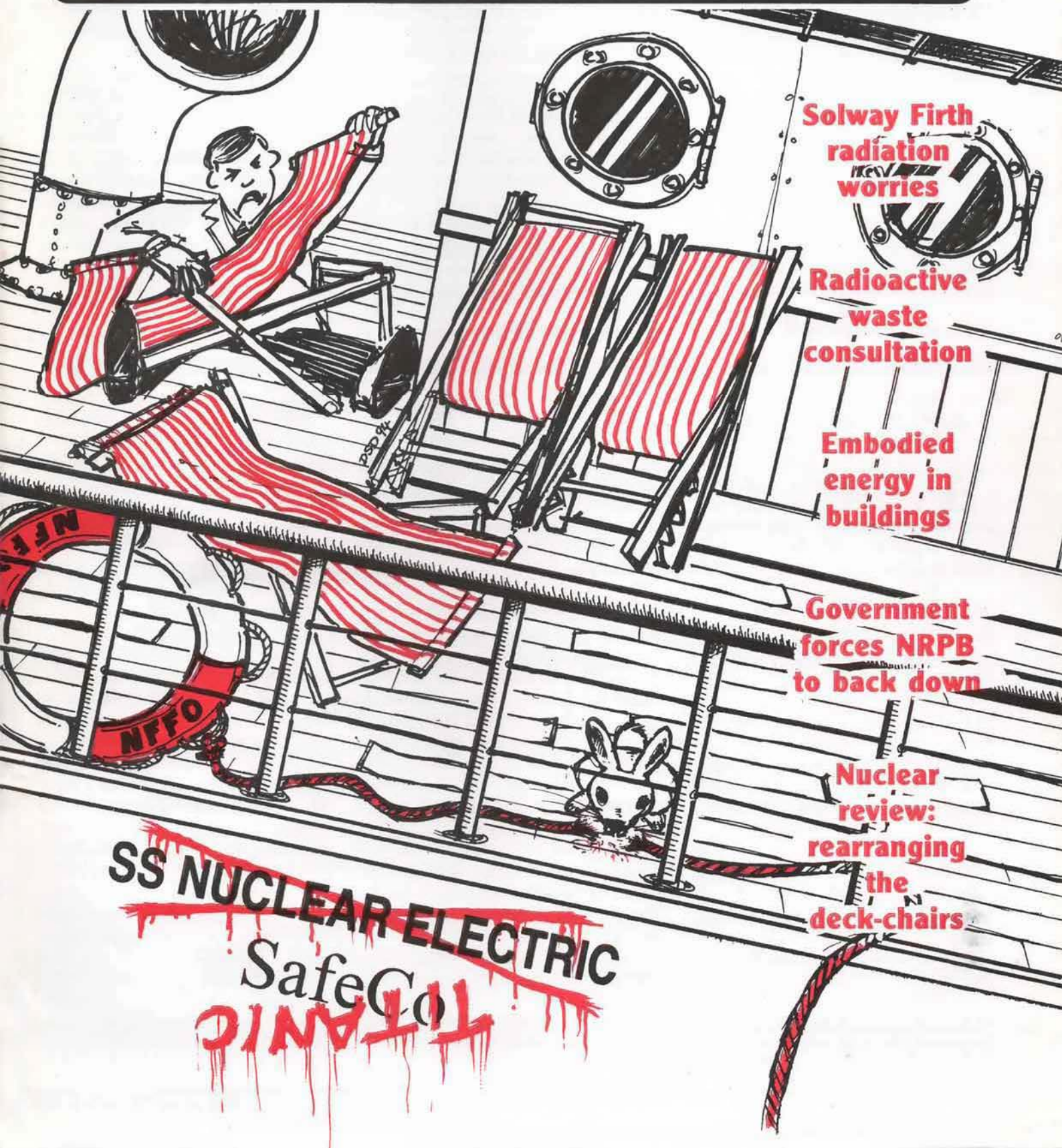


SAFE ENERGY

No.102

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**Solway Firth
radiation
worries**

**Radioactive
waste
consultation**

**Embodied
energy in
buildings**

**Government
forces NRPB
to back down**

**Nuclear
review:
rearranging
the
deck-chairs**

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Nuclear reviews

SUSTAINABILITY, inter-generational equity and radioactive waste make strange bed fellows. The government, in carrying out its review of nuclear power and nuclear waste management, claims that any new policy formulation should adhere to both the principles of inter-generational equity and sustainability.

However, under current scientific knowledge there can be no solution to the radioactive waste riddle which can be considered either sustainable or equitable. A fact which is implicitly recognised within the Department of the Environment's (DoE) consultation document on radioactive waste management, in which the timetable for

establishing a Nirex deep dump has been abandoned.

Furthermore, the DoE makes no hard and fast proposals on disposing of high-level radioactive waste, preferring to wait 50 years — thus leaving the crucial decision to future generations, hardly an equitable process. We have supposedly benefited from the nuclear generation which created the waste but they will have to manage it.

It is time that we faced up to the fact that finding a solution to the dangers of nuclear waste is beyond our current scientific knowledge, indeed we must recognise that it represents an unacceptable risk to the health and well-being of generations to come over a time-scale which is beyond human comprehension. This and this alone is a good enough reason for

rejecting any proposals for new nuclear power stations.

However, if this is not enough for Whitehall, then the complete failure of the nuclear industry to achieve economic viability after over four decades of public funding unparalleled in the history of the industrial revolution should surely be enough to dent the confidence of even the hardest nuclear baron.

Once again the *Safe Energy* editorial will leave the last word to Sir Brian Flowers who, in the 1976 Royal Commission on Environmental Pollution, said it is "irresponsible and morally wrong to commit future generations to the consequences of fission power unless it has been demonstrated beyond reasonable doubt that at least one method exists for the safe isolation of these wastes for the indefinite future."

Jobs, nuclear power and renewables

AS the nuclear industry tries to justify its continued existence, one of the issues it has cited is that of jobs.

But if employment really is the issue, the Department of Trade and Industry (DTI) should be looking elsewhere.

It is no coincidence that two of Labour's most vocal MPs in support of nuclear power Dr Jack Cunningham and more recently Brian Wilson ("Nuclear review", p4) both have considerable numbers of nuclear workers within their constituencies, Cunningham with Sellafield and Wilson with Hunterston. But their local self-interest should not be allowed to overshadow the full picture.

Wilson, given his Highland connections as founding editor of

the West Highland Free Press, should not forget that it was the failure of Hunterston to deliver cheap electricity that led to the closure of the Invergordon aluminium smelter and the consequent loss of jobs in the Highlands.

It should be remembered too that when Glasgow engineering company James Howden, which was at the forefront of wind power technology, decided to pull out of the industry in 1989, a key reason it gave was the lack of a home market.

The DTI's own Renewable Energy Advisory Group (REAG), reporting in 1992, considered the Scottish Renewables Obligation (SRO) proposal "inadequate to stimulate the renewable industries in Scotland". The target figure has since increased by 50%, but REAG's basic criticism remains. So much for the SRO's stated aim: "the encouragement of the renewable energy industry".

While the House of Commons Public Accounts Committee may take too short-term a view of research and development, its criticism of the fact that 84% of wind turbines installed under the Non-Fossil Fuel Obligation in England and Wales were imported are surely valid ("Research money wasted", p21).

And it was the DTI's Energy Technology Support Unit which reported: "The world-wide market for renewable energy products and services is potentially enormous ... [and] offers the opportunity for the development of a significant UK industry for domestic and export sales," ("Renewable energy potential", *Safe Energy* 101).

If the DTI is to take the issue of jobs seriously, it will reject the claims from the nuclear industry and redirect some of the billions of pounds that are thrown at nuclear power towards creating a thriving renewable energy industry.

SAFE ENERGY

FEATURES

8 Solway Firth radiation worries

Findings were recently published from a radiation survey of the north Solway coast, an area affected by Sellafield, Chapelcross, a depleted uranium-tipped shell firing range and Chernobyl fall-out. **Dr David Sumner**, an independent radiation consultant, reviews the report and calls for more comprehensive monitoring and reduced emissions from Sellafield.

10 Radioactive waste consultation

For the first time in over a decade, the government is reviewing its radioactive waste management policy. **Dr Patrick Green**, Friends of the Earth's senior energy campaigner, and **Dr Rachel Western**, nuclear researcher, read between the lines of the consultation document and argue against short-term fixes to solve the problems created by the failure of the disposal programme.

12 Embodied energy in buildings

While the benefits of energy efficiency within buildings is now widely appreciated, **John Brennan**, of Gaia Architects Scotland, highlights the excessive amounts of energy used in producing building materials and in construction, which for a typical industrial building is greater than the energy consumed during its useful life.

14 Government forces NRPB to back down

Plans by the National Radiological Protection Board to tighten dose limits for the public were rejected by the government following nuclear industry pressure. **Ian Fairlie**, who is engaged in PhD studies in nuclear waste matters at Imperial College London, argues that the decision was based on expediency rather than science.

15 Nuclear review: rearranging the deck-chairs

With the long-awaited nuclear review now under way, the nuclear industry has come up with a range of survival packages. But evidence submitted by the Consortium of Opposing Local Authorities systematically destroys the industry's economic, security of supply and diversity arguments, reports **Mike Townsley**.

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Nuclear review

NUCLEAR POWER should take its chances in the private sector, argues the CBI in its submission to the government's nuclear review, joining a growing consensus that the industry should be free to compete but without any further subsidies.

CBI chairman Sir Bryan Nicholson said that following "an extensive and lively debate" it had been decided to offer strong support for the privatisation proposal. However, he added that receipts from the Fossil Fuel Levy should be set aside to pay for decommissioning: "Electricity consumers have already contributed substantially for the industry's inherited liabilities, they should not be asked to pay again," and "... if the government should decide to intervene in the future investment decisions for strategic reasons, we believe the costs should be made clear and a matter for public debate."

Several changes were made to the CBI's document at the eleventh hour, following intense nuclear industry lobbying. In an earlier draft the CBI argued that there are no economic or strategic reasons to build new reactors, and that "under no circumstances should electricity consumers be looked to as a source of operating subsidy."

The CBI further wants any proceeds from nuclear privatisation to be put towards meeting the cost of the industry's massive liabilities.

The Association of Independent Electricity Producers, which now counts PowerGen and National Power amongst its membership, has also offered qualified support for privatisation. It argues that nuclear power should be "given no special advantage over other privately owned generating business." It also wants nuclear power's status as protected base-load capacity to be re-examined in light of a move to the private sector.

British Nuclear Fuels, however, is believed to be opposed to the privatisation of the two nuclear generators. The company wants the government to instead give "clear commitment" to the future of nuclear power and expressed "a willingness to consider" privatisation if

asked to do so by ministers. BNFL sources told *The Guardian* that it found Nuclear Electric's enthusiasm for privatisation "surprising".

Without a strong nuclear construction programme at home, warns the British Nuclear Industry Forum in its evidence, Britain could lose out on export opportunities in the world nuclear market said to be worth £500 billion.

Its submission argues: "As things stand the nuclear industry is set to earn Britain £1bn a year by 2000, but with the government's backing for far more power stations in Britain the export earnings could grow much larger."

The Forum, which represents the nuclear power construction and engineering industries, said that building a new nuclear power station every two years from 2002 would merely maintain capacity.

Treasury challenge

Lord Weir, chair of the Weir Group, said at the launch of the evidence that nuclear power had proved itself economically, adding that while nuclear power would need state support this did not necessarily mean subsidies. With a clear indication of knowing exactly where in government the main challenge lies, he warned (or threatened): "It will not be acceptable for the Treasury simply to say that the requirements for financing Sizewell C are too complex or too different to fit in with their normal way of handling such things."

Meanwhile, Brian Wilson MP has slammed the Scottish Trades Union Council's (STUC) submission as "unrealistic and undesirable." The STUC is calling for a continued moratorium on new nuclear power stations in Scotland.

Wilson argues that the adoption of such a policy would kill off the Scottish nuclear industry, with the loss of thousands of skilled jobs. The STUC, however, said Scotland is currently 70% over capacity and that plans for increased capacity would be unacceptable. Its general secretary said a loss of jobs in the industry would be compensated for by the creation

of jobs in other areas.

Stop Hinkley Expansion, the local pressure group established in the early 1980s to fight the proposal for a PWR at Hinkley Point in Somerset, cites Michael Grubb of the International Institute for International Affairs in its evidence: "The task of gaining public acceptability for the nuclear industry therefore now seems a huge one. Bitter experience shows the dangers of trying to force through a technology which rouses deep public opposition even in countries where it is politically possible. In most countries, trying to expand current nuclear technology now looks like facing an extremely hard and damaging battle. It would also be a brittle path. The greenhouse effect might conceivably give nuclear power another chance after Chernobyl, but a further major accident, or use of a nuclear weapon derived from nuclear power, would probably spell the end in most countries."

SHE has trawled through past opinion polls to provide an overview of changing public attitudes to nuclear power. They found "despite some blips, the clear progression had been one of growing opposition to more nuclear power, and shrinking support."

The respected polling organisation Gallup has conducted 17 different surveys since 1979; SHE reports that: "Those who feel that nuclear power should be expanded have shrunk from 42% in 1979 to just 13% in 1991. By contrast, the total of those who either want nuclear generation stopped, or not developed any more at present (a moratorium), has increased from 42% to 78%."

Over the same period Gallup also sought the public response to the question "if a nuclear power station was to be built in your area ... ?" The number who would "oppose it" has jumped from 42% to 67%; those who wouldn't oppose it but "would still feel anxious" have stayed relatively constant; and those who would "agree to its being built" have decreased from 16% to 6%.

■ While opposition to nuclear power grows, the Liberal Democrats came perilously close to rejecting its anti-nuclear stance. In a poorly attended early morning session, a show of hands looked as if the party conference had overturned the policy dating back to 1978, but a card vote maintained the policy by just four votes. □



Nuclear smuggling

RECENT revelations about the extent of trafficking in weapons-grade nuclear materials have led to calls for a strengthening of international intelligence co-operation and a greater role in policing the material for the International Atomic Energy Agency (IAEA).

In Europe a deep split has emerged over the best way to tackle the problem of the apparently growing nuclear black market. Following the revelation that German police seized some 300g of plutonium in a highly controversial 'sting' operation, the German government wants the issue to come under the aegis of Europol. However, although first discussed in 1991, Europol is currently no more than a proposal for some form of pan-European police force or police co-operation.

While the German government wants it to be a police force for Europe, both the UK and France, fearing a loss of sovereignty, are deeply opposed. At a European Union interior and justice ministers' meeting held at the beginning of September in Berlin, Home Office

minister Michael Forsyth rejected Germany's position, arguing that the best course of action would be to first assess how serious the problem was. In the UK, said Forsyth, there is no evidence that nuclear smuggling is a problem.

In Germany there were 41 cases of nuclear smuggling in 1991, 158 in 1992 and 241 in 1993, as well as the incidents this year.

Nuclear smuggling has also been a topic of discussion for the IAEA, which traditionally provides safeguards cover for civilian nuclear material. The governments of the United States, Germany, France and the UK are offering up to £6.4 million to the cash-strapped organisation if it agrees to operate as an international clearing house for intelligence in the battle against the smugglers.

In addition to formalising relations between national intelligence agencies and police forces, the Authority plans to establish an international database to track the smugglers, which will be paid for by the US National Security Council.

The IAEA is to consider how a series of international missions — similar to those governing civilian sites — can be set up

to monitor plutonium handling facilities and to provide expertise and hardware.

■ Current IAEA standards which allow up to 8kg of plutonium to be missing from a nuclear plant before alarm bells begin to ring are far too lax, according to a report by the US Natural Resources Defence Council.

Thomas Cochran, the Council's senior scientist, says that a one-kiloton bomb can be made with as little as 1kg of plutonium, using designs developed in the US during the fifties and described in papers that are no longer classified.

According to the report, US officials have known for years that the IAEA standards were inadequate, however, tighter standards would require a considerable increase in the Authority's pitifully small budget and would add significantly to the already alarmingly high costs of reprocessing.

Cochran warns that the recent seizure of over 300g of plutonium in Germany illustrates the lax standards of plutonium control: "This should be a wake-up call."

One kilogram of plutonium is very easy to hide, he added: "It would fit in a cigarette package." □

Plutonium mine

Ageological repository for spent nuclear fuel has been likened to a "plutonium mine" by the International Atomic Energy Agency's senior safeguard's official, Bruno Pellaund, who is charged with the task of establishing safeguards for such waste.

While the Agency expects to be able to terminate safeguards on vitrified high-level waste (HLW) — the HLW which results from reprocessing and is then sealed in glass blocks — Pellaund said safeguards on spent fuel cannot ever be terminated.

While most countries are still discussing the best way to 'dispose of' HLW, progress being made in Sweden means that the IAEA needs to establish clear and specific requirements for monitoring a final repository so that it will be known early enough in the design

process what access will be needed later for safeguards purposes.

"In the early days of nuclear energy, we talked of 'operator-friendly' facilities, and it was very embarrassing after 20 years to realise you could not get access to a pressure vessel to do some safety-related monitoring because nobody had thought to leave sufficient space," he said. "Then we went on to 'safety-friendly' and also 'safeguards-friendly' designs — to make sure that, in big facilities, reprocessing or fuel fabrication plants, people can have access to critical points. The same should apply to repositories."

Pellaund added that he was not talking about intrusive monitoring: "I do not call deploying micro-seismic instruments on site intrusive. From the safeguards viewpoint, measures we would require should not affect the sealability of the site. We will not demand little shafts to be able to go down. We will use indirect means,

like seismic mice able to detect somebody digging at the site, or satellite surveillance to identify any surface work."

While the IAEA expects to be able to terminate safeguards on the vitrified waste, "this does not mean the Agency abandons interest in it."

Before the formal termination of safeguards, Pellaund said, the IAEA will demand four assurances from the country that stores and finally disposes of vitrified waste:

- identification of the proposed repository site;
- notification if the waste is moved after interim storage;
- notification of when the waste is placed in the repository; and
- notification of any intention to reprocess the waste.

If the waste containers were retrieved so 'useful' materials could be extracted then those materials would once more fall under IAEA safeguards. □

Japanese plutonium

FOLLOWING the publication of a report* by Greenpeace International, the US government has announced that no more technology which can be used for plutonium handling will be sent to Japan, for fear that it could be used for weapons manufacture.

While the Greenpeace report highlights US collaboration since 1987 on the Japanese reprocessing plant at Tokai-mura, arguing that such assistance broke US proliferation law and

contravened the Non Proliferation Treaty, the Department of Energy (DOE) has stopped short of admitting the transfers were illegal. It has not yet responded to demands that the technology should be reclaimed, construction at the site should be cancelled and sensitive information be returned. The DOE said it is taking Greenpeace's charges seriously and is preparing a "comprehensive response".

At the heart of Greenpeace's concerns is the construction of a plant at Tokai-mura for reprocessing fuel and depleted uranium 'blanket' material from the country's Monju and Joyo breeder reactors. The plant which

should be completed around 2000 will produce 'supergrade' plutonium, with a Pu-239 content greater than 96%. "Such plutonium presents an extreme plutonium risk due to the fact that small quantities can be used directly in lightweight, highly accurate, nuclear weapons or alternatively blended with plutonium of different isotopic concentrations to make weapons-grade material." □

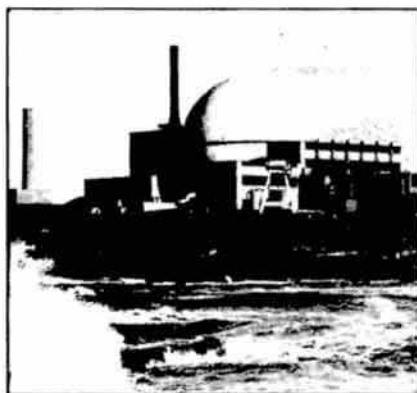
* "The unlawful plutonium alliance: Japan's supergrade plutonium and the role of the United States." Greenpeace International, September 1994.

HEU boats

A potentially embarrassing setback for US non-proliferation policy, involving the return of spent highly enriched uranium (HEU) fuel from four European research reactors, was narrowly avoided at the end of September.

Two ships, carrying 153 weapons-grade elements, were eventually allowed to unload their cargo at the Sunny Point military port in North Carolina on 25 September. Two weeks earlier the Governor of South Carolina, Carroll Campbell, in whose state lies the Savannah River military nuclear complex, where the elements will be stored, obtained an injunction against the unloading of the ships when he argued that the US Department of Energy had failed to carry out an environmental investigation. A panel of four Appeal Court judges overturned the earlier injunction obtained by Campbell on 23 September arguing: "The State of South Carolina has not, at this stage, demonstrated an immediate, irreparable and actual harm that requires us, at this time, to dismiss the significant concerns expressed by the Secretary of State and the Department of Energy."

Paul Leventhal, of the Washington-based Nuclear Control Institute, underlined the Clinton administration's fears, commenting: "For 16 years, US policy has been to phase out commerce in HEU because of proliferation and terrorism risks. This type of uranium was



Dounreay

used in the original Hiroshima bomb. Prior to the Gulf War, Saddam Hussein's nuclear program was dedicated to producing HEU for nuclear weapons. Experts fear that a theft of bomb-grade uranium from international commerce could provide a group or a state a significant shortcut to the bomb."

Atoms for Peace

The shipments are part of a 409 element emergency order issued by the Clinton administration under its non-proliferation policy. The administration hopes eventually to bring home some 15,000 HEU elements which the US dispatched to research reactors all over the world as part of its 'Atoms for Peace' programme. However, it will first have to conclude a process which began in 1988 — when its previous importation certificate ran out — of providing an adequate environmental impact assessment for the policy. The importation policy is expected to be reinstated sometime next year.

The emergency order was granted to alleviate the problems experienced in storing the elements by four research reactor sites — Astra (Austria), HORS (Netherlands), DR3 (Denmark) and Orison (Sweden), and to prevent them from sending the spent fuel to Dounreay in Scotland where it would have been reprocessed. Contracts with Dounreay include a clause which says the resultant waste must also be taken back but the countries lack the facilities to handle it.

The DOE is particularly hostile to the idea that Dounreay could be used to reprocess US-origin HEU — which would undermine their programme to force research reactors to convert to using non-weapons grade low enriched uranium — and last year it offered a Belgian operator some \$500,000 as compensation to break a contract with Dounreay.

While Dounreay had hoped to capitalise on the legal complications facing US importation policy, it has now all but admitted defeat. Contracts have now dried up and the research reactor spent fuel reprocessing plant has been mothballed. However, that did not stop UK government officials seeking high-level talks in the US last month to see if it could drum up a little extra business for the plant.

US Energy Secretary Hazel O'Leary welcomed the arrival and unloading of the HEU saying: "The acceptance of this spent nuclear fuel sends a strong message to our foreign allies that the United States is a serious partner in eliminating the nuclear non-proliferation risks associated with availability of highly enriched uranium in the global marketplace." □

Waste ship

NEXT YEAR'S shipment, from France to Japan, of the most highly radioactive waste ever transported should not go ahead before a full public appraisal has been made, says an international coalition of environment groups.

The coalition of groups — the Nuclear Control Institute (US), Greenpeace International (Holland), Citizens' Nuclear Information Centre (Japan) and WISE (France) — has sent an open letter to the governments of France, Japan and the United States. It says:

"We are writing concerning the planned shipment of highly radioactive vitrified nuclear waste from France to Japan that is now expected to take place in February 1995 — the first sea shipment of its kind. Customary international law and the UN Convention on the Law of the Sea requires the governments of France and Japan, as the shipper and receiver of the waste, respectively, to conduct an environmental impact assessment of this shipment and release the results. The US, as the originator of the nuclear fuel from which the wastes were extracted and then

vitrified into glass logs, and with responsibility for a number of the prospective en-route territories, should actively support the preparation of such an assessment by France and Japan."

Further, argues the coalition, because the shipment could lead to increased exposure to radiation the French government is required under Euratom to provide the European Commission with an explanation in advance of why the shipment is necessary.

Also, because this shipment will be the first of its kind, Euratom dictates that a prior review is conducted by the European Commission of specific measures being employed to protect public health.

In addition to a full environmental impact assessment of the shipment, the coalition wants the "release of technical data on the radioactive waste, test results on the shipping containers [and] specific information about the ship's route."

"We want hard facts, not a slick public-relations campaign."

British Nuclear Fuels, which plans similar shipments to overseas customers, including Germany and Japan, will be watching the outcome of this first transport with considerable interest.

Consignments of highly radioactive

waste are expected to start leaving Thorp at Sellafield around 1998. If the company's proposals for waste substitution are accepted by government, it believes that the necessary number of such shipments can be cut from 5,000 to 150. Such a cut would result in considerable cost saving, said BNFL.

In its evidence to the government review of radioactive waste management policy, it says substitution would achieve this reduction by giving overseas reprocessing customers the option of taking an additional quantity of high-level waste (HLW) in place of the bulkier intermediate and low-level wastes.

The policy received a boost from the government's Radioactive Waste Management Advisory Committee (RWMAC) which said in August that the radiological impact on the environment of substitution would be neutral. However, it added that if BNFL is allowed the option of offering substitution there is a case for a "small additional quantum of vitrified waste to be returned over and above that calculated on radiological grounds."

Acceptance of substitution would also require the overseas customer to get full regulatory backing for taking back only HLW. □

Nirex knocked

CUMBRIA County Council has called for a public inquiry into plans for a nuclear waste repository at Sellafield, following a planning application submitted by Nirex for a Rock Characterisation Facility (RCF) some 735 metres below the site.

Nirex says the RCF represents the next logical step in its investigation into the suitability of the Sellafield geology for playing host to radioactive waste for hundreds of thousands of years.

The company wants to sink two deep shafts and excavate a network of tunnels extending deep into the volcanic rock to examine how water at this depth flows. If it is found to return to the surface and cause a risk of contaminating drinking water with radioactive material which would be dumped in the repository, the company will be forced to take its investigations elsewhere.

While Nirex contends that the results from the RCF "will be useful wherever the final choice is," Cumbria County Council wants the whole notion of deep disposal

examined before the drive to use Sellafield picks up unstoppable momentum. It cites the government's radioactive waste review and doubts over the government's commitment to deep disposal as reasons for its belief that Nirex is jumping the gun.

■ Meanwhile, Dounreay's operator, the Atomic Energy Authority (AEA), has reissued its application for extending the site's existing low-level waste storage pits despite an earlier vociferous rejection of its planning application by Highland Regional Council.

The new plan would involve super-compacting drums of low-level waste before sealing them with concrete in standard freight containers. The containers would then be stacked in a concrete lined vault. Many objectors to the previous application believe this is 'no more than the old plan with a new coat of concrete.'

Since the earlier application, which was rejected largely on the basis of a site visit made by regional councillors, the Authority has embarked upon a £15 million three-year clean up programme. On their visit to the old waste pits, councillors were horrified to find

thousands of barrels of nuclear waste scattered on the surface. Many were rotten and some 800 drums had been stacked on top of full pits beside the sea since 1985 and only recently been covered with tarpaulin. Others were covered by a net to keep scavenging birds away from the waste.

Last year the Region's director of planning, Richard Cameron, said: "The council's objective is for positive and on-site management ... provided regulatory measures are installed, an inventory of radioactivity is established, orderly storage is undertaken, monitoring takes place and recovery is possible."

AEA's consultants, PIEDA, said in an environmental assessment submitted with the planning application: "Construction and operation of the extension is consistent with the regional council's views of waste management as stated in the Structure Plan."

Jim Baxter, the site's director, commented: "We have a great deal of work to do in the decommissioning programme at Dounreay in the coming years, and it is essential to our operations that we have a route for disposing of the waste which will inevitably be generated."

The planned extension would last 15 years. □

Radioactive Ribble

ENVIRONMENTALISTS, backed by Lancashire County Council, have called on British Nuclear Fuels (BNFL) to spend £900 million a year to clean up beta radiation discharges from its Springfields plant, the risks from which, they argue, have been underestimated by HM Inspectorate of Pollution (HMIP), the Ministry of Agriculture, Fisheries and Food (MAFF) and BNFL.

Levels of thorium discharges, say the environmentalists, cause high levels of beta contamination on mud flats by a park and in some recreational areas of Preston. Critically, they argue, the banks dry out several times a year and the radiation contaminated silt blows off the grasses onto gardens, which raises the possibility of ingestion which could be dangerous. The silt also falls on pastures which are used by grazing animals.

A report by BNFL for HMIP shows that the discharges of thorium, an impurity in the uranium Springfields makes into fuel rods for power stations, could be reduced by storing the waste on site for six months before release. However, the company claims that such expenditure is unjustified: "The

important thing, whatever the levels are, is the risk to people and the Pollution Inspectorate, the Ministry of Agriculture and local independent experts have all said there is simply not a risk. And they use extremely pessimistic assumptions."

The effects of beta radiation depend critically on the pathways by which the radiation could affect the public. One of the key measures made by MAFF is the likely dose to the gonads of anglers sitting on the silt. Local environmentalists are critical of MAFF's approach, arguing that the total level of contamination on the Ribble has not been fully assessed. Despite the fact that the plant began discharging radioactivity in 1946, the extent of contamination has only appeared in MAFF's official publications for the past two years.

Louise Ellman, leader of the County Council, said: "We have conducted studies and we are concerned. We believe that the levels should be as low as they reasonably can be. We hope by drawing it to the company's attention they will take precautions."

Springfields' discharge authorisations will be reassessed next year by HMIP and calls have been made for the thorium limits to be reduced. □

Sizewell delay

NUCLEAR ELECTRIC (NE) has failed to live up to the commitment it gave government to have Sizewell B up and running by 31 August this year, and is facing the prospect of further embarrassing delays.

The news is not encouraging for the nuclear industry, the very future of which is being questioned during the current government nuclear review. Exactly how late, and over budget, Sizewell B ends up being will play a crucial role in the processes of deciding whether the current moratorium on new nuclear build should be lifted.

Seven years ago the nuclear industry claimed that it could build and load fuel into the station within 72 months. However, it still lacks permission from the Nuclear Installations Inspectorate for fuel loading and is without authorisation from HM Inspectorate of Pollution to discharge radioactivity into the environment.

NE, which had hoped to begin generating electricity during the summer, claims that while Sizewell B is based on a standard Westinghouse pressurised water reactor design it is in many ways a prototype, causing greater complexity in the commissioning process than expected.

It is now extremely doubtful that the plant will begin operating before next summer. □

Radioactive pollution in the Solway Firth area has long been a concern: with Sellafield to the south and Chapelcross to the west, it was also affected by Chernobyl fall-out and has a weapons range on its northern coast which tested depleted uranium-tipped shells. Dr DAVID SUMNER* reviews a recent radiation survey of the north Solway coast and argues for further investigation, particularly following increased discharge limits for Sellafield.

The Solway Firth — radiation worries

CONCERN about the radioactive contaminants in the Solway goes back at least a decade. The Radioactive Pollution Survey Group for Wigtownshire, formed by concerned local people in 1984, arranged an independent survey⁽¹⁾ of environmental samples which showed that radionuclides from Sellafield had migrated upstream along the River Cree. Significant contamination was revealed in sites which were not routinely monitored, and average values of americium-241 and caesium-137 were found to be significantly higher than those reported by the Ministry of Agriculture, Fisheries and Food (MAFF).

Several subsequent studies have confirmed the existence of Sellafield-derived radioactivity, particularly in tide-washed pastures⁽²⁾; but prior to the recently published aerial survey, the extent of this contamination was not fully appreciated.

In November 1992 a new group, Galloway United Against Radiation Damage (GUARD), was formed. One of the reasons which led to the formation of GUARD was the realisation that, with the commissioning of THORP, discharges from Sellafield were set to increase, leading to further contamination — when the full extent of present contamination was still unknown. There were no published estimates of the probable doses that would be received in Dumfries and Galloway if the new Sellafield discharge authorisations were approved. During the consultation periods last year, official assertions were that the doses to 'critical groups' in Dumfries and Galloway would be less than in West Cumbria. However, the latest MAFF Monitoring Report⁽³⁾ indicates that at present these doses are roughly comparable: 160mSv in Dumfries and Galloway and 190mSv in West Cumbria.

An aerial survey of radionuclides along the north Solway was carried out by the Scottish Universities Research and

Reactor Centre (SURRC) in February 1993 and published in May 1994.⁽⁴⁾ It contains maps of the distribution of caesium-137, potassium-40, bismuth-214 (a radon daughter) and thallium-208 (a decay product of thorium). In addition to the aerial survey itself, a number of soil samples were taken for calibration purposes.

In response to the concern about the use of depleted uranium on the Ministry of Defence range at Dundrennan, a retrospective analysis of the spectral data from the range and its adjacent coastal areas was carried out to establish whether or not there was any evidence for enhanced levels of uranium daughter protactinium-234m. The survey found no evidence of widespread uranium contamination; but the story on other artificial radionuclides is not quite so reassuring.

The Solway Firth's rich and largely unchanged environment continues to play a key role in the life of many people. It also has one of the largest expanses of tidal mud flat in Britain, serving as a feeding ground for a spectacular array of animal and plant life. The coastal waters and rivers support important salmon and sea trout fisheries.

The Solway Firth partnership

Levels of caesium-137 range from approximately 2kBq/m², a level consistent with global weapon's testing fallout, and from 2-40kBq/m² on terrestrial sites affected from deposition from the Chernobyl accident; interestingly the Chernobyl deposition seems to be consistent with a more northerly trajectory than previously supposed for the main Chernobyl plume.

But the highest levels of caesium — from 40kBq/m² to over 200kBq/m² — are found on tide washed pastures which have accumulated marine sediments from the Irish sea. The report lists 17 merse (salt marshes) sites which, because of their combination of fine particles and grasses, have accumulated 'appreciable' radioactivity from Sellafield discharges. Because the peak discharges were in the 1970s, the maximum concentration of radioactivity is typically about 5-10 cm below the surface.

Previous surveys of soil and tide-washed pastures had shown contamination in some of these areas; what is new in the aerial survey is that some of the contaminated areas are shown to be extensive — the report singles out Kirkconnel and Wigtown merses which are several kilometres long and up to 1km wide — and fall within sites of special scientific interest (SSSIs). An important site is Caerlaverock, a winter refuge for more than 12,000 barnacle geese.

At this point a common response is to put these findings 'in perspective' by comparing the artificial with the natural radioactivity. The main granite intrusions in the area (at Dalbeattie, for example) are indeed readily visible in the maps of natural radionuclide distribution, and the report comments that the merse deposits are "comparable in extent and dose rate

with several notable granite intrusions". But it may not be fair to compare the gamma ray dose from caesium-137 deposited in the merse sites with natural radioactivity in granite. The external gamma ray dose from caesium-137 may not be the most important type of exposure, since the high caesium-137 activities

are associated with plutonium and americium-241. (The additional importance of americium is that, even if discharges were to stop tomorrow, concentrations will continue to increase, because it is a decay product of plutonium-241). Concentrations of americium-241 were measured by the SURRC team in sediment samples, since it is not possible to detect it in an aerial survey.

In line with previous studies which have looked at samples from tide washed pastures, concentrations of caesium-137 at the Wigtown calibration site were frequently over 1,000Bq per kilogram, and americium-241 activities were typically a few hundred Bq per kilogram. Assuming that plutonium is also present, this is not an insignificant quantity: it means that a few handfuls of soil contain the maximum permissible body burden of actinides ie. if it entered the body it would give rise to a continuous annual dose of about 1mSv.

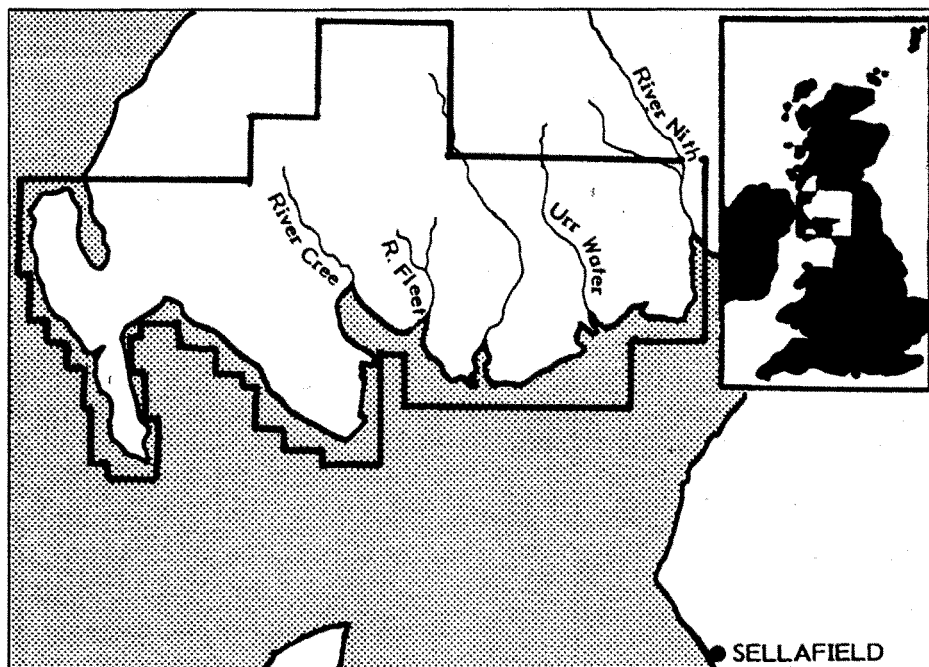
Concentrations of radionuclides in environmental samples are frequently compared with the NRPB's Generalised Derived Limits (GDLs).⁽⁵⁾ The problem is that there is a GDL for well-mixed soil, and another GDL for marine sediments, but not one for salt marsh. If we were to use the GDL for soil, then most of Wigtown samples would be above the 25% 'investigation limit' set by the NRPB. Note that this is not a limit in any enforceable sense; it is simply a level at which more detailed investigations of the doses to exposed individuals are supposed to be carried out.

Exposure pathways

So what are the implications of these levels in terms of doses? One of the problems with assessing doses to individuals who might be exposed is the multiplicity of pathways. Clearly there are a number of possible exposure pathways — people walk on the merse, breathe in sea spray, eat fish and shellfish, put seaweed on their gardens, and so on; also sheep and cattle graze on the merse. The only survey which has estimated doses admitted there was a problem in identifying all the pathways: "The occupancy times related to the recreational uses of tide-washed pasture were found to vary widely ... what is of concern is the extent to which different activities should be seen as additive ... for example, how many horse-riders are also keen bird-watchers, or how many haaf-netters also play football regularly at Kirkcudbright. Such questions are almost impossible to answer in general."⁽²⁾

Problems such as this were generally brushed aside during the Thorp consultations last year, and are being dismissed by the Scottish Office now. The Scottish Office Press Release that accompanied the SURRC report is disingenuous (to put it charitably). It claims that "Radiological monitoring ... shows that radiation exposure of the public has been controlled in full and strict accordance with internationally recommended limits." In the light of the above this can only be a statement of faith; the truth is, we don't actually know whether the doses received by some people have exceeded the limits or not.

Full assessment must be made of the doses likely to be received by those living near and/or making use of containment areas — and not only humans, as many of the contaminated sites are important ecosystems (Caerlaverock for example). In the words of the report: "A list of the main merse sites ... includes a number of locations which are not monitored routinely under existing Scottish Office



Map showing survey area

arrangements. It would ... therefore be prudent to extend the regular monitoring to some of these locations, and to ensure that their potential significance is considered in radiological assessments."

There are really two problems here: the first is that, because of multiple pathways, some individuals may receive unacceptable doses; the second (less likely) possibility is that the estimated doses are in error by a much larger factor. The excess of childhood leukaemia around Sellafield (and to a lesser extent, around some other nuclear installations) remains unexplained, and environmental radioactivity has not been ruled out as a possible cause.

Some concern

I think the SURRC Report makes it quite clear that there should be some concern about the present situation, and more work needs to be done. In addition there must be some concern about future developments. Under the new authorisations, discharges from Sellafield are set to increase; although it is true that discharges are much lower now than they were in the 1970s, there will be significant increases in some radionuclides, for example discharges of technetium-99 — which does not occur naturally — will increase forty-fold. Technetium is concentrated by lobsters by a factor of 10,000 or so and in certain kinds of algae and seaweed by a factor of 100,000 or more. Present monitoring of sea food is rather limited (in 1991 MAFF measured radiocaesium in two samples of fish from Kirkcudbright and one sample of winkles and cockles from the 'North Solway coast'). So clearly more

comprehensive monitoring is required, both of seafood in general and the contaminated sites in particular.

There must be some concern about the longer-term future. The four decades' worth of Sellafield discharges laid down in the salt marshes may be relatively immobile at present, but it is not difficult to think of many ways in which they could be remobilised in the future — rising sea levels, land reclamation, and the laying of oil pipelines for example. In light of this uncertainty, it seems doubly irresponsible to have allowed the discharges from Sellafield to increase. □

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For the first time in over a decade the government is reviewing its radioactive waste management policy: a genuine attempt to address the serious issues or a complacent justification for changing nothing? Dr PATRICK GREEN, Friends of the Earth's senior energy campaigner, and Dr RACHEL WESTERN, nuclear researcher, read between the lines of the consultation document.

Rad waste consultation

IN the early 1950s, the UK was the first country to establish a nuclear power programme, yet at that time scant regard was given to managing the inevitable radioactive waste. In 1976, the Royal Commission on Environmental Pollution severely criticised the nuclear industry for failing to address seriously the problems of radioactive waste management. The basis of current government policy was established in 1977 to address the Commission's criticisms.

The underlying principals of the policy are environmental responsibility, waste minimisation and disposal. However, no credible implementation programme has been produced and despite over ten years of sustained effort Nirex has failed to establish a disposal programme. Up until now, government and industry have maintained that technical solutions to radioactive waste management do exist and that the real problem is simply one of public perception.

Government policy

Government policy on radioactive wastes is based on the six responsibilities given to the Secretary of State for the Environment in the 1977 white paper. These require that:

- the creation of wastes from nuclear activity is minimised;
- waste management problems are dealt with before any large nuclear programme is undertaken;
- waste is handled "with due regard to environmental considerations";
- waste accumulated at nuclear sites is disposed of;
- there is adequate research and development on waste disposal; and
- waste is disposed of appropriately.

Policy Opportunities

The implementation of this policy is in complete disarray. The continued use of nuclear power stations is continually increasing waste stockpiles and the reprocessing of this waste increases the problem still further. After over ten years of effort the nuclear industry has found it impossible to produce a credible disposal programme. The Nuclear Review presents the opportunity to fundamentally rethink

the infrastructure, implementation and institutional framework of nuclear power in order to ensure that in the future the requirements of waste management policy are met. The Radioactive Waste Consultation Document, with all its failings and contradictions, put forward by the Department of the Environment (DoE) does begin to meet this challenge, but fails to address the profound policy implications of the abject failure of disposal policy.

To meet the requirements of radioactive waste management policy the role of the nuclear industry must be re-evaluated. Most observers, including the nuclear industry, now accept that government funding for construction of further nuclear power stations will not be forthcoming. Nuclear power is uneconomic and the nuclear industry has no role to play in the generation of competitively priced electricity. The UK was the first country to establish a nuclear power programme and therefore it will be the first to develop an industrial-scale programme of decommissioning and waste management. This is where the future of the nuclear industry must lie, to ensure that the formidable radioactive legacy it has created is managed in an environmentally responsible manner. The industry's commercial future lies in waste management and not in waste creation.

This requires that the irrational policies currently governing waste production and waste management are abandoned and a pioneering policy, based on the principals of sustainable development, is established. Nuclear power and reprocessing have no role in such a policy and must be abandoned. Equally, the implications of unavoidably burdening future generations with a legacy of nuclear wastes must be addressed within any waste management strategy.

Failure of disposal policy

The DoE consultation document has reiterated the government's commitment to a waste management policy based on the ultimate disposal of radioactive waste and has endorsed the continuation of Nirex's geological investigation work at Sellafield.

However, critically, this support is qualified by the recognition that early disposal is not achievable. Furthermore the government has specifically questioned whether disposal is the best means of meeting the requirements of sustainable development. The government must recognise that there is only one answer to this question. It has argued that our responsibilities to future generations are "best discharged" by early disposal of radioactive waste, ensuring that no action will be required by future generations to manage the radioactive wastes our society has created. However, the superficial attractions of disposal are undermined by the nuclear industry's failure to generate a safety case. Disposal is irreversible and can only be compatible with sustainable development if safety can be guaranteed before any waste is disposed of. Given the current state of scientific understanding, this is not possible.

To guarantee the safety of a repository the release of radioactivity from it and the behaviour of the radionuclides in the environment must be quantified over hundreds of thousands of years. This requires a comprehensive understanding of the processes and mechanisms that will act on the radionuclides over time-scales that transcend human experience. This is a task of phenomenal proportions.

Nirex research reports have commented on the "paucity of data" and the "major deficiencies" in the data available to use in the risk equations; some data has even been described as "virtually non-existent". The radiological risk presented by contaminated groundwater presents particular problems. Groundwater will enter a repository, dissolve radioactivity and carry it back to the surface. Fractures in the surrounding rock will provide express routes for the transport of contaminated groundwater. However, fracture flow is not understood. Moreover, the impact of repository excavation on water flow is not understood, and the role of the repository entry shaft as an express route for radionuclide return has not been quantified.

Until such fundamental uncertainties have been resolved it will be impossible

to produce a convincing safety case for nuclear waste disposal. It is therefore critical that the proposed excavation of the Rock Characterisation Facility (RCF) proposed by Nirex at Sellafield is subject to a rigorous public inquiry. RCF excavation would destroy the very hydrogeology it is intended to measure. The Secretary of State for the Environment has excluded consideration of site specific issues from the current consultation. Friends of the Earth considers it essential that Nirex's RCF planning application is called in for a public inquiry.

Moreover, no large-scale site-specific investment at Sellafield should be implemented until the industry is able to give a commitment to long-term safety as such investment would inevitably prejudice the industry to full-scale repository development at the site.

Time to face realities

The government must face up to the scientific reality that development of a robust safety case for nuclear waste disposal is not currently possible and is extremely unlikely to be achieved within the time-scales currently being considered for development of a repository. Despite the apparent attraction of a policy that removes all responsibility for radioactive waste management from future generations, it is not currently possible to achieve this. Disposal is not scientifically credible and if implemented now could not be relied upon to ensure public safety. Disposal, therefore, cannot be consistent with the requirements of sustainable development.

As disposal is not within our current technical and scientific capability, it is therefore not possible for this generation to discharge its responsibilities to future generations. This must be acknowledged and policies must be developed and implemented which will minimise the unavoidable burden that will be passed on. These policies must be developed within a framework of sustainable development. This demands the adoption of a flexible policy that is not dependent on safety guarantees which are impossible to meet; a commitment to a robust and credible long term research programme, and adequate funding.

Need for flexibility

It is imperative that flexibility is incorporated into any strategy adopted. This demands that the wastes must be retrievable. In November 1987, Nirex launched a consultation document, *The way forward*; the responses highlighted

the public demand that the waste should be retrievable. The Radioactive Waste Management Advisory Committee commented that: "Safety [was] judged to be the paramount factor by respondents" and monitoring and recoverability were perceived to be "a key aspect of safety assurance". Despite this, retrievability is not a requirement of current waste management policy.

Under the constraints of current technology, flexibility may only be achieved through the adoption of above ground retrievable storage. However, it is important to stress that Friends of the Earth does not propose the adoption of indefinite storage. By indefinite storage, we mean that this generation cannot take a decision to store wastes on the surface indefinitely and do nothing more. Such action removes the ability of future generations to take their own decisions and actions. However, adoption of interim storage cannot and must not be avoided.

A prerequisite for public acceptance of interim storage, and the issues that it raises, is government acknowledgement that there will be no more nuclear power stations. Society may have to pass on the radioactive waste legacy that has been created over the past fifty years, but it must not add to it.

Further, for interim storage to be compatible with the requirements of sustainable development, it is essential that it is developed in parallel with continued and rigorous long-term research and resources, ie financial provision. This means that the next generation will be able to decide whether the knowledge base has increased sufficiently for a more permanent solution to be adopted or whether storage should continue. Resource provision means that segregated waste funds must be established so that the next generation has the financial resources to take and fund the waste management decisions it decides are appropriate.

Compromising public safety

Although the government has begun to grapple with the implications of the fact that disposal is unachievable, it has yet to explicitly state that a policy of interim storage should be adopted. Friends of the Earth also has significant concerns that the DoE has proposed typical short-term measures to side-step the failure of Nirex to develop a disposal site. Rather than meeting the challenge of sustainable development, the DoE has proposed that the safety criteria which underpin current policy should be weakened and diluted. This is unacceptable.

It is proposed that greater volumes of waste should be sent to local landfill sites, that short-lived intermediate-level waste should be sent to the low-level waste site at Drigg, and that the reliance on the achievement of specific safety targets for a repository should be abandoned. Dilution of the regulatory framework in such a way is unacceptable and must be vigorously opposed.

Safety target

In 1984, the DoE set the safety target for a repository which required that the target risk to an individual of contracting fatal cancer should be less than one chance in a million per year. Nirex has been unable to demonstrate that it could meet this target. However, rather than acknowledge that the scientific uncertainties rule out disposal for the foreseeable future, the DoE instead proposes that the one in a million target should be weakened so that qualitative rather than quantitative criteria are used to determine whether a disposal facility should be developed.

This proposal directly contradicts government statements that disposal will remove the need for future generations to intervene. If the risks arising from disposal cannot be quantified there is no scientific basis for the belief that disposal discharges our responsibility to future generations. Qualitative judgements must not be the determinant of the acceptability of a proposed operation. If the risk cannot be quantified, then disposal cannot be acceptable. The DoE must recognise that its one in a million target is a rigorous standard which must be adhered to. Public acceptability requires rigorous safety standards and any weakening is unacceptable.

Conclusion

Sustainable development and radioactive waste disposal are not compatible. Furthermore, disposal is not technically achievable. The only feasible option for radioactive waste management is for the government to adopt interim storage. This has been recognised by the DoE and is now under consideration. It is important that the additional short-termist proposals to overcome the problems created by the failure of the disposal programme — the proposed weakening and dilution of the safety target and the adoption of unacceptable short-term fixes — are rejected. Only then will this society begin to grapple with the legacy of fifty years of a failed experiment in nuclear power. □

A fully referenced version of this document is available from SCRAM for £1 (inc p&p).

Energy efficiency offers something-for-nothing in tackling the environmental problems of energy use. But while reducing energy demand within buildings has received much attention, JOHN BRENNAN, of Gaia Architects Scotland, argues that we also need to look at the total amount of energy used in producing the structures themselves.

Embodied energy in buildings

HALF of the United Kingdom's energy consumption is from buildings and it has been clear for decades that reducing this demand is beneficial. One statistic commonly used is that if every household in the UK replaced an ordinary light bulb with a low-energy one the saving would be the equivalent of the output from an average sized coal fired power station: the notion of reducing anti-social forms of power generation by a collection of light bulbs is certainly seductive.

In the history of energy conservation, the first generation of buildings focused on insulation and subsequently the notion of super-insulation. Designers tried to catch heat from the building's occupants, their activities and from the sun then retain it for as long as possible. In climates such as the New Mexico Desert this system had its attractions; in European climes, the indecision of our weather has tended to neuter this technology.

Second generation construction addressed heat loss from air leakage through the building fabric, typically amounting to between one third and one half of the total wastage through a building. The perceived solution was to insulate highly and seal the structure, utilising mechanical air handling systems and heat exchangers. Whilst on paper this seemed reasonable, in practice applying strict tolerances of air tightness to current construction standards was not and is not easily achievable.

Technological approach

First and second generation building became increasingly orientated towards an overtly technological solution. Questions should have been asked of whether it was appropriate or defensible that buildings in the UK required to be mechanically ventilated. There was a vast expenditure of resources both intellectual and economic in the single-minded desire to reduce the energy consumption of buildings in use, which revolved around the consumption of power primarily for heating and lighting. The effect on health of living in what was effectively a sealed box was also questionable, mechanical filtering and

ventilation often retaining many pollutants, gave rise to small-scale outbreaks of what is commonly called sick building syndrome. An additional drawback was the all too common brutal appearance of these structures both inside and out, and their overbearing influence on the lifestyle of the user precluded widespread acceptance.

Third Generation Building endeavours to take an integrated approach to energy conservation and to its environmental impact. A quality we all look for in a structure is its longevity and durability; "built to last" being a cliché that crops up time after time. Many building materials are of an age that dwarfs even our oldest ruins. Stone resides in a natural state for hundreds for millions of years then in a brief snapshot of its life span is used as part of a building and eventually returns to the natural environment, albeit often in a different form. Even a living material such as construction timber is normally

"A typical industrial building consumes more energy in the materials it is composed of and its construction than energy consumed during its useful life."

grown for sixty years, the design life of most modern structures.

Every building material is either harvested or, if non-renewable, extracted. Trees are harvested, iron ore for steel is extracted, as is clay for bricks. It is then transported and refined, timber is sawn and seasoned, iron ore is smelted and rolled. Often materials are once more transported and at another location transformed through manufacturing, sometimes repeatedly. Finally, there appears, not by magic but more often after a set of energy intensive industrial processes, the final component, be it a steel beam, a timber floorboard or an aluminium door handle. These elements then go together to form a building; each one of these steps involves contributing to the finished object varying levels of

embodied energy. At the end of a building's life, the structure is dissembled with varying degrees of violence. Material is transported off site; components are reused in other buildings or recycled into different forms. If neither of these options is possible, the material or component is dumped, preferably to biodegrade or at worst remain as waste.

Every material we use to build with contains embodied energy. If we were to extract raw material from a building site manually, for instance earth and whatever vegetation was to hand, and somehow assemble it into a dwelling, eventually, once completed, we would have a true zero energy building, where no resources had been expended on its construction. This mode of construction is how we built originally, yet its chances of widespread acceptance in Northern Europe is limited.

A typical industrial building consumes more energy in the materials it is composed of and its construction than energy consumed during its useful life. Even if it were designed to incorporate high levels of insulation, passive solar collection, photovoltaic cells and the whole gamut of energy conscious measures, when judged on its total energy consumption, including embodied energy, it can never pretend to be a low-energy building.

At present, methods of reducing energy consumption during a building's life has reached a point where further reductions become more complex, more expensive and in many ways more inappropriate. At the same time, there are vast tracts of unharvested benefits lying in the realm of embodied energy. As strides have been made in reducing energy consumption, so embodied energy becomes a progressively greater proportion of a building's total energy use.

For example, an industrial structure of aluminium sandwich panel construction embodies 10,000kWh/m²; this is equivalent to the energy consumption of a family house over a full year. Why is this the case? Aluminium starts as Bauxite ore, mined in South America and transported across the Atlantic to the UK. Already,

each kilo of aluminium bears an equal share of the fuel oil used by the ship, the electricity used to extract the ore, the energy even to sink the mine. Once in the UK, the bauxite is then smelted. Being rather an awkward metal to separate, this is achieved via electrolysis, passing large currents of electricity through the molten ore to remove the metal. Once smelted into ingots it is again transported and rolled into sheets, transported once more, typically to Europe, rolled, formed, and machined to a cladding panel. Such cladding is now a global export commodity and as such the aforesaid panel is duly dispatched to South East Asia, where finally it is installed on a building. At each step in this global process, each kilo of aluminium has absorbed an every increasing amount of useful energy.

A kilo of aluminium contains 56kWh of energy. If an equivalent amount of timber were used it would embody 0.1kWh. We expend nearly six hundred times more energy on a piece of aluminium than the equivalent of timber. 56kWh, whether it is heat lost from a badly insulated house or embodied energy in a low energy house made from aluminium, both make poor use of energy.

Cyclical approach

Third Generation energy-conscious building is cyclical. It is an approach which realises the impact of extracting materials and transforming them into building components as well as their fate following the demolition of a building.

A linear building is the opposite of a cyclic house, it takes materials and produces waste. A good example of is the inexplicable rise of the uPVC window, a component that is energy intensive and toxic in its manufacture, uses non-renewable hydrocarbons, is difficult to re use, expensive to recycle and non-biodegradable. The fact that it is energy efficient in use tends to pale into insignificance when looked at in a more holistic sense. A linear building

consumes water and produces sewage, a linear house consumes fuel and exhausts it through heat loss.

The cyclic building endeavours to take entire responsibility for its existence, trying as much as possible to minimise waste, energy consumption and toxicity, to return materials and the elements it has consumed back to the environment without compromising it. It is in this framework that embodied energy should be considered.

How can we reduce our consumption of embodied energy?

The process of building a house can consume up to 500,000kWh, thus even the process of building a house or an extension involves decisions on resources as well as money. Given the sheer number and scale of projects, architects and builders are among the greatest consumers of embodied energy in this country — half the battle is realising that this is the case.

It is important to recognise the negative impact of energy intensive materials. All metals involve many processes to finish up with even a simple nail. Extraction, smelting and fabrication all involve vast amounts of energy. Often the use of metals within a building can be easily substituted by another material. The use of plastics is becoming more widespread in building, often as a 'durable' substitute for timber. Plastics require large amounts of energy to transform them from hydrocarbons and like other energy intensive materials tend to be environmentally unfriendly in other areas. The production of plastics is a high polluting process, they are often toxic in use and unsafe in fire. And the so-called durability of plastics makes it extremely difficult to dispose of them.

The energy used in transportation is also important. This can be on a local level; sand from a sand pit, timber from a saw mill; both with a relatively low transportation impact, but the trend is for materials to be transported more on a regional and national level as

production is concentrated in two or three industrial centres. A good example is the increasing use of plasterboards rather than plaster as internal surfaces to housing. Traditional plaster finishes employed material in powder form which was transformed and then applied on site. Plasterboard uses the same basic components but is fabricated into a sheet material by three companies in the whole of the UK and then distributed by road and rail nationally, each sheet progressively acquiring extra embodied energy. It is no coincidence that thermoplastics and metal products, whilst having high energy embodied in extraction and transformation, also incur high transportation penalties.

It is important to say that this should not be received as an index of proscribed substances, what is more important is to be more informed about the decisions we make about how we build.

Sustainable resource

Economically, the importance of extracting materials and fabricating locally is a potent way, for instance, of regenerating rural economies. Timber is a material of low embodied energy in its extraction and transformation into building components. When farmed properly it is a sustainable resource and when felled locally minimises transport costs. In Scotland most building timber is sourced from either northern Europe or Canada. There is a rich resource on our doorstep, but methods of local supply and fabrication into components useful for building are still in their infancy.

When used within a building, timber is a highly insulating material, is durable, can be built without the need for specialised machinery and can be re-used or left to biodegrade quite happily. There is great potential, none of which forces any change in our lifestyle, and even in conventional economic terms is of positive benefit. The major question posed in this scenario is not whether it is feasible but rather why it is not accepted wisdom.

Embodied energy and reducing energy consumption is only one link in the environmental chain. Buildings also need to address questions of material toxicity, waste, and re-use. These are all integral concerns. The selection of building materials and the method of architectural design must be addressed if a structure is to be truly energy conscious. It seems ironic that so many environmental buildings try so hard to squeeze the last pips of heat loss from the structure while so much more can be achieved so much more elegantly and so painlessly addressing sensibly the issue of embodied energy. □

Energy intensiveness of a building material will act as a rough guide to its 'greenness':

kWh/m²

Domestic buildings	1,000
Office buildings	5,000
Industrial buildings	10,000

Annual energy consumption of different building types:

kWh/m²
less than

Office, warehouse, school, shop	195
Factory	222
Hotel	361

Plans by the National Radiological Protection Board to tighten the dose limit for members of the public have been rejected by the government following nuclear industry pressure. The new limit could have led to nuclear plant closures, reports IAN FAIRLIE, who is engaged in PhD studies in nuclear waste matters at Imperial College, London.

RADIATION DOSE LIMITS

Government forces NRPB to back down

LAST year, moves by the National Radiological Protection Board (NRPB) to tighten the public limit for exposure to radiation ran into strong opposition from the nuclear industry and the Nuclear Installations Inspectorate (NII).

In 1985 the International Commission on Radiation Protection (ICRP) and the NRPB recommended a public limit for radiation exposures from all sources of 1mSv per year.⁽¹⁾ This was formally accepted by the Government in 1986,⁽²⁾ and has been the de facto public limit used by the nuclear industry since then. In 1991, the NRPB, following a fivefold increase in risk estimates from radiation, proposed a dose constraint of 0.3mSv per year for members of the public exposed to radiation.⁽³⁾ A constraint — a new concept introduced by ICRP 60 in 1990 at the urging of senior members of the NRPB — is different from a limit. It would be an upper limit for ALARA (As Low As Reasonably Achievable) practices, and would remove the main deficiency of ALARA: its subjective nature. The new constraints would apply to all radiation sources, ie existing and new ones.

Although breach of a constraint would not be a criminal offence, constraints would be much quicker to implement and amend. In practice, they would result in the NRPB using its persuasive authority to secure reductions in radiation exposures, rather than the Health and Safety Executive's NII using its legal powers. With the NII's slothful past record in regulating the nuclear industry, this would probably be a worthwhile step, especially as the proposed new constraint, 0.3mSv per year, was tighter than 1mSv per year.

However, from the nuclear industry's responses⁽⁴⁾ and the NRPB's final recommendations⁽⁵⁾ the government and the nuclear industry were not happy with the NRPB's 1991 proposals. After two years of behind the scenes arm twisting, they forced the NRPB, in late 1993, to recommend yet again the old 1mSv limit, which the government had already accepted back in 1986. They also forced the NRPB to restrict

its proposed new constraint to "new sources", not existing nuclear plants. This must have represented quite a climb-down for the NRPB. But the board didn't back down silently: it added a rider to its recommendations in uncoded language in which it stood by its convictions:

"The Board believes that, in general, it should be possible for existing plant to be operated so that the dose to individual members of the public does not exceed 0.3mSv per year. However, it recognises that in some cases a realistic assessment of doses may suggest that the facility cannot be operated within this figure. In these cases, the operator must demonstrate

limits as low as 0.2mSv, which Sellafield can't meet.

The DoE is soliciting comments on the statement: "The government considers that the concept of a constraint is a useful complement to the principle of optimisation in the design of new installations particularly in cases where members of the public could be exposed to radiation due to discharges from several installations located in close proximity. It also agrees that a distinction should be drawn between new and existing installations. The government is minded to accept the NRPB's advice that the dose constraint should not exceed 0.3mSv/y for members of the public and that this figure should be applied in the design of new nuclear installations. But it should be seen to complement rather than replace the primary dose limit of 1mSv/y (for members of the public from all non-medical man-made sources of radiation), and the dose target of 0.5mSv/y (in respect of the limits set in discharge authorisations for

a single site at which existing and/or multiple installation are located). Views are invited on this system of limits targets and constraints." □



that the doses resulting from the continued operation of the plant are as low as reasonably achievable and within the range of tolerable risk."⁽⁶⁾

It is well known within the nuclear industry that Sellafield cannot be operated within the NRPB's proposed constraints, so the constraints had to be scaled down; the new limits have been decided by political rather than radiological and health considerations.

Nuclear review

This matter merits further investigation, especially given the government's on-going nuclear review and in particular its review of radioactive waste management policy. The Department of the Environment's (DoE) consultation document on radioactive waste management repeats the NRPB's rider but significantly changes the last six words from "within the range of tolerable risk" to "within dose limits".

The reason for this change is that the tolerable risk range results in dose

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While the civil servants in Palace Street trawl through the nuclear industry's wish list for privatisation, the Consortium of Opposing Local Authorities has submitted its evidence to the Department of Trade and Industry. It systematically destroys the industry's economic case and rubbishes any claim that nuclear power offers security of supply or diversity benefits. MIKE TOWNSLEY reports that any restructuring of the free market to support a privatised nuclear industry would amount to no more than rearranging the deck-chairs on the Titanic.

NUCLEAR REVIEW

Rearranging the deck-chairs

ONE thing on which all sides in the debate over the nuclear industry's future agree is that nuclear power could not withstand the ravages of the free market. It will have to be supported in one way or another. As the Chair of Scottish Nuclear, James Hann, recently observed: "Government cannot afford to fund new nuclear power stations, and the private capital markets, left entirely to their own devices are unlikely to fund nuclear developments."

"They are attracted by the lower capital costs of combined cycle gas stations and the resultant earlier pay-back."

"So a real clash exists and without any intervention by Government, in one form or another, the prospects for our born-again nuclear industry are still uncertain."

It is therefore vital that, during the nuclear review, the reality of nuclear economics is finally revealed. According to Nuclear Electric's (NE) submission any privatisation structure must "... provide sustainable value for money for the taxpayer and achieve a balance of risk exposure which is acceptable to both the privatised company and the Government."

Evidence from the Consortium of Opposing Local Authorities (Cola) establishes that under none of the review criteria does nuclear power represent value for money.

Value for money

Cola was originally formed in 1987 to represent the interests of local authorities on both sides of the Severn Estuary which were opposed to the planned pressurised water reactor at Hinkley Point, Somerset. It produced a strong and wide-ranging case for the Hinkley Inquiry and views the production of its evidence for the nuclear review as the "culmination of a sustained and critical appraisal of the nuclear debate."

Its evidence covers five of the central issues on which the government is soliciting views:

- the economic and commercial viability of new nuclear power stations in the UK;
- whether nuclear power offers diversity, security of supply and environmental benefits or disadvantages;
- arrangements for government support, including the use of the fossil fuel levy;
- the management of reprocessing, waste and decommissioning liabilities; and
- the feasibility of privatisation.

In announcing the review process, the government stated quite clearly that its policy aims could be most fully achieved through the mechanisms of the market. Adding, the Fossil Fuel Levy (FFL) and the Non Fossil Fuel Obligation (NFFO) are transitional arrangements to allow NE to achieve competitiveness and that new stations are only viable if they can achieve a commercial rate of return without the transitional arrangements. And, even if intervention in the market is deemed necessary for strong environmental, social or economic reasons, the government should tread softly and interfere gently only as a last resort.

New nukes

Yet, reports Cola, even after initial boasts of a bright subsidy-free future, NE now admits that a new nuclear station could only be built in the private sector with considerable government intervention. It would require that many of the central market mechanisms be suspended and abused. The industry's wish list includes:

- substantial government finance to boost capital returns to a level demanded by the capital markets;
- a guaranteed market for electricity sales, possibly through the introduction of a new NFFO; and
- government underwriting regulatory risk relating to pressurised water reactor construction and operating performance.

Damned by its own evidence, argues Cola, "in admitting that a commercial rate of return cannot be provided by a new plant without government support. NE has already failed a crucial government requirement." It could therefore be "argued on these grounds alone" that new plant should not be sanctioned, concludes the consortium.

If, however, the government decides to "waive" its earlier incantation of market philosophy it must "give careful consideration to" the following questions:

- Has NE presented an accurate assessment of the magnitude of government support that would be required, particularly relating to the scale of direct financial support and the underwriting of risks?
- Are the reasons for government support suggested by NE sufficiently strong to justify the actual scale of support required?

The answer to both, as demonstrated by Cola's evidence, is no.

Cola singles out reactor performance, capital cost and the required rate of return as the key indices of the commercial and economic viability of new plant.

NE takes load factor, or availability, as a central indicator of reactor performance, and claims a new PWR could achieve a load factor of 85%, a considerable increase on its earlier estimates. However, argues Cola, NE's own evidence on international PWR experience shows that 75% would be a more realistic load factor to use. An independent examination of overseas experience with PWRs suggests a figure of 70%. The consortium, however, opts to use the optimistic figure of 75% with the rider that "the evidence suggests that this is a generous assumption: a risk-averse private investor might therefore choose to adopt a central-case load factor of 70%."

Further, NE estimates that the capital cost of Sizewell C would be £3,520m, Cola rejects this as "neither reasonable nor prudent." Such a figure is derived

on the basis that savings of between 35% and 41% can be made on the cost of Sizewell B, despite a "world-wide history of increasing capital costs over time ... and, until quite recently, NE did not expect so spectacular a reduction in capital costs."

Reworking NE's "two methods of estimating capital costs using more realistic numbers produces a range of £4000m to £4600m," according to Cola, adding, "it must be remembered that a capital cost of £4000m is a low estimate which would be an exceptional achievement." In addition, warns Cola, "... a capital cost of £4600m is far from a maximum estimate: there are a range of factors which could produce significantly higher costs."

Any investment in generating capacity should be evaluated along private sector lines, says Cola. It calculates that the private sector would require a pre-tax rate of return of 13% and not 11% as suggested by NE's advisers, Price Waterhouse.

Using Cola's investment appraisal central assumptions — a 13% discount rate, a 75% load factor and a capital cost of between £4000m and £4600 — the total levelised lifetime cost of generation from Sizewell C would be between 5.6p/kWh and 6.3p/kWh, as compared to about 2.9p/kWh from a new combined cycle gas turbine station.

In its evidence, NE calculates that a new nuclear station at Sizewell would require a total subsidy of £1600m, while Cola put the figure at between £3600m and £4500m. Therefore, concludes Cola, "NE has not presented an accurate assessment of the level of required total subsidy." Clearly new nuclear power stations "are not economically viable in the UK."

Environment and diversity

NE's statement that continued government support is justified on environmental and strategic grounds must be measured against the scale of the support required and the cost of alternative approaches. In view of the scale of the necessary support, according to Cola, "these reasons would have to be very powerful indeed."

In assessing the best way to achieve optimum diversity in the electricity supply industry, Cola found that out of 81 supply "option performance and diversity value scenarios" 74 lead to renewable sources of energy taking a larger "share of the optimal UK electricity supply mix than nuclear power." And, even in the remaining seven scenarios (the most favourable for nuclear power) a "significant tranche of

renewables remains competitive with nuclear power. This, and the current very low capacity of renewables, means that government support would still be more effective directed at these technologies.

"No reasonable rationale therefore exists for directing support at nuclear power for the purposes of maintaining or enhancing diversity."

If NE's claim that new nuclear construction is "essential" to meeting future environmental targets were valid, comment Cola, then it would "provide an overriding reason for maintaining nuclear's current contribution to the electricity supply mix, regardless of diversity optimisation arguments." However, the consortium reports that research commissioned by the Nuclear Free Local Authorities from Cambridge Econometrics (CE), illustrates how a "packages of measures consistent with current government policy could achieve significant reductions in CO₂ [carbon dioxide] emissions by the year 2020, without new nuclear power stations."

Carbon cuts

The Rio Convention commits the government to stabilising UK CO₂ emissions at 1990 levels (160mt of carbon per year) by 2000. The government's Energy Paper 59, produced in 1992, translates this into a reduction target of 10mtc.

CE produced two scenarios — Business as Usual (BaU) and a Target Scenario. The BaU scenario not only undermines NE's claim that the current nuclear market share of 25% must be maintained to meet the Rio commitments but also undermines Energy Paper 59.

Apart from no new nuclear plant beyond Sizewell B, it assumes that the government will achieve its target of 1,500MW of new renewables capacity by 2000, rising to 2,000MW by 2020, and that the rate of petrol duty continues to increase by 5% in real terms each year. It also assumes that no further measures to promote energy efficiency, beyond those already planned, are introduced. CE calculates that under BaU CO₂ levels will decline until 2000, followed by a period of stability until 2015 and then a slight rise to 156mtc in 2020.

The main reasons for the big difference between the BaU calculations and those of the government, says CE, lie in the fact that more up to date data was employed and that the government failed to take into account the early 1990's recession. "Both of these factors

result in Energy Paper 59 showing emissions already 10mtc higher in 1995 than BaU."

CE's 'Target Scenario' assumes additional support for energy efficiency measures and renewable energy sources with increased taxation of road fuels, which is consistent with the government's current strategy for reducing carbon emissions. Under this scenario carbon emissions in 2020 drop to just over 130mtc. Of this 25mtc, or so, saving over the BaU scenario, 11.6mtc are contributed by energy efficiency measures, 5.2mtc from additional renewables and 8.6mtc from raised petrol duty.

CE comments further that there are a number of reasons why the projected reductions in carbon emissions "might be an under-estimate." Neither "the BaU nor the Target Scenario embody the potential savings that might follow from increased combined heat and power capacity. This might bring about an extra 14mtc saving by 2020." Further energy efficiency measures, such as regulatory measures and information campaigns, are "not explicitly modelled either" and could provide an additional 35mtc saving.

The assumptions regarding expanded energy efficiency and renewables programmes are modest, says CE, and are all cost effective in the narrow sense of providing savings to the investor: "Taking a broader view of cost-effectiveness, the investments are expected to give rise to other benefits, such as lower emissions of other pollutants, and reduced risks associated with security of future energy supplies."

Returning to the Cola-commissioned evidence, there are a range of difficulties involved when comparing the environmental and strategic benefits of different power sources: "If evidence on such factors is partial, incomplete or simply not available, then the quality of the overall assessment will be impaired. Furthermore, the relative weight to be assigned to what are often highly disparate factors must ultimately remain a matter of political judgement."

Such difficulties are evident in the assessment of the Hinkley Point Public Inquiry Inspector, who, argues Cola, "placed far too much weight on the alleged benefits of the proposed PWR, and insufficient weight on the potential costs of nuclear accidents."

It is suggested that "the societal risk from a new nuclear reactor should now be judged intolerable on the grounds that the industry's own estimate of the probability of a major accident exceeds



that which should be considered the maximum tolerable level."

In considering possible environmental and security justifications for government support and market intervention, Cola concludes: "It seems indisputable that new nuclear plant would not provide sufficiently strong net environmental and strategic benefits to justify the actual scale of support required."

Privatisation

The review process also gives scope for comments on whether privatisation of the nuclear industry, with or without a commitment to new nuclear plant, represents value for money to the taxpayer. Such a question demands that a thorough evaluation be made of the use of the Fossil Fuel Levy, the scale and timing of liabilities and future financial viability.

While the FFL has been used to discharge some inherited liabilities by NE, it has also been used to fund investment in plant, including the construction of Sizewell B. About £1,630m of FFL money was used as an interest free source of cash by NE for Sizewell B. This, argues Cola, "exposed the levy funds to unnecessary risk. The FFL should not be used to subsidise further nuclear construction." The public sector would need to be compensated "for the loss of any levy receipts invested in privatised assets. If Sizewell B and the AGRs are sold, a sum of around £1800m (plus interest) should be repaid by the new company to government."

Claims made by NE that they could be profitable before the Levy by 1995/96 are rejected by Cola as "highly

unlikely." Without taking account of financial charges, profitability is likely to be first achieved in 1998/99. However, if financing of liabilities is taken into account, NE does not become profitable until 2002/03, "and then only just."

NE is unlikely to be able to meet its liabilities over the next ten years unless it is allowed to use money from the National Loans Fund (built up by the FFL). Without such access NE would show small losses in each year from 1998/99 to 2005/06 as the burden of meeting liabilities increases.

If an attempt to fund Sizewell C is made using internal funds along with meeting liabilities, NE's projected cash surplus of £3,800m becomes a deficit of over £750m by 2005.

Further, Cola reports that: "There are a range of highly plausible circumstances in which NE would fail to establish an overall positive balance of assets over liabilities before the commissioning date of any new PWR."

Further clarification is required of the extent and timing of liabilities which would be left in the public sector following privatisation. NE's proposals "entail leaving over £9000m of discounted Magnox liabilities in the public sector."

The way forward

"It is important to progress the review in a way which enables a rigorous, systematic and open appraisal of the key issues to be undertaken," argues Cola.

Cola has identified a number of steps for adoption as part of the review

process, without which public confidence in the outcome of the review is likely to be low.

First, the publication of information to assist the independent appraisal of NE's financial position. In particular Cola wants NE to publish operational data by individual reactor and it wants further information on the fuel services contract with British Nuclear Fuels.

Second, the publication in full of the government's analysis of environmental and strategic factors.

Third, the publication of a green paper setting out the government's assessment of the evidence and the resultant policy options. This, argues Cola, would allow essential commentary and public debate prior to the publication of a white paper.

Let the market decide

Cola's evidence makes clear that the government should not provide support for new nuclear plant and recalls the government's position as stated in the white paper *The prospects for coal*:

"Change is inevitable in a modern industrial economy. Companies and industries rise, flourish and decline; and others take their place. Mining and its associated activities cannot be exempt from this process, which has been seen many times and in many places."

Cola concludes: "If the Government is prepared to adopt this position on the coal mining industry, it should be consistent and apply the same logic to nuclear power." □

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Irish and Scottish links

A "complete cessation of military operations" announced by the IRA has, amongst much else, raised the prospect of the electricity interconnector between Northern Ireland and the Republic being reopened.

The interconnector was blown up by the IRA in 1976, and work would be needed on both sides of the border to reopen the link. This could, though, be carried out in a matter of months, the cost is put at IR£500,000 for the Irish Electricity Supply Board (ESB) and close to £1m for Northern Ireland Electricity.

There are also plans for a sub-sea link between Scotland and Northern Ireland.

Opposition to this, in both Scotland and Northern Ireland, is based on the pylons which will be erected to connect the sub-sea cable to the grids, and a public inquiry on this started on October 4 in Scotland and a similar inquiry in N Ireland is expected to begin next January. The project depends on receiving funding from the European Union, but any decision on that will hinge on the outcome of the inquiries.

Scottish Power, which has a massive overcapacity of generating plant, sees the possible reopening of the Irish link as further expanding its export opportunities.

Plans for a sub-sea link between the Republic and the British mainland have already been cancelled by ESB. □

Grid connection problems

PROBLEMS faced by renewables projects over connection to the grid were raised by the House of Commons Welsh Affairs Committee in its recent report on wind power ("Welsh wind report", *Safe Energy 101*).

The committee recommended that electricity regulator Prof Stephen Littlechild "conduct an investigation into the procedures of the Recs [regional electricity companies] in dealing with applications from renewable energy technologies and into their dual roles as developers of wind farms (and other renewable projects) and controllers of the grid network."

The present arrangement causes three main concerns for independent generators. First, the possibility of excessive connection charges. Second, that the utilities, which are often rival

bidders for places in the NFFO (or Scottish Renewables Obligation), could gain an unfair advantage through knowledge of competitors' plans. Third, that utilities, with much greater knowledge of grid strengths and weaknesses are in a much better position to choose suitable sites for renewables schemes.

The first of these problems, connection charges, has already been addressed by Littlechild. It is intended that from April next year in England and Wales the Recs' monopoly will be brought to an end. Littlechild hopes that allowing other companies to compete to connect new customers and upgrade existing connections will reduce charges.

David Porter of the Association of Independent Electricity Producers has welcomed the move: "Our members are fed up with being quoted high connection charges... some charges have been so high as to destroy the prospects of some schemes going ahead." □

Hydro saving energy

BRITAIN'S most northerly electricity utility, Scottish Hydro-Electric (HE), is keen to break out of its North of Scotland base to other parts of the UK, and diversify into other energy fields.

It has set up a contract energy management (CEM) operation which plans to have eight offices around the UK selling energy on a contract basis. "I'm not selling electricity; I'm selling energy," says Ken Stott who is heading the venture. Where customers need gas, it is likely to be supplied by Vector Gas — a joint venture established last year between HE and Marathon which already has 2,000 customers throughout the UK.

According to David Sigsworth, HE's head of energy trading, energy efficiency is "the driving force behind business propositions put to customers." HE hopes to become the second largest CEM business — behind AHS Emstar — within five years.

HE is also expanding into combined heat and power (CHP) and is already a major player with over 15% of the UK market. Its first scheme, of 9MWe, at Arjo Wiggins Appleton paper manufacturers in Dover is fully operational. A second plant, of 157MW, at Sellafield is a joint venture with BNFL and will be operational shortly.

Its latest scheme, announced in September, is a 47MW plant to supply electricity and steam to Salt Union in Runcorn, Cheshire, which manufactures evaporated salt from brine. HE hopes to be able to begin further CHP developments in the coming months.

Pylon policy

THE (English and Welsh) Country-side Commission has issued a position paper calling for measures to reduce the impact of overhead power lines. It argues for "coherent, targeted programmes of undergrounding overhead lines, with route realignment, screening and other measures where these are more appropriate."


As part of this policy, the commission believes that "major development, including major electricity installations, should not be located in National Parks, The Broads, the New Forest, AONBs or Heritage Coasts unless there is an over-riding national need and there is no other feasible location." □

Large users' plans

LARGE energy users have been thwarted in their campaign to cut electricity costs by trading outside the electricity Pool. The plan has been rejected by the electricity regulator, Prof Stephen Littlechild, who favours reforms to the Pool as a way of cutting costs.

Ian Blakey, chairman of the Energy Intensive Users' Group, says "We will keep pressing our case."

Another avenue being examined by a consortium of large electricity users is the purchase of generating plant being disposed of by National Power and PowerGen. Companies including ICI, BOC and Blue Circle, are holding talks with the generating companies to try to agree a price for the plant. □



HYDRO-ELECTRIC

■ HE has become the first retailer in Britain to use the European Union's (EU) energy rating label for fridges and freezers in its 52 shops. The labelling, part of the EU SAVE programme, gives clear information about the energy performance of domestic goods.

The scheme will become mandatory throughout the EU from 1 January 1995. It is intended to expand the labelling to other goods, including washing machines, dishwashers and tumble dryers in the future. □

CFL boost

LAST year's successful promotion of compact fluorescent lamps (CFL) in England and Wales — which increased sales five-fold — is to be repeated this October and November.

The Energy Saving Trust (EST), in conjunction with CFL manufacturers, the Lighting Industry Federation and retailers, will cut the price of CFLs by over one third for two months. EST funding for the scheme comes from the regional electricity companies in England and Wales; Scotland and Northern Ireland will not be included in the promotion.

Sales of 740,000 during 1993's two-month scheme equalled total sales at those outlets involved for the whole of the preceding year. The EST's target for this year's scheme is one million CFLs.

It is also hoped that customers will buy more CFLs in the future rather than revert to conventional bulbs and that the publicity surrounding the promotion will increase awareness of CFLs generally.

In addition to the cut-price promotion, the EST is providing one free CFL to every household in receipt of the government's Home Energy Efficiency Scheme grant during 1994/95. The two CFL schemes together are expected to save 14,500 tonnes of carbon emissions per year.

Schemes offering reduced-price CFLs have also been tried in both the Netherlands and the Czech Republic. The Dutch scheme was expected to be self-sustaining after a few years of incentive programmes, but they have found a dramatic drop in sales at the end of the promotion. This is due, at least in part, to retailers' hesitance to stock CFLs and other energy-efficient lighting because of their long life cycles.

The Czech scheme has been limited in scope because of a similar regulatory regime to that in the UK which prevents electricity utilities recouping the cost of energy conservation measures through increased electricity rates. □

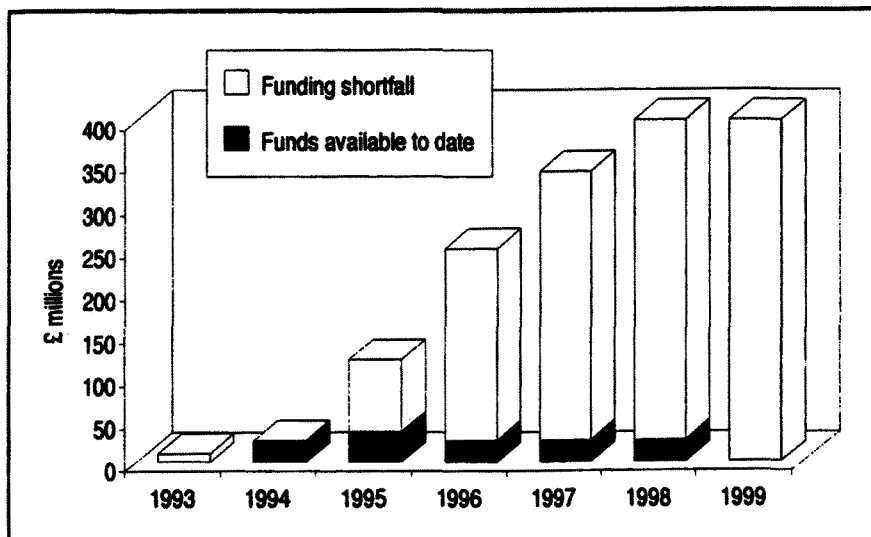
EST cutbacks

FUNDING problems facing the Energy Saving Trust (EST) ("Energy inefficiency", *Safe Energy 101*) have led to a drastic cut in its energy efficiency plans.

The EST is charged with producing annual savings of two and a half million tonnes of carbon by the end of the century.

Both the gas and electricity regulators are refusing to allow utility funding at anything like the level required by the EST to meet its intended spending of £2bn up to the year 2000. Executive director Eoin Lees said that the EST is now "just trying to keep the show on the road".

However, even without much help from the EST, the government may yet meet the carbon emissions target thanks to the stagnant economy and the dash-to-gas. □



Illustrative profile of EST investment levels required

HMIP backs IGCC

ELECTRICITY generators should be adopting Integrated Gasification Combined Cycle (IGCC) technology as the cleanest available method of using coal and oil, according to David Slater, director of HM Inspectorate of Pollution (HMIP).

By turning coal or oil into a gas prior than burning it in a combined cycle gas turbine (CCGT) Sulphur and Nitrogen emissions could be reduced.

Under the Integrated Pollution Control initiative, which came into effect for generators in England and Wales last April, the companies were given 12 months to submit upgrading proposals for all their sites.

While demonstration IGCC plant is being built in the Netherlands and Spain, Slater regrets that there is none in the UK. Making his views clear to National Power and PowerGen he warned that HMIP "will be keeping a close eye on developments to ensure that such alternative technologies are fully considered by the electricity supply industry." □

Greenhouse conference

INTERNATIONAL reductions in carbon dioxide (CO₂) emissions beyond the year 2000 have been called for by the German government, writes Pete Roche.

Its proposed protocol, which would commit industrialised countries to a fixed percentage reduction in CO₂ by a specified date next century, was put forward at the tenth Intergovernmental Negotiating Committee for a Framework Convention on Climate Change (INC10) in Geneva last August.

As the first serious proposal by any developed country for a legally binding reduction in greenhouse gases, it was a small but highly significant step. The Germans wanted the European Union (EU) to aim to adopt a protocol at the first Conference of Parties (COP1) to be held in Berlin next March. Only Denmark, of the other 11 EU countries, supported the Germans.

The EU as a whole restated its

position of stabilising CO₂ emissions at 1990 levels by 2000 while recognising the need for further measures in future.

While the scientific findings presented at INC10 suggest that the problem of global warming remains as urgent as ever, the conference was inconclusive and serious negotiations were put off until COP1 in 1995.

The UK government supported this delay, and suggested a 1997 deadline, at COP3, for adoption of a protocol. It now acknowledges the inadequacies of the current commitments, but is not yet prepared to do more.

■ Japan does not expect to meet its commitment to stabilise CO₂ emissions at 1990 levels by the end of the century.

A report by the country's Environment Agency says that by 2000 emissions will probably surpass 1990 levels by three per cent — around ten million tonnes of CO₂. Even this is considered optimistic by some environmentalists.

The Agency proposes energy efficiency measures and recycling rather than incineration of rubbish to try to meet the target. □

Renewables disorder

AS a result of the absurd structure of the Non Fossil Fuel Obligation (NFFO) and the Scottish Renewables Obligation (SRO), there has been a rush of planning applications for wind farms throughout Britain, many of which have been rejected.

With the vast oversubscription for the limited number of schemes which will be included in this October's NFFO-3 and SRO-1, most of the projects hastily seeking planning permission will never get the go-ahead from the government, even if they get past the planners.

The issuing of a National Planning Policy Guideline (NPPG6) and Planning Advice Note (PAN45) by the Scottish Office in August — updating the draft guidelines — offers some

assistance to Scottish local authority planners but there is still considerable confusion.

The unnecessary concern over the possible number of wind farms caused by the once-a-year allocation is compounded by the bidding system which forces developers to select sites on economic rather than environmental grounds, which can lead to developers pushing planning regulations to their limits.

■ While the UK media often gives the impression of the country being overrun with wind turbines, other countries quietly get on with developing their wind industries.

With almost 100MW of capacity installed in the first six months of this year, Germany now has well over 400MW of wind power, more than double the UK total. □

Community wind

A government-funded study has been set up to look at community involvement in new renewable energy projects. Opposition to renewables schemes, particularly wind power, is often prompted or exacerbated by the feeling of having a project imposed on a community for the benefit of outsiders.

A £50,000 research contract has been awarded by the Department of Trade and Industry's Energy Technology Support Unit to three companies which together have experience of community financing and structures, renewable energy schemes, and planning and the environment.

Ray Mitchell of consultants Rubicon Link, Jeff Bishop of consultants BDOR and solicitor Malcolm Lynch will carry out the study. They will look at the experience of community projects in

Sweden and Denmark to see whether similar structures, types of investment and tax concessions could be applied in the UK.

■ Plans for one of the UK's first community owned wind farms are being proposed by the Environment Trust. The London-based group has applied to build ten 500kW turbines at Fraddam near Hayle, Cornwall.

It is intended that the scheme would be owned by a charitable trust — the Hayle Energy Trust — with a board of directors from the local community.

Income from the wind farm would be used to promote energy efficiency in the area, with the first target being to draughtproof all 3,000 homes in the Hayle district.

There has been some opposition to the proposal, but Jon Aldenton of the Environment Trust says opponents are nearly all incomers to the area and that most of the residents are strongly in favour. □

Industry moves

CARTER Wind Turbines, one of only two UK companies manufacturing large turbines, has won a government contract to develop a new machine.

With less than 20% of the turbines so far erected in the UK being manufactured in this country, government support for domestic industry is clearly needed if the UK is to compete at home, never mind start exporting to the growing international market.

The 50% grant will be used to help develop a turbine "slightly larger" than Carter's present 300kW machine, the exact size of the machine will be dependent on market requirements.

■ Two new UK wind farms, in Tyrone, Northern Ireland and Lancashire, England, will both use WindMaster 300kW turbines imported from Belgium.

E F Energy Ltd of Belfast is developing a 5MW wind farm on Owenreagh mountain near Strabane; the project is one of six chosen under the first round of the Northern Ireland Non Fossil Fuel Obligation (NFFO) ("Irish renewables", *Safe Energy 101*).

US company New World Power plans a ten-turbine wind farm at Caton Moor near Lancaster, which has a contract under the English and Welsh NFFO-2. The company, which has submitted a number of projects to the NFFO and its Scottish equivalent,

Bird-kill research

THE problem, or perceived problem, of bird kills and wind farms in America was addressed at a conference in Colorado, USA, last July. The conference, attended by over 50 people from North America and Europe, came up with questions rather than answers, and it was agreed that further research needed to be done in a number of areas.

Bob Thresher of the (US) National Renewable Energy Laboratory — co-sponsors of the conference — summarised the conference findings, saying that research is needed on the defining problem, why birds enter wind farms, what impact, if any, there is on bird populations, possible mitigation measures and protocols needed for further research. □

Flicker guidance

A code of practice for wind farm developers and telecommunications operators is to be drawn up to try to deal with the potential problem of electromagnetic interference; the spinning blades of turbines could cause flicker on televisions and disruption to other communications.

Following a meeting in Solihull, West Midlands, in June, between representatives from wind developers, local authorities and the communications industry, a working group led by Marcus Trinick of solicitors Bond Pearce and Andrew Garrad of consultants Garrad Hassan has been set up.

The group will produce guidance on what developers should look out for and who they should contact. It will outline technical problems they may face, advise on separation distances for turbines and provide a code of good conduct. □

believes that wind power may soon be economic in the UK, able to operate in the open market without subsidies.

■ Regional electricity company Manweb, which operates in Merseyside and north Wales and already has shares in two operational wind farms, has plans for four large developments.

Three of the sites, which are bidding for a place in the next round of the NFFO, are in Wales and the fourth is in the Strathclyde region of Scotland.

The Welsh schemes are for 92 turbines of 360 kW at Llyn Alaw reservoir, Anglesey, 83 turbines at Mynydd Yr Hendre near Carno, Powys, and around 100 turbines on Denbigh Moors, Clwyd. □

Solar developments

IT is perhaps surprising that for some applications the viability of using solar energy is better the further north you go, writes *Kerr MacGregor*.

This is particularly the case for solar heating of buildings, whether by passive (architectural) or active (engineering) means. Because it is colder for longer at higher latitudes, space heating is needed for longer and it is therefore possible to make more use of solar energy. The longer heating season more than compensates for the lower monthly solar radiation: nine months of Shetland sunshine is worth more barrels of oil or units of electricity than three months of Sicilian sunshine.

This has been the main theme of the North Sun series of international conferences. Pioneered by the Scottish Solar Energy Group, the first conference held at Napier College, Edinburgh, in 1984 attracted delegates from almost all the high latitude countries, especially Scandinavia.

North Sun has been held at two-yearly intervals since then, travelling to Sweden, Denmark, England and Norway. This

September it returned to Scotland for its tenth anniversary, being held at the Mackintosh School of Architecture, Glasgow.

It was a great opportunity to review a decade of progress in solar energy. Highlights included the steady progress reported by the Swedes on their massive solar heating projects which collect solar heat in the summer, storing it in underground caverns for winter distribution through the district heating networks of nearby towns.

Several Norwegian architects described their successful low-energy and high amenity solar houses which are ideally suited to Norway (and Scotland).

Denmark and the Netherlands have healthy and growing solar water-heating industries, partly due to supportive governments but also because of active involvement from their energy utilities.

A notable project in England is the retrofit cladding of a University of Northumbria building with solar cells to do double duty as rain shields and electricity generators ("Solar progress", *Safe Energy 101*). Scottish projects include the largest building in the world

to use a new solar material, TIM (translucent insulation material) — a Strathclyde University building — and a pioneering project which has brought solar energy to the people of Easterhouse, a peripheral housing estate in Glasgow.

The Scottish organisers of the conference were glad to welcome delegates from North and South America and from many East European countries, no doubt looking for solutions to the massive energy and environmental problems they face.

■ A wafer-thin plastic film being developed in the US could produce electricity from solar power at a fraction of present costs.

The film could provide generating capacity for 1 cent per watt compared to \$1.5 for the cheapest alternative, according to Alvin Marks of Advanced Research Development Incorporated.

It is planned to impregnate the film of electricity transmitting acetylene with a molecule which mimics photosynthesis, developed at the US energy department's Argonne National Laboratory near Chicago. □

EC backs renewables

CONTINUED strong growth into the next century is predicted for renewable energy sources in the European Commission's latest annual economic survey*.

The strongest growth is likely in biomass, wind and geothermal, with wood, agricultural residues and waste being increasingly used for electricity generation.

■ Funding for around 180 energy technology projects, totalling Ecu147m, has been allocated under the European Union's Thermie programme. Included in this are 74 renewable energy projects which will receive a total of Ecu46.6m.

The Thermie programme, which started in 1990, is in its final year but the Commission hopes to establish Thermie-II to continue the work. □

* "Panorama of EU industry 1994." EC, 1994.

Research money wasted

GOVERNMENT research development and demonstration (RD&D) funding for renewables has been criticised by the Public Accounts Committee.*

Contrary to many media reports, it was not the principle of investing in renewable energy research which was attacked by the committee but the direction and management of the programme and the lack of return on the investment.

Amongst the specific points raised by the committee were:

- the need for the Department of Trade and Industry (DTI) to provide more support to UK applicants in obtaining European Commission RD&D funding;
- the reluctance of the DTI to drop its geothermal hot dry rocks programme, and the lack of return on the £40m spent;
- despite £54m being spent on wind power, emphasis on large-scale and vertical axis machines has meant that 84% of turbines now installed in the UK are imported.

The committee expressed concern that "of the projects approved in principle

under the first two Non-Fossil Fuel Orders, less than 50% are currently producing electricity, and half of the projects approved under the second Order may never go into production largely because of planning refusals." With £340m having been spent on R&D since 1975, they doubted that the "relatively modest increases in new electrical generation justify the large sums spent."

Responding to the report, the Network for Alternative Technology and Technology Assessment (Natta) has argued that a long-term approach is needed to energy research. The present trend at the DTI, noted by the committee, is away from research spending and towards subsidising electricity generation. Natta calls for expansion of research and development to support longer-term options like offshore wind, deep-sea wave, tidal barrages and tidal streams offer the UK very large energy resources. "The use of short-term market criteria is no way to plan strategically for the longer term," argues Natta. □

* "The renewable energy RD&D programme", Committee of Public Accounts. HMSO, 1994.

Forest waste

WIND power developer Ecogen hopes to build a 10MW biomass-fired power station in Keilder Forest.

The company already has plans for a 250-turbine wind farm at Humble Hill in Keilder Forest. The biomass power station would burn forest waste and could also use coppiced wood.

The company would like the power plant to be combined heat and power, but this depends on the final site selected and finding customers for the heat.

■ Plans for a straw-fired power station at Calne, Wiltshire, should be put to a public inquiry, according to Friends of the Earth (FoE) and the Council for the Protection of Rural England.

The proposal for a £35m 20MW station

comes from Southern Electric and Group Cereal Services, a farmers' co-operative. They hope to win a contract in this year's round of the Non-Fossil Fuel Obligation.

FoE has expressed concern over emissions both from the power plant and from traffic going to and from it. Another criticism was made by a local campaigner: "As the plant is not a combined heat and power station, we feel it is not eco-friendly." □

REVIEWS

The efficient alternative; by Pat Agnew.

Tarragon Press; 1994, 93pp, £5.95.

Pat Agnew's earlier book "Hydro Power and Electricity in Scotland" was abridged in *Safe Energy* 86/87. Now he looks at how electricity is generated and used in the UK.

The book provides a mixture of the politics and the engineering of how we got to where we are now and where we should go in the future, as the book puts it: "How we can do away with nuclear power, reduce pollution, conserve natural resources and save money."

The blend reflects Agnew's own interests as an engineer and university lecturer (now retired) and also a Green Party activist.

At 93 pages it is a fairly short book, which is probably an advantage given that it seems to be aimed at providing a basic introduction to the subject.

The book is not without its limitations, but these are generally omissions rather than errors. For instance, in the section on the greenhouse effect only passing mention is made of methane — it concentrates almost exclusively on carbon dioxide. I was also rather surprised that energy efficiency, though a recurring theme of the book, was not given a chapter of its own.

I would take issue with the author over his assertion that: "one good feature of the NFFO is that rubbish is considered to be a non-fossil fuel, so that the burning of rubbish to provide useful heat is being encouraged." To be fair, Agnew does precede this by arguing the merits of recycling, and refuse incineration is not a clear-cut issue, but its inclusion in the NFFO (and the Scottish Renewables Obligation) is restricting the development of genuinely renewable methods of electricity generation.

It is in chronicling the development of the electricity supply industry in the UK that Agnew is at his best, explaining how our large-scale centralised system came about. He also gives a flavour of the many and varied issues related to electricity supply.

With the interweaving of technology and politics, it would be an ideal book for students starting out in engineering; giving them a sight of the political framework within which, as qualified engineers, they will be working, and to think a bit more about the wider impact of what they do.

GRAHAM STEIN

Vital signs 1994-1995; L R Brown, H Kane & D Malin Roodman.

Worldwatch Institute/Earthscan; 1994, 158pp, £10.95.

This is the third annual edition of *Vital signs*, published in association with the World Wide Fund for Nature (WWF). It is packed full of graphs, figures and information showing trends in a wide range of environmental indicators: everything from global temperature to world bicycle production.

The text accompanying the graphs helps to explain the reasons for and significance of current trends. And the good news is that bicycle production increased to 108 million in 1993 — almost three times that of the motor car. **GS**

European directory of renewable energy suppliers and services 1994.

James & James; 1994, 484pp, £49.50.

As well as a comprehensive guide to Europe's renewable energy industry (with over 5,000 companies and organisations listed), there are many interesting articles on everything from geothermal to biomass.

The section on wind power is particularly good; staff from the Ris National Laboratory, Denmark — which produced the European Wind Atlas — look at resource estimation and the siting of wind turbines, and Andrew Garrad, of Garrad Hassan, considers the potential, possibilities and prospects for off-shore wind power. **GS**

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REVIEWS

**New renewable energy resources;
World Energy Council.**

Kogan Page; 1994, 391pp, £35 (hb).

Traditionally no friend of renewables, the World Energy Council (WEC) now appears to be taking them seriously. This book stems from a three-year investigation begun in 1989 under the direction of the WEC Study Committee to look at the "possible place of 'new' renewable energy resources within the world's total energy consumption over the coming decades."

When the group reported its findings in 1993 ("World energy reports", Safe Energy 97), it was critical of the Council for previously having given renewables "secondary status as minor contributors to the overall energy picture."

Make no mistake, the WEC — a non-governmental organisation with members from 100 countries — still sees coal and nuclear power as the strongest long-term prospects, but this thorough study will have boosted renewables' stock within the Council and beyond.

Over 80 specialists from widely varying countries — industrialised, with economies in transition, and in various stages of development — contributed to the book. Renewable energy tech-

nologies are applicable to all their countries.

The study considered two scenarios: 'current policies' and 'ecologically driven', and looked at the prospects for 2020 and briefly considered the possibilities for 2100. 'Traditional' biomass and large hydro were excluded from the study because "particular issues and problems arise with [their] provision of energy."

Six working groups looked at different kinds of renewables: solar, geothermal, wind, biomass utilisation, mini/micro hydro and ocean energy; and their findings are presented in separate chapters.

The overall findings show that action is needed for the accelerated introduction of renewable energy resources; a "necessary and beneficial element in an integrated development strategy."

Under the current policies scenario a growth in new renewables of 3.4 times 1990 levels is forecast for 2020, but this brings the total contribution to a modest 4% of total primary energy supply (with world energy use predicted to double in this period). The ecologically driven case improves this

total to 12% (30% including 'old' renewables).

Under the latter scenario, a reduction of 25% in global CO₂ emissions (compared to current trends) is projected for 2020, with growth in new renewables contributing about one-third of the decrease.

The authors call for:

- continued and expanded research and development for renewables;
- a move away from short-term economic decision making, with consideration of long-term energy and development needs;
- inclusion of the costs of external impacts in economic decision-making;
- the creation or designation of a single organisation to give international focus and leadership to the increased use of renewables;
- the establishment of regional centres of excellence for renewable energy, to give training, technology support, and resource databases

appropriate to the regional needs.

The committee expects renewable energy system costs to fall over the next few decades, while fossil-fuel costs are set to rise, and "renewable options are likely to become the economic choice in an increasing number of regions and applications."

An important point on development made in the book is that because of their disperse nature "renewables have the potential to make a major contribution to economic development by distributing economic activity over a wider area, thereby slowing the migration of rural people to cities, and alleviating many social problems."

There is nothing earth-shatteringly new in this book — tremendous potential for renewables, environmental benefits, institutional barriers preventing their development — but it is well researched, comprehensive and realistic.

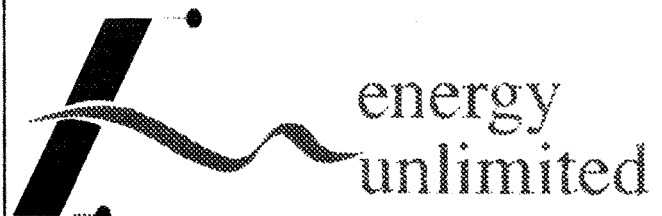
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Two heads ...



A copy of British Nuclear Industry Forum's annual report has reached LBR. Its diary of events for the past year includes a photograph of "jubilation at winning the British Steel Challenge in the yacht Nuclear Electric".

Cheap electricity might be beyond the nuclear industry, but at least they know how to sponsor yachts.

And a close look at the picture shows that Nuclear Electric, the yacht that is, had an unfair advantage: one of the crew members clearly has two heads!

Carbon claims



Nuclear Electric has been forced to amend its claims on carbon dioxide abatement following a complaint to the Advertising Standards Authority by the Nuclear Free Local Authorities. Adverts run by NE now say its nuclear power stations prevent 50 million tonnes of carbon emissions annually, previously they claimed 55 million tonnes. Even this assertion is based on the dubious assumption that nuclear

plant, if closed, would be replaced entirely by coal-fired stations — an argument accepted by the ASA.

The reduced figure did not last long, however, and NE's environmental report 1993/94 published in September claims its power stations "... compensate for the environmental impact of other types of electricity generator — [preventing] the emission of some sixty million tonnes of carbon dioxide last year."



Plutocracy

As LBR reported in *Safe Energy 100*, United States Energy Secretary Hazel O'Leary was not impressed by a Japanese nuclear industry video where cartoon character Mr Pluto tells children that drinking plutonium-laced water is perfectly safe.

The Energy Secretary's letter, which warned of "dangerous" and "misleading" information, has received a considered response from Japan's Power Reactor and Nuclear Fuel Development Corporation: "We don't believe [O'Leary] ... would write such a cheap letter. Obviously someone else wrote it while she was away."

Health farm



LBR has received details from CORE (Cumbrians Opposed to a Radioactive Environment) of the £4 million refurbishment of the Sellafield visitors' centre.

While not perhaps in the same league as Japan's Mr Pluto, Sellafield plans to inform youngsters that the complex is "rather like a mother hen, looking after tired and troublesome atoms. She's a bit of a sheepdog too, making sure that none of her flock escape."

Thorp is likened to a health farm where atoms can relax before being put back to work with the help of Warm Pond, Decanner and Nitrick. Atoms are variously characterised as "pretty cheeky", "a bit loony", "naughty" and "pretty exhausted" rather than 'deadly'.

And even the "wicked atoms" can be dealt with by "Vic the Invisible with her cloak of black glass. In no time at all, the atoms are trapped, never again to cause trouble."

Mighty atom's adventures at Sellafield end with the reassuring words: "This atomic health farm at Sellafield makes sure everything's safe and sound."

Energy saving



LBR passes on the following information without comment: an energy efficiency officer with the West Yorkshire police force, Trevor Brown, was fined £75 at Leeds crown court in August. He was found guilty of stealing £3.14 worth of gas by fiddling his meter.

Nimbyism



News reaches LBR of a well-publicised campaign in Sweden opposing 27 turbines being built on the large island of Öland. It led to a petition signed by 38 more-or-less prominent Swedish personalities being sent to Prime Minister Carl Bildt.

A closer inspection of the 38 opponents revealed that only two were permanent residents of Öland, another ten had holiday cottages, the others had no connection with the island at all.

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