* Further information, lobbying material and petition available from The Campaign for Cold Weather Credits, P.O. Box 221, Glasgow, G1 2LA or tel: 041 226 3064.

Warming to energy saving

GLOBAL warming under-pinned much of the debate at this years Neighbourhood Energy Action (NEA) conference in Durham writes Stephen Edwards. There was widespread agreement that energy efficiency has a vital role to play in reducing CO₂ emissions, but less consensus on how best to promote the appropriate measures.

Energy Minister, David Heathcoat-Amory, told the conference that the self evident value to individuals of energy conservation obviated the need for financial incentives from government. He believes this autumn's publicity campaign, together with appliance labelling, home energy rating and competitive markets created by privatisation would all help to encourage the adoption of energy efficiency measures.

Opposition Energy Spokesperson, Rhodri Morgan, disputed this claim, feeling that privatisation had little bearing on the take-up of energy efficiency measures. He wants to see government taking the lead in

such measures as appliance labelling.

Environment Minister, Tony Baldry, like Heathcoat-Amory, regards the forthcoming publicity campaign as essential to raise public awareness. Other measures promoted by his Department included the Green House Programme for local authority housing and the revision of the Building Regulations. He was also enthusiastic about the possibility of next year's Earth Summit in Brazil establishing an international framework for reducing greenhouse gas emissions.

He believes that eventually energy prices should reflect the full environmental and economic cost of their production. Delegates were concerned about the effect this, and the European Community's promised carbon tax (see p20), would have on low-income households.

Both Morgan and Dr Brenda Boardman, Senior Fellow in Energy Efficiency at Oxford University, criticised the current Home Energy Efficiency Scheme (HEES), which provides insulation for recipients of certain benefits only, as inadequate. Morgan denounced it as more an attempt to provide temporary work for the long-term unem-

ployed than any serious commitment to solving the problem of fuel poverty.

Boardman pointed out that 6.4 million homes suffer from fuel poverty. At an average cost of £2,500 to bring each home up to an acceptable standard of insulation, it would cost £1,250,000,000 to improve 500,000 homes a year. The annual allocation to HEES is only 3% of that. She suggested that the Non Fossil Fuel Obligation could be diverted towards energy efficiency measures. This would make £1,550,000,000 available annually.

An equally imaginative suggestion came from James McKinnon, the Director General of the Office of Gas Supply. He proposed a levy of 3p per week on customers, which would raise £25,000,000 per year. If this was matched by British Gas and similar action taken by the regional electricity companies, the resultant £100,000,000 could be distributed to NEA and similar organisations to finance their activities.

Such positive thinking gained much support from the conference, leading delegates to hope that government would take note and play a more direct role in the energy efficiency field, rather than insisting on

REVIEWS

Nuclear Power - Shut it down! Vol I & II: an information pack on nuclear power and the alternatives.

**Compiled and Edited by Crispin Aubrey,
Danielle Grunberg and Nicholas Hildyard.**

The Ecologist; 1991, 822pp, £30.

The western nuclear industry is caught in a pincer movement: as increased public environmental expectations combine with the Government's 'free market' philosophy, it is being squeezed out of its protective shell and into the real world.

It has come a long way in the last half century, from the dizzying heights of 'clean, cheap, safe and reliable ... reactors as small as your fist ... a panacea for all the worlds ills' to being the scourge of privatisation, a technological and sociological pariah. "But," as the editors of this

dossier point out, "the promoters of nuclear power still feel confident that the industry will revive, especially in areas like Eastern Europe and the Third World. The threat has not disappeared."

This document serves as a warning to countries which in the wake of political revolution would choose western development as a model for their industrial progress.

From the cradle to the grave, the dossier encompasses topics such as Uranium Mining, Radiation and Health, Accidents through to Waste and De-

commissioning. The articles are drawn from many sources including: *The Ecologist*, *New Scientist*, *WISE*, *Critical Mass*, *The Financial Times*, *The Guardian* and - I am pleased to say - a considerable input from the pages of *SCRAM*.

Not content to simply knock the nuclear case, volume II concentrates on the alternatives to nuclearisation. Here again we are treated to seminal articles on many facets of the alternatives case. From the Kats and Keepin "Greenhouse Warming: Comparative analysis of nuclear and energy efficiency abatement strategies", through Ian Brown's "Least Cost Planning" to Cynthia Pollack Shea's "Power from the Sun".

Although the second volume contains many useful articles, it would have been improved by adding more information, which certainly

exists, on the problems faced by developing countries. In particular much could have been made of "Energy for a Sustainable World", the report of the End-use Oriented Global Energy Project. The chapter on "Alternative Energy Futures" from the readers guide published by the World Resources Institute would have been an interesting inclusion.

Over all, this is an invaluable resource for emerging pressure groups, containing articles and papers which all campaigns require to argue their position, and that normally take a month of Sundays to collect. So far about 500 copies have been sent out to groups in Developing Countries and Eastern Europe.

MIKE TOWNSLEY

■ Available from *The Ecologist*, Worth Vale, Camelord, Cornwall, PL17 8ER.

Anti-Nuclear Movements: A World Survey of Opposition to Nuclear Energy; by Wolfgang Rudig.

Longman; December 1990, 485pp, £48.

In his introduction, Rudig suggests that non-academic readers might want to skip chapter 2 which discusses "theoretical approaches ... to assist us in our analysis of anti-nuclear movements" and move straight on to "empirical analysis". Don't! Chapter 2 is fascinating. Rudig is searching for an ecological theory to explain the development of anti-nuclear movements, but finds no single theory adequate.

Expert dissent is a necessary precondition of protest, the vast majority of which is directed at planned rather than existing capacity.

Local conflicts fulfil the function of a "precipitating event" when the local population are prepared to act in an unconventional manner and gain national attention - a bit of repression from the State also helps escalate the conflict.

The book includes some interesting snippets about early opposition. The poet John Betjeman was one of the 598 objectors to the Bradwell station. Giving evidence in 1956; he argued that the station would destroy the "pastoral scenery" of an area better than anywhere in the South of England. Winfrith was temporarily halted by conservation groups using ancient rights to graze sheep going back to the time of Richard II. The government had to get a bill through Parliament to extinguish the rights.

In 1971 at an inquiry into an AGR planned at Portskewett in South Wales, nuclear safety was first mentioned. Objectors had come across work by Ernest Sternglass on radiation hazards. This failed to impress the Inspector who gave planning permission, but the station was

never built. Then came the first concerted effort by environmental groups at the Torness inquiry in 1974.

Rudig goes into similar detail about other countries, particularly the US, France and Germany. His analysis answers questions such as 'why did the anti-nuclear movement in France disintegrate?' and 'why are there such huge differences between the UK and Germany?'

Where I have to disagree with Rudig is in his conclusion about opposition to Torness. "In terms of raising the issue of nuclear energy at national level, opposition to Torness played no major role." Of course I am biased, and Rudig does recognise the role Torness played in setting up a network of groups, but I have met so many people whose experience of climbing over the hay bales in 1979 has had a lasting impact on them, I don't believe it should be dismissed so briefly.

The UK nuclear industry's policy, since about 1978, of concentrating developments on existing sites, has worked reasonably well, but since

Sizewell B, the strategy has begun to look "shakier". "The feeling that the tide has swung against nuclear energy, that a nuclear power station is not any more a prestige object but a liability for a region, could have a profound impact on local attitudes ... an existing site policy does not guarantee local acquiescence any longer."

Support for operating nuclear plants is generally high in the host communities, particularly in the immediate vicinity, but this does not necessarily mean wholehearted support for further stations. However, despite a negative attitude to new stations, an existing one seems to make political protest less likely. This book has a wealth of information for the strategists amongst us - and you don't have to agree with all of it (Greenpeace are written off as "not much of a problem for the world nuclear industry") to find it stimulating ideas for future action. In fact it is important for anti-nuclear activists to read it, because you can be sure the pro-nuclear strategist will.

PETE ROCHE

REVIEWS

The International Politics of Nuclear Waste; by Andrew Blowers, David Lowry and Barry Solomon.

Macmillan; 1991, 326pp, £45 hb, £17.50 pb.

Take it from one who (in this field) knows his oats, this above all is a book for students of the social nightmare of nuclear waste. It is not a book to borrow but one to own and to read – again and again. There is a difficulty about that; I shall come to it at the end.

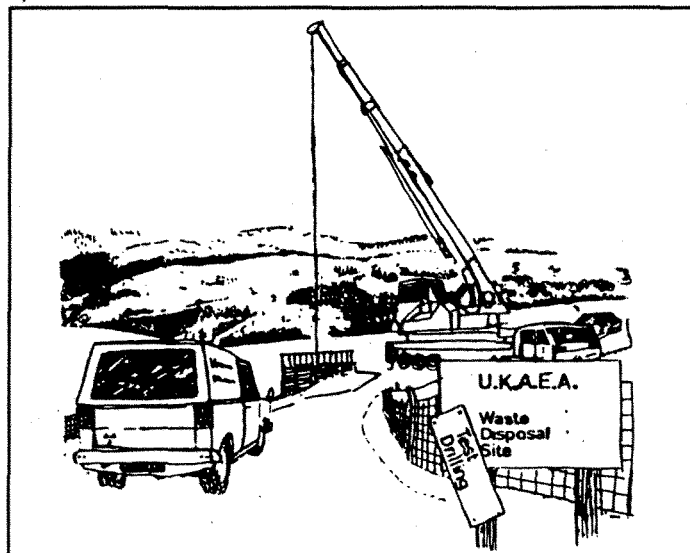
It does what the title promises, but with a difference! For this is a work of genuine scholarship which is going to influence thinking for a long time. All of the authors have personal experience of the problem and have taken great trouble to interview people and to visit the sites concerned (except, it seems, Japan – well, one can't have everything.) References magnificent. The team, an honest lot about their own short comings, as well as everybody else's, confess in the preface to difficulties of collaboration. Well, this reviewer can't find any seams; every page can be read with pleasure as well as profit by anyone interested.

The profit is important; for this is much more than history. There is reasoned and bold speculation on every facet of the problem. Interest in Britain will inevitably

centre on the two chapters which deal with the Battle of the Dumps – especially Elstow, with which campaign both British authors were intimately involved (Barry Solomon is from the US). Here you learn at first hand how a pressure group works, the mistakes it can make and how it readjusts. This section is worthy of study by any pressure group on any topic; but above all for us – for future nuclear waste campaigns lie ahead and they will be better because of this book.

I have a few criticisms which are worth making though they count for little against the value of the book as a whole.

Firstly; there are a few points at which I wish they had been a little more careful with the science. The statement (p10) that vitrified high level waste is fit for geological emplacement "in 20-50 years" cannot pass unrebuked in authors of their importance. My estimate, made for PANDORA (which, in fairness, they quote elsewhere) was 600 years; Walter Marshall, former head of the CEBG, estimated 100 years or more. (The latter is not gener-



ally known. Coily – for him – he made it in Scotland.)

Still on the science: insufficient chemical knowledge has caused them to under-value dry-storage, about which they show a curious ambivalence. Possibly mistakenly, I am inclined to relate this to traces of a love-hate relationship with the out-of-sight-out-of-mind bore hole solution which occasionally show. Though they are nowhere dogmatic about it – that is never their purpose – they tend to view dry-storage as interim only.

Yet the one thing to emerge indubitably from all the decades of research is that, if you want nuclear waste to remain where you put it, you must keep it drier than dry. This implies engineered designs, supervision, retrievability – and hence accessibility. For 20 years it has been proved at the Wylfa dry-store; and the fact that, through an idiotic design of a flat roof it leaked rainwater which corroded some fuel cans, underlines the imperative of dryness.

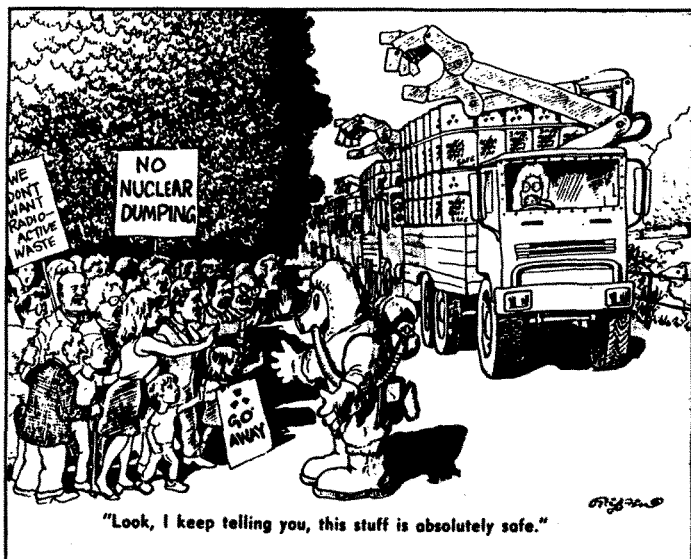
Finally, I could have wished for more on the early high-level waste campaigns. They taught us much. For instance, the irrelevance of party-politics and the need to put forward positive alternatives rather than being merely negative, which campaigners do not like – and which could have caused the Welsh movement to run out of whack had it not been recti-

fied. More about the difficulties of campaigning in sparsely populated areas with activists widely separated would have been welcome and relevant; for it is endemic in the Scottish movement with its leadership presently strung between Paisley and Kirkwall.

Am I using the reviewers privilege to hawk my own ideas? Not at all; for I have in fact given expression to this book's crowning achievement; that it is utterly impossible to read more than a few pages without having one's own thinking powerfully stimulated. Nothing is more necessary nor more welcome. My heartfelt thanks to them.

But none to Macmillan. 'To own and read again and again' – at this bloodsucking price? I already have a list of people wanting to borrow my review copy who would rather buy it but can't afford it. The price is an insult to the authors – for whose scholarship Macmillan paid nothing – and a loss to us. Books of roughly comparable importance and size which have recently been reviewed by SCRAM are roughly half the price. Few authors could have been so well placed as Blowers and Lowry to have told Macmillan how this book would sell if reasonably priced. I conclude that Macmillan do not do market research; aspiring authors will no doubt draw the correct conclusion.

DON ARNOTT



Source: Daily Mirror, 19 August 1986

LITTLE BLACK RABBIT

Dounreay drug haul

A well organised gang of drug runners finally came to grief in the Scottish Highlands. Stopped by police and customs officers, the gang produced forged paperwork and tried to pass off their £101 million load of pure Colombian cocaine as inert nuclear samples from Dounreay. An astute customs officer observed "The idea was right, but the van was wrong. You don't shift nuclear waste in a rent-a-van from Forfar." Dounreay please note!



Sponsorship 1: pedal power

LBR has unearthed details of more taxpayers money wasted by Nuclear Electric (and their predecessors at the CEBG). The 'Exploratory' science exhibition in Bristol received £200,000 from the old CEBG. Nuclear Electric meet some ongoing expenses, and are credited as sponsors of a section of the exhibition on electricity and magnetism - and also, incredibly, a pedal powered television. For some reason Nuclear Electric missed out on the chance to sponsor the most appropriate exhibits - a set of dinosaurs.

Sponsorship 2: surf's up

AEA Reactor Services at Dounreay have modestly entered the sponsorship game, supplying a large minibus, complete with driver, to take the Scottish surfing team to Eurosuff '91 in Lacanau, France.

Quite how many of the surfing

fraternity are in need of reactor services remains a mystery to LBR; but when the taxpayers are footing the bill, who cares?



Five years on

Tam Dalyell MP, aired his familiar pro-nuclear views at Labour's recent annual conference. Less well known was Tam's brief remission from adoration of all things nuclear. On May 22, 1986, Dalyell wrote in his *New Scientist* column: "I have never been so uncomfortable as I am now about a long-held political view ... I did not think that an accident such as happened at Chernobyl could ever happen ... any development at Sizewell must be along the lines of an AGR. No Government would be able to withstand the fury [if it decided] to go ahead with a PWR." Five years later and Tam's up there speaking against a resolution proposing a halt to the PWR at Sizewell.



Not adding up

Privatisation has brought a new economic realism to Scottish Power. Tendering recently for an electrical contract with Edinburgh District Council, they undercut the closest challenger by around £50,000. When Council officials contacted Scottish Power to check the details of the tender "major arithmetical errors" were uncovered. LBR cautions Scottish Power customers to check their electricity bills very carefully!



Condoms 1: Engineers use them on the job

News has reached LBR that condoms imported into Zimbabwe to combat AIDS are proving invaluable to the engineers of the Hwange power station. Forced to improvise because of a shortage of spare parts, power station staff have been using condoms as pressure gauges.

Condoms 2: a correction

LBR offers apologies; the MP concerned about vulcanisation of rubber by irradiation, and the implications for condoms, Paul Flynn, represents Newport, Gwent, not Newport Pagnall!



Thought for the day

LBR recently received a copy of an article from the Uranium Institute Annual Symposium 1991. The author, Dr Margaret Maxey, was writing on the religious symbolism of nuclear power.

The paper portrays the anti-nuclear movement as being "propelled by all the fervour of a religious crusade" and accuses it of "neo-pagan romanticism, cloaked as secular religiosity". Distrust of nuclear power was explained as a lack of understanding and a desire for simplicity.

The real problem for the nuclear industry is that the more people look, the more they understand, the more they oppose!

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Woody biomass

Woody biomass – what is it?

BIOMASS can be defined as the total weight of living material in a given area. Ecologists might consider it to be all living flora and fauna; farmers generally know it as silage. Specifically,

woody biomass energy refers to the energy converted from sunlight by photosynthesis, which is stored in green plants and trees either as carbohydrate or as hydro-carbon.

It is usually described in terms of 'green' weight when freshly cut, and dry weight when airing or heat

drives off the moisture. Willow, for example, has a dry weight of 41, 43, and 46% of its green weight when cut after 1, 2 and 3 years of growth. When dry, burning is more efficient.

The value of woody biomass, in relation to other fuels, is conservatively estimated at 1 tonne of air dried wood being

equivalent to 0.5 tonne of coal or 0.33 tonne of oil. If a three bedroom house derives heat from around 4 tonnes of coal in a year, the same could be achieved from between 5 and 7 tonnes of wood. This amount would cover around 0.7 hectares of land. At present, biomass may account for about 1% of energy production in Britain.

Rekindling interest in wood energy

OF the renewable energy resources available in the UK, biomass is the largest and most economic. However, compared with other countries, it has been largely ignored and underfunded", says the Watt Committee on Energy.

Yet, in recent history, woody biomass has tended to be neglected or only considered at a more sophisticated level. This is despite the fact that biomass provides energy for around 90% of rural people in the third world, and that biomass provides energy for developed countries to an extent greater than might be expected (in the United States of America more energy is derived from wood than from nuclear power).

Deriving energy from trees presents a truly sustainable opportunity. Unlike other hydro-carbon fuels such as coal, oil, or peat, energy from tree crops and forestry is renewable, if the forest is regenerated. Regeneration alone, however, does not constitute sustainability.

Undervalued

Woody biomass has been ignored for two reasons. In Western economies it offers little by way of rate of return, at least not within the life-time of the landowner. It also fails to whet the appetite of scientists, only a few are interested in the alchemy of conversion processes to high-grade fuels.

It rarely figures in energy statistics and receives relatively little funding for research, for development, or to encourage its integration in other

areas, such as agriculture. Where it has received attention, interest has concentrated on areas of biomass that require processing. Yet energy can also be derived from biomass with minimal refinements, ranging from drying and sorting into calorific value, to the making of pellets, briquettes, and powder from wood and straw.

Sustainability

A new perspective, based on sustainability, makes links with and views the subject in relation to wider issues. Environmentally, it is necessary to consider ecological impact through-out a cycle. It is also important to consider the impact at national level and in relation to neighbours and others on the globe.

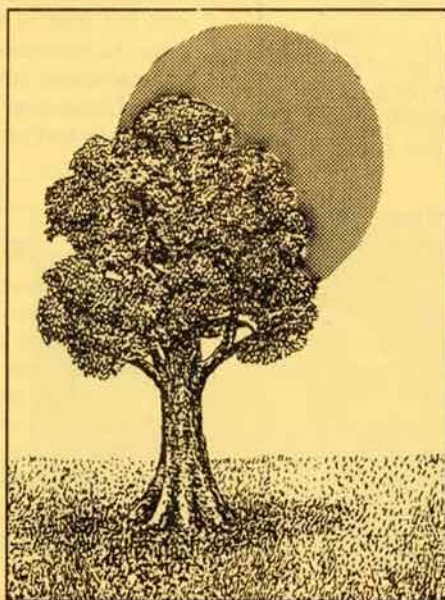
What are the options for increased biomass production? Can there be a

'blue-print' for biomass under existing agricultural methods which satisfies the requirements of sustainability in Britain or elsewhere? Choosing and adapting species through selection or genetic engineering, or according to local ecology may provide clues. Certain trees suit specific ecosystems, being precisely adapted to climate, soils and topography. There would be strong regional variations, for example, as a general rule of thumb, oak is highly appropriate to much of the British Isles. Further north, birch and pine species predominate, and on very wet soils, willows thrive. These categories would necessarily vary with any changes to the climate.

Is a more flexible approach preferable, integrating forestry into other activities?

Woody biomass has to be incorporated into wider concerns for a rapidly changing countryside with a history of ecological decline. It isn't necessary to delve far into environmental issues before those related to the importance of trees are discovered. Trees are highly valued in the landscape for local ecology, amenity and wildlife, but can energy be included?

Any move to exploit woody biomass on a large scale could lead to potentially dramatic changes to a countryside already in a dynamic state. The inevitable conflicts arising will only be reconciled with the involvement of as many people as possible in the decision making process.



Advantages of woody biomass for energy

There are several criteria by which woody biomass can be assessed as an energy source.

1 The present emphasis in the energy sector is to acquire fuel at least cost, therefore wood must stand up to cost effectiveness throughout the cycle. European estimates, taking account of production costs per hectare and costs of investment, operation and maintenance put biomass at 3–5p/kWh. This is within the UK Government target of below 6.5p/unit. The Norwegians consider it to compare favourably with hydro power.

2 A recurrent concern in energy is security of supply. Home grown fuel would obviously lead to greater influence over supply.

Within a flexible mix of renewable energy sources, including intermittent sources such as wind power, biomass offers a greater degree of control. It can be stored and introduced rapidly to smooth out fluctuations from other sources.

3 Employment is an important criterion for energy assessment. Governments have for a long time supported farmers in order to maintain the fabric of the countryside. But with dramatic changes to rural areas in the foreseeable future, development of a new tree industry would tackle the problems of rural areas, keeping people in the countryside.

4 Energy forestry closes the absorption/emission cycle. As the trees grow they take up carbon dioxide from the atmosphere, which is then released during combustion. Therefore, the process produces no net increase in atmospheric concentrations of CO₂.

The take up of CO₂ during tree growth on a large scale has also been recognised as a way of helping mitigate global warming. This has led to recent suggestions of massive afforestation programmes not connected to energy production. However, afforestation alone is insufficient. Without tackling industrial greenhouse gas emissions, the underlying trend of global warming will continue.

5 Particulate emissions from wood combustion give cause for concern, but can easily be removed from industrial scale plant. Combustion emissions of sulphur and nitrogen are considered relatively low and easily controlled. Wood has a much lower sulphur content than coal or oil. Emissions of nitrogen oxide and sulphur dioxide from larger biomass generating stations are very low: NO_x around 50 parts per million (ppm), SO₂ about 100ppm.

Highly efficient technologies make significant contributions in further reducing methane emissions, a by-product of biomass combustion. Pyrolysis and gasification would prevent many emissions.

As with most plans to tackle environmental problems, a 'cradle to grave' approach must be adopted. Consideration here must be given to the end use of trees. Their use for energy production will close the carbon cycle. Alternatively, the use of wood in construction, in housing or furniture for example, will bind carbon for longer periods. Simply leaving trees to rot, as occurs under existing forestry conditions, would result in the release of methane, another more potent greenhouse gas.

Growing regimes

ENVIRONMENTAL impacts also occur in relation to the type of tree growing regime. Under monoculture plantations, with the emphasis on achieving optimum productivity, large amounts of pesticides, herbicides and fertilisers are used and frequently lead to contamination of ground and surface water, and air pollution especially of nitrogen. Such a planting regime may additionally reduce species diversity of an area and its value as a habitat for wildlife species.

These problems could be alleviated to some extent. The use of organic fertilisers, such as sewerage, and the ash from the combusted biomass. A European Community view is to encourage the Black Locust, a tree species from America, which is itself nitrogen fixing. Serious thought must be given to the type of species used, planting and landscaping. This only scratches the surface of environmental impacts of growing regimes which will to a large extent dictate the sustainability or otherwise of this resource.

Interest in woody biomass is growing amongst diverse groups in Britain. This follows several decades of discontent over neglect and abuse in the countryside as its productive capability turned from agrarian to industrial.

The farming community has historically benefited from several support mechanisms to maintain the rural fabric. Now the agricultural economy is changing, and the landscape too will change. Fewer people are needed to farm the land; food mountains give rise to mechanisms to reduce food production, including setting aside large amounts of land. In the UK alone, 1–1.5 million hectares of land will be taken out of agricultural production by 2000, and over 5 million hectares by 2010. Farmers may be looking at farm forestry as an avenue for diversification, but there are other rural dwellers who could gain from the support which has in the past been for the exclusive benefit of farmers.

Other perspectives on biomass use, which seek to realise significant benefits to the local ecology, economy and communities should be explored. These tend to emphasise nonintensive agriculture, often on marginal land. They may also be associated with the reintroduction of indigenous species to stabilise areas where the landscape is suffering from erosion.

Conservation

Many amenity groups are keen to use volunteers to cultivate forestry for landscape and aesthetic purposes.

Some may be concerned to reintroduce regionally indigenous species in the face of, what is seen to be, a burgeoning encroachment of exotic species. As such their concern is with the loss of this resource base which they regard as close to extinction. In Scotland, for example, only 7% of original forest cover remains as native woodland, with the rate of loss over the last 40 years probably greater than any other comparable period.

Woodland on farms

There are schemes available now, as in the Ministry of Agriculture's Farm Woodland Scheme, or in the pipeline, such as their Crofting Forestry plan, which seek to increase the amount of woodland on farms. The objectives are: to divert land from agricultural production thus reducing surpluses; to enhance the landscape and create new wildlife habitats; to help support farm incomes and rural employment, and to encourage interest in timber production from farms.

Energy as an end use is not recognised here, although farmers would be interested if they saw a market for energy forestry.

Energy forestry

Broadly speaking, energy forestry falls into two categories – short rotation forestry (SRF) and modified conventional forestry (MCF). MCF is similar to conventional forestry practice but trees are initially planted closer together and later the thinnings are taken and used for energy. This system enables the whole tree to be regarded as waste and therefore as a fuel and allows an early income return from the plantation. Single stem species are usually clear felled after between 12 and 20 years.

SRF itself has two types – coppicing and single stem. The coppice trees are harvested at three to five year intervals but the stump is retained to continue to sprout after each harvest.

Appropriate locations for the two systems differ. For example, single stem species are particularly suitable for less fertile upland areas, whilst coppicing could make use of lowland agricultural land.

Evidence from Sweden suggests, under SRF cropping methods, that 60 cubic meters of wood per hectare is attainable giving 20 tonnes of dry matter per year. 7.5 cubic meters of Salix (willow) wood is roughly equal to one tonne of crude oil. Research in the US indicates that, given initial energy inputs in the planting and growing process, longer growing periods – of around 60 years – may

produce a greater energy yield.

In Britain, research is being undertaken by the Energy Technology Support Unit and concentrates mostly on the planting of stands of trees, using modern agricultural methods and inputs. Their research aims are geared towards: stimulating the supply of wood from existing woodland; evaluating techniques for producing and harvesting wood fuel produced by short rotation forestry; and investigating and stimulating the possibilities for expanding the use of wood as an industrial fuel.

Other studies include the environmental impact of energy forestry, and integration into conventional agriculture.

Trials are taking place at several sites within the British Isles. They typically emphasise: quantity grown, quantity of inputs, selection of species, and some testing of machinery; and follow rigorous scientific lines. Tree cultivation tests have frequently proved inconclusive due to loss of the crops, especially from disease.

Scandinavian research, however, has been more fruitful. The Swedes, for example, undertook a similar Research and Development programme in 1976, which found between 20 and 30 species suitable for energy forestry.

Site choice



Planting



Management



Harvesting 3-5 years



Regenerating shoots

The woodland economy

There are those who see wood-based energy opportunities in a broader context. Closely integrated into the socio-economic structure of the community, opportunities emerge for the creation of jobs and increased incomes as well as local environmental improvements.

The Woodland Economy concept, advocated by Highland Greens, seeks to benefit local ecology, economy and social well-being. Their starting point is that today's landscape is severely eroded and declining to a landscape, typified in Iceland, where any vegetation struggles for survival.

The present unsustainable forestry situation is associated with exploitation of resources, in particular land, characterised by control of these resources from outwith Scotland. Wider issues such as land ownership are therefore integral to the debate, and

indeed, the whole forestry situation here is closely enmeshed with a global forestry crisis. Our own forestry neglect is seen as a driving force of the global forestry crisis.

These issues are ignored in other analyses. As such, forests being created today bear little resemblance, if any, to the lost forest resource and forestry economy.

RSPB



Roy Dennis



Above: Norwegian glen, with farms, small industry and wooded hills.

Left: Scottish landscape – conifer monoculture plantation, eroding hillside, depopulated.

The european context

FEW countries can be considered to derive their energy on a sustainable basis, but comparisons are interesting, for example, between Norway and Scotland. Both are advanced western countries, at similar degrees of latitude and longitude with similar population levels. Both have totally different patterns of landscape and energy management.

Despite its enormous reliance on hydro power, Norway's traditional forestry and the forest industry account for 5% of the total energy supply, and it is keen to develop other renewables including biomass which is anticipated to increase in use through combustion together with household waste.

Estimates of between 7% and 15% have been suggested for its contribution to national energy provision, figures borne

out by experience in Scandinavia. Woody biomass accounts for 15% of the energy requirement in Finland, while the Swedish Government is highly supportive, giving 25% grants for new CHP fuelled on biomass.

Estimates for provision from biomass for the EC in 1980 stood at 5% from biological residues and 5% from specific energy crops, but was constrained at that time by the desire not to disrupt established agricultural practice. This has altered with changes to the Common Agricultural Policy (CAP). However, to emphasise farming's role may be stretching the point. If all Europe's set-aside land was given over to SRF, energy production would only amount to around 4.4% of EC energy needs.

In eastern Europe there is more than one power struggle taking place. While the

nuclear industry's future looks decidedly shaky in the west, they are showing remarkably 'footloose' thinking, for a capital intensive industry, with their sights firmly fixed on eastern European locations to keep them alive.

Meanwhile, the larger western civil engineering companies are preparing packages of renewables, based on biomass, solar and wind power, aimed at eastern Europe, in anticipation of stricter environmental legislation.

However, increased interest in biomass for energy in eastern Europe, particularly Czechoslovakia and Hungary, has to be set against the fact that 30% of existing forestry is irreparably damaged by acid rain. Effective international protocols for environmental protection will be needed to make major replanting schemes viable.

Development

IN many rural parts of the Third World there is 90% dependence on wood for fuel. While there are other fuel sources in the urban areas, the reliance on woody biomass for energy is still high.

This is predominantly utilised in an unprocessed form to produce heat, but also provides lighting, a social focal point, etc. The only real processing is from woody biomass to charcoal, to reduce weight for transportation, but this is very inefficient given the amount of energy lost.

Major increases in the production and diverse usage of wood from northern forests would reduce the pressure exerted on the Third World for wood products. This is particularly so in the context of the Amazon, Indonesia and other large rainforest areas which are integral to the global oxygen/carbon cycle.

It would also give the right

signals that we in the North take this important resource seriously.

Any technological innovations from the North, particularly in terms of conversion of biomass to electricity, could be seen as appropriate for export to the South. The technology could be readily understood and far more affordable than, say, a nuclear power station. Size, simplicity and lateral thinking are frequently governing criteria for appropriate technology in countries which cannot afford even an electricity grid.

This should not be underestimated. Although there are many who recognise the importance of closing the gap between the affluent North and poorer South, nearly all are lost for just how this can be done. Sustainable energy forestry is clearly an example of possible energy policy convergence.

Biomass futures

BIOMASS in Britain is starting from a depleted resource base. Impoverished tree landscapes reflect ecology in decline and erosion towards a barren land. "Plant a tree in '73" may have crystallised the situation for a few, but the concern for wider acceptance of trees in the landscape is still of prime concern. It is inevitable, therefore, that arguments emphasise the more immediate benefits of trees in their lengthy growth process.

However, the benefits, in tackling the global environmental crisis and in energy provision, in a sustainable framework, should not be ignored. 'Down-the-line' end-use is especially important in energy terms.

The UK's 1% of primary energy consumption from biomass is abysmal, even in comparison to other western states, and must be attributed to our infatuation with fossil

fuels. The faith in space-age technological solutions to energy stand in stark contrast with the neglect of this fundamental resource.

A recent Department of Energy document on CO₂ reduction said the present UK resource (1.3 Mtce) could rise nearly 10-fold by 2030 - their current review must take this on board.

Increasing interest is apparent, but connections have to be made. This is the only avenue for different environment groups impeded by technologically led government policy.

The dramatic changes to rural areas and large tracts of land freed from agriculture will add stimulus to these debates and call for widespread participation in decision making. This is essential for successful solutions to problems in a dramatically changing countryside.

Further reading

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