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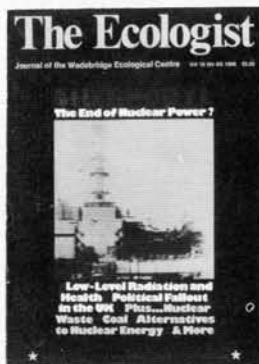
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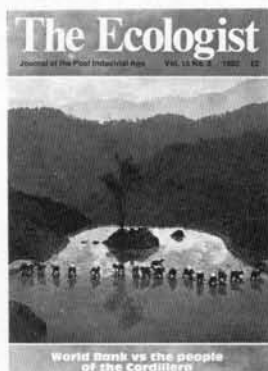
FRANCE'S NUCLEAR PROGRAMME:
A Recipe for Bankruptcy
The Myth of Cheap Nuclear Electricity



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Errata and Apology: In Vol. 17 No 4/5 (1987), we omitted the article by Denys Trussell ("The Harrowing of New Zealand") from the contents page. The contents page should be amended to read:

- Denys Trussell* **The Harrowing of New Zealand** 180
Neither population growth nor poverty can be blamed for the destruction of New Zealand's forests. They have simply been cashed in pursuit of short-term profits.

We apologise to Mr Trussell for this omission.

Lay-out and Design: Mark Finch

Let the Market *really* rule, Mr Parkinson

At the Sizewell B public inquiry, the CEBG based its case for building a PWR on the grounds that it was likely to be the most economic option, that system demand required new capacity to be built, and that it would help provide security of supply, presumably against the machinations of the coal miners and the threat of strike action. Since then the government's privatisation plans for the electricity supply industry have been announced in a White Paper, and Energy Secretary, Cecil Parkinson, has made it abundantly clear that one segment of the three new companies, including two generating companies and one operating the grid, would be to maintain a proportion of nuclear generated electricity on the supply side. Equally the twelve distribution companies that take over from the Area Boards will have to use a specified minimal proportion of non-fossil fuel electricity generation. The magnanimity in lumping nuclear power with other alternative sources of electricity generation, presumably wind, waves and others, may appeal to those who hope for a serious commitment to the renewables, but the intention is clearly to favour nuclear. In fact, Parkinson's stipulation that nuclear power should form part of the generation mix indicates a real fear on the government's side that nuclear power may not meet the market test.

Nuclear Power—up for auction

Nuclear power has undoubtedly put the government into a bind. Parkinson has invoked competition and the market place as a means of satisfying consumer demand for a better deal when it comes to electricity tariffs and bills, yet nuclear power in Britain, despite special treatment from the beginning, has never lived up to economic expectations. By the end of the late 1970s, the analysis of Professor Jeffery and others had revealed the deceit behind the constantly reiterated statements that nuclear power was, is and always would be cheaper than other forms of thermal power generation. It is now obvious that the ageing magnox reactors, with very large question marks over their continued safe operation, will be an enormous embarrassment for privatisation. Who really would want to take on the responsibility of decommissioning such radioactive piles, especially having seen the furore over waste disposal sites in Britain? As for the AGRs, they are not much better, having revealed serious weaknesses in their safe operation during refuelling. Moreover other studies now underway indicate that such reactors are not quite the benign giants that the CEBG, or SSEB for that matter, has claimed them to be.

Parkinson has swallowed the CEBG's party line that demand for electricity is now again taking off after a respite of more than a decade. Indeed the Energy Minister has talked of thirteen new large power stations being required by the end of the century at an

investment of some £30 to £40 billion. It is remarkable how a government which prides itself on stimulating business efficiency should be stuck on promoting exactly those investments which lead to mis-use of resources and energy inefficiency.

The lessons are indeed there to be learnt and they come from the market place and sound accounting systems rather than from the rigid, centralised monopolistic practices that have been part and parcel of electricity generating in this country since World War 2.

Energy Conservation—the way forward

The United States for instance has begun clearly to show the way in this respect. In fact, a recent study of the costs of nuclear power fully vindicates the foresight of American utilities in turning away from such fool-hardy investments, even when in the midst of construction. According to the Public Citizen's Critical Mass Energy project, the operation of nuclear plants in the United States may be costing between \$7 to \$13 billion more per year than the industry's claimed total of \$8 billion. The increase is thus double or more. One reason for this substantial increase is the rising cost of operation and maintenance which together have exceeded inflation by an average of more than 10 per cent per year over the past few years. In 1987 alone the cost of major repairs was 30 per cent greater than the previous year, and the economic penalties of keeping plants going for a minimum lifetime of 20 years have become severe.

The report of the public citizen group points out that when decommissioning costs, together with interest on construction as well as operation and maintenance are taken into account, the generation costs rise to 20 cents per kilowatt-hour compared to the industry's figure of 2 cents for production costs. The Federal subsidies, which in 1984 totalled \$15 billion and the reduced insurance premiums, as obtained under the Price-Anderson Act, are not taken into account when estimating generating costs. The United States now has a large surplus generating capacity and at least 85 per cent of its nuclear power plant capacity could be shut down while leaving every region of the country with a 20 per cent reserve margin. Way-off projections in growth in electricity demand during the early 1970s and an obsession to get in on the rush to build nuclear power plants in the United States have been largely responsible for the surplus, but an added ingredient has been the drive to save energy as sponsored by the utilities themselves. Southern California Edison, for example, has managed to displace 8 megawatts of generating capacity simply by giving away compact energy-saving fluorescent lights to low income ratepayers. The cost of saving a kilowatt-hour, according to Christopher Flavin and Alan Durning of the Worldwatch Institute, is less than

operating the nuclear power plant at San Onofre.

The concept of energy conservation has now pervaded the thinking of most of the major utilities in the United States. As George Manteatis, executive vice-president of Pacific Gas and Electric, the world's largest private sector utility, has pointed out: "Conservation programmes are considerably less expensive than the cost of adding new capacity and clearly less risky from an investment perspective."

Meanwhile Bonneville Power Administration, covering the Pacific North West, has developed a linear analytical model called a 'least cost resource mix model' which evaluates the mix of supply systems, whether thermal, conservation or renewable, that will best serve the region in terms of security and cost. Such models indicate the usefulness of taking conservation into account when planning the power supply system and, indeed, in actively promoting conservation-minded behaviour through offering free home surveys and low interest loans, or even cash rebates.

In the UK, the history of the Electricity Supply Industry since the 1950s has been actively to turn its back on anything which smacks of saving watts and reducing demand for electricity. Combined heat and power, as Norman Jenkins has pointed out in *The Ecologist* (Vol 16, Nos 5/6) gets short shrift in Britain, despite its enormous potential to save energy and simultaneously to reduce emissions of gases such as carbon dioxide, sulphur dioxide and nitrogen oxides. Indeed, most of household energy is required in space heating and for domestic hot water, which can be admirably supplied in cogeneration or fully-fledged CHP systems, where the thermal energy is made use of rather than being dispersed immediately into the environment. Moderate size CHP plants, with their heating links, can be relatively quickly established; yet, it is just such size of plant that the CEBG has been shutting down with unseemly haste over the past few years. Moreover, a wide range of fuels can be used in such plants and by having a carefully controlled mix, security of supply can be maintained.

France—the wrong model

Luckily for Britain, our resources of fossil fuels, in particular coal and natural gas, have prevented our government's obsession with nuclear power from its full realisation. It will soon be a decade since the then Energy Secretary, David Howells, called for a nuclear programme of 15 GW to be embarked upon in the early 1980s. Then, as now, France has been upheld as a country to be admired for its single-minded pursuit of nuclear power. Yet, as we point out in this issue of *The Ecologist*, the price that France has paid has been crippling. It is now a country with an enormous debt burden, acute problems of overcapacity, and despite substantial government subsidies, a growing reluctance on the part of the consumer to increase electricity use in the factory or home. France is indeed a country we should scrutinise, but as a *warning*, not a model to be followed.

What has been disturbing, in the aftermath of the

Sizewell PWR inquiry and the Inspector's report, is the way that errors concerning the costs of generating nuclear electricity were allowed, or perhaps even encouraged, to influence decisions concerning permission for the plant. As Professor Jim Jeffery has pointed out to the Department of Energy, numbers were used for the savings to be made in operating the Sizewell PWR that were derived from faulty calculations, namely those of the Cambridge Energy Research Group. Yet it was just those numbers that the Inspector relied on and which were accepted verbatim by his advisors in the Department of Energy who helped him compile his report. The result is that the Inspector exaggerated the putative savings to be derived from the Sizewell PWR by £24 per kilowatt per annum, an amount which is substantial when one considers the reactor size is equivalent to more than one million kilowatts.

The economic case is now so deeply flawed that the government is resurrecting the well-worn argument for maintaining nuclear power, namely that it is necessary for security of supply. In the United Kingdom the backbone of electricity generation to-date has always been of fossil fuels. They can and do come from a variety of sources, both indigenous and imported, and as we saw in the last miner's strike of 1984 the miners no longer have a stranglehold over electricity production. Admittedly nuclear power stations were on hand during the strike and they generated a fifth of the electricity; so too were oil-fired stations which until then had been standing more or less idle because of the CEBG's strategy not to burn oil. There are a number of ways in which security of supply can be maintained, including pressing ahead with the renewables, such as wind, wave and tidal, that can together supplant nuclear power. Improving efficiency at the consumer end through electrically economic household gadgets as well as in the factory, and building up a network of CHP stations will also do as much for securing supply through reducing demand as having nuclear power on tap.

In fact, to rely on nuclear power is to risk security of supply. One major accident and half the British countryside is devastated and who really would want to keep the other nuclear power stations operating under such circumstances? And if there were a major accident in France, would we really turn a blind eye? There is no justification for wanting to continue having an expensive, inefficient and intrinsically flawed power source in Britain to supply our electricity. If Cecil Parkinson can help generate through privatisation a system which gives proper scope to the clean, safe and efficient production of electricity, based on sound economics, then he should indeed be supported. However, the present plans are supporting a lame duck that has had plenty of opportunity to prove itself in the market place.

Peter Bunyard

The Myth of France's Cheap Nuclear Electricity

by Peter Bunyard

Advocates of nuclear power insist that France's nuclear programme is now generating some of the cheapest electricity in Europe. In fact, electricity prices in France are higher than those in Denmark, the Netherlands and West Germany, countries which have reduced or non-existent nuclear programmes. Moreover, French prices do not reflect accurately the real costs of nuclear generated electricity, which has been heavily subsidised by the government. Indeed, far from being an economic success story, nuclear power in France has brought Electricité de France to the verge of bankruptcy and made France one of the least energy efficient countries in Europe.

In early 1974, the French Government, worried by France's 40 per cent dependency on oil for electricity production, embarked on its nuclear programme, based essentially on Westinghouse's Pressurised Water Reactors (PWRs), but since taken over entirely by the nationalised industry Framatome. Thus 13 gigawatts — 1 gigawatt (GW) equals 1000 megawatts (MW) — were ordered in 1974 and 1975; 12 GW in 1976 and 1977; and 5 GW each year from 1978 to 1981. By early 1986, firm orders had been placed for 55 PWRs, totalling 61 GW. Between 1985 and 1991, nuclear plants under construction will increase capacity by 30 GW — a rise of nearly 100 per cent compared with the number operating in 1985, when France was already 60 per cent dependent for its energy on nuclear, with hydroelectricity capable then of providing 20 per cent and fossil fuel the remainder. At the end of 1987, France had 44 PWRs operating.

In 1982, the Noël Josephe Committee concluded that France had by then sufficient capacity installed to meet likely demand in 1990, which it evaluated at 370 Terawatt hours — one terawatt hour (TWh) equals one million watt-hours — rather than the 450 TWh forecast by Electricité de France (EDF) for 1990. In response, the government restricted the construction programme from three to two, then to one firm order every other year. Even so, by 2000, France's nuclear power stations will account for some 40 per cent of all Europe's nuclear capacity, and will top West Germany's, Britain's, Sweden's and Belgium's nuclear capacity combined.

Claimed Cheapness

Advocates of nuclear power insist that France's nuclear programme has enabled her to generate some of the cheapest electricity in Europe, thus making her industry potentially more competitive. For example, M. Jean-Pierre Capron, General Administrator of the France's Atomic Energy Commission (CEA), claimed in a recent issue of *L'Express* that the price of electricity in France is "one of the cheapest in the world", whilst EDF President Marcel Boiteux is adamant that "We have the best prices in Europe, except for Denmark". That view is echoed in Britain where successive energy ministers have repeatedly pointed to France's avowedly cheap nuclear electricity to justify nuclear expansion in Britain.

In fact, as a recent 1986 comparison of European electricity prices, carried out by the Federation of West German Utilities, makes clear, French electricity is by no means as cheap as EDF claim. Interestingly, the survey found that those countries with a reduced or non-existent nuclear programme were generating the cheapest electricity. For instance, Denmark, with no nuclear stations, had electricity that was at least 25 per cent cheaper than that from France, with her 75 per cent nuclear generated electricity; meanwhile, Belgium, with 60 per cent nuclear, generates electricity that is nearly 60 per cent more expensive than that in Denmark. The Netherlands, with 2 nuclear plants (thus 7 per cent nuclear) had electricity 20 per cent cheaper than France and West Germany, with 25 per cent of its electricity nuclear generated, was 6 per cent cheaper.

Those figures are broadly confirmed in other reports. For instance, according to the European Council of Chemical Industry Federations, in July 1986, a company contracting for 40 MW generating capacity, operating 8000 hours a year, would pay 25 per cent more in France than in Italy, and 75 per cent more in France than in Sweden or Norway.

Significantly, France's Director General for Energy and Raw Materials to the Minister of Industry, M. Jean Syrota, has stated: "For large industrial consumers, the Netherlands, Denmark and Italy offer lower prices today than EDF: this is not to mention the countries extremely favoured by nature, like Norway and Sweden, nor the practices carried out by certain electricity companies to deliver electricity at less than list prices as part of commercial contracts..."

Cheap hydropower currently provides 20 per cent of France's electricity and, as Andrew Holmes points out in *The Financial Times*, if it were not for that contribution, tariffs would have to be higher still. Moreover, with coal now available at \$30 to \$35 a tonne, nuclear's purported economic advantage becomes 'non-existent'. As Holmes remarks, "EDF is continually producing international price comparisons which show its own tariffs off to best advantage. These seem to bear little relationship with other international comparisons produced by National Utility Services and by various industry trade associations".

Prices do not Reflect Costs

The controversy is not simply over the question of comparative prices. As Sir James Goldsmith points out in a

strong critique of the myth of France's cheap nuclear electricity, published in *L'Express*, there is the world of difference between the 'price' at which electricity is sold and the real 'cost' of producing and distributing it. In France, the 'price' has been kept artificially low, that is below the true 'cost' price, both by the various subsidies and grants (amounting since 1979 to more than 30 billion francs at 1987 values) which EDF receives from the State and by the trading losses incurred by the company.

In effect, the French are paying two bills for their electricity — "one directly, through the electricity bill from the EDF, and the other indirectly through tax payments, from which the State subsidises the EDF and meets the latter's losses."

Had EDF been forced to abide by the rules of the market place, it would undoubtedly have been a different story. Here the US experience is telling, for, as Christopher Flavin of the WorldWatch Institute points out in *The Bulletin of Atomic Scientists*, "In the United States, nuclear power has failed a market test that it does not have to meet elsewhere." Thus, in sharp contrast to the EDF, public utilities in the US have to justify their investments to their stockholders. This, in the case of nuclear plants, they have been increasingly unable to do. As a result, 1974 was the last year that a nuclear plant was ordered in the US and was not subsequently cancelled. Consequently, according to *The Financial Times*, the number of power plants due to be completed between 1991 and 1995 will be approximately one tenth of those completed between 1986 and 1990. The cancellations consist of 66 GW of Pressurised Water Reactors (PWRs), 34 GW of Boiling Water Reactors (BWRs) and 8 GW of High Temperature Gas Reactors (HTGRs). For coal-fired plants in the USA, orders and cancellations have more or less balanced each other out.

Subsidies

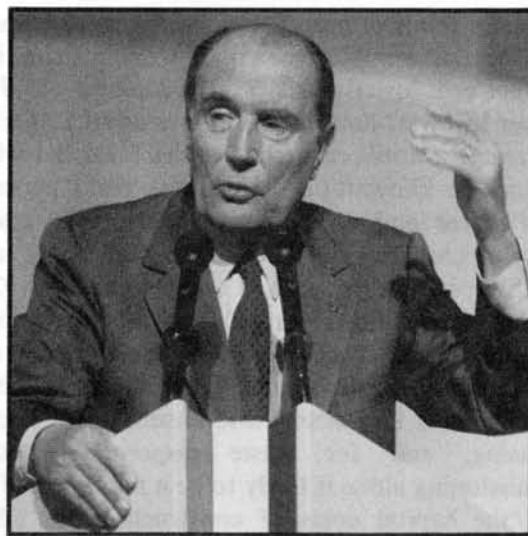
In order to keep down the price of electricity — thus helping to maintain the myth of cheap nuclear power — the French Government has been heavily subsidising EDF:

a) Subsidising EDF's Debt.

As a direct result of its nuclear programme, with its massive construction costs, EDF had accumulated a debt of 221 billion francs (£22 billion) by the end of 1987, a sum that is greater than the French paid in income tax in 1986 (some 213 billion francs) and one and a half times greater than the total annual investment in private industry. Because of EDF's borrowings, France has become third in the world after Brazil and Mexico as a debtor nation.

EDF's would have been greater still had it not been for the capital subsidies given by the French Government, which, between 1979 and 1981, ran at the rate of 5 billion francs (£500 million) a year — a sum equivalent to the capital costs in France of one PWR. In 1982, the government went further, writing off a 9 per cent deficit, in addition to giving the 5 billion franc subsidy.

On top of this, government guarantees, which would not necessarily be available to private companies, have enabled EDF to secure major loans on both domestic and international capital markets. Yet, the returns on the capital invested have, by the standards of other French industries, been extremely poor: thus EDF's capital requirements per unit of "Value Added" to the French economy are six times



When first elected, President Mitterrand had the support of many French Greens, who naively thought he would put a halt to the country's massive nuclear programme. Although the programme was reduced, however, the Mitterrand administration has continued to support the nuclear industry to the hilt through numerous grants and subsidies.

higher than those for the rest of French industry. Indeed, EDF consumes nearly one quarter of the nation's industrial capital to contribute just one-twentieth of the nation's Value Added.

At present, EDF is not paying back any of the capital it has borrowed, only the interest, a commitment which, despite government intervention, eats up at least 20 per cent of the company's annual income. After a year in which EDF has again plunged into the red, following a short respite of two years in the black, its President, Pierre Delaporte, states that the debt will not be reduced before 1990. In fact, if the French Government persists in keeping electricity prices artificially low, it is unlikely that EDF will ever pay off its debt, especially since the company is still obliged to go on borrowing. Indeed, EDF, thanks to its nuclear programme, is now on a financial treadmill: soon, according to Marcel Boiteaux, it will have to start ordering new plants simply to replace those that will be reaching the end of their lives, thus sinking deeper into debt.

b) Subsidising the Private Consumer at the Expense of Industry:

There is no single set price for electricity in France. Instead, in common with other countries, a system of tariffs operates. French industry — in particular, Pechiney (aluminium) and Atochem (chemical) — has complained that it is being overcharged for its electricity in order to boost sales of domestic central heating (see below). The claim is that EDF has been overcharging industry to the tune of 8 billion francs a year.

That claim has been upheld by Prime Minister Chirac: as a result, from February 1st 1987, prices went down 5 per cent for non-commercial customers, and for small and moderate consumers; and for businesses, by 1 to 2 per cent.

Underestimating or Excluding Costs

Underlying EDF's chronic financial problems has been an unwillingness to face the real economic costs of its nuclear programme. Thus, EDF has not properly evaluated or accounted for rapidly rising capital costs, with their 'knock-

on' effects in terms of accumulating interest to be paid. In 1975, EDF's cost estimates for a plant coming on line in 1980 were 25 per cent lower than actual 1980 costs—15.7 centimetres per Kilowatt-hour (c/KWh) instead of 12.6 c/KWh. And increases are still occurring: thus Chooz B-1 will cost 5000 francs per kilowatt (at 1982 prices), plus 8 per cent for architect's fees and 35 per cent interest. In addition, reprocessing costs in France have also been rising rapidly, by some 26 per cent per year in real terms since 1972.

The Dutch economist Herman Damveld also points out that French electricity prices do not reflect the real cost of nuclear energy, notably because EDF allows too little for decommissioning its reactors and ensuring site safety, for reprocessing, and for waste disposal. The cost of decommissioning alone is likely to be a minimum of 10 per cent of the capital costs of construction. In addition, insurance premiums are paid by the French Government.

Damveld estimates that the real cost of France's nuclear generated electricity are likely to be double or even triple those stated by EDF. He has recalculated France's nuclear generating costs, using a 1982 price basis for a PWR coming on line in 1992, and taking into account those costs ignored by EDF. Thus *capital charges* go from EDF's estimate of 10 c/KWh to 20.5 c/KWh (with decommissioning), and fuel charges from 5.1 c/KWh to 10 c/KWh, once proper reprocessing charges, waste disposal and insurance are taken into account. The result with maintenance and operating costs included at 4.0 c/KWh is a cost of 34.5 c/KWh, compared to coal at 33.5 c/KWh and EDF's figure for nuclear of 19.1 c/KWh. However, should the nuclear plant operate for less than 4000 hours per annum, on account of over-capacity or for other reasons, then, in 1982 prices, generating costs go up to 46 c/KWh — that is, treble EDF's estimate of 1981.

Deep Financial Crisis

EDF is now in serious financial difficulties. In 1982, a report in *Nucleonics Week* quoted the then EDF President, M. Guilhemon, as saying that EDF's 'financial problems' were "at their worst in 30 years". Two years later, the Government's Audit Office concluded that EDF's financial situation since 1981 was 'disquieting'.

In 1981, EDF lost 4.4 billion francs and, in 1982, 7.9 billion francs. In 1982, losses for 1983 were expected to be 14 billion francs, but by raising electricity rates by 8 per cent on May 1st 1983 and another 5 per cent on September 1st, the potential was cut back to 8 billion francs. Another 2 billion francs were saved through boosting the export of electricity by 9 TWh more in 1983 than in 1982.

With inflation included, the rates of EDF's electricity would have to rise on average by up to 15 per cent per year, which would mean a 45 per cent increase in just three years, just to break even. However, instead of permitting the necessary rise in rates, the government instead absorbed the losses of 1981, 1982 and 1983.

The Public Accounting Office notes that the nuclear programme has necessitated heavy investments, the financing of which has brought about considerable financial difficulties. At the time that the programme was launched, EDF had stated that those financial burdens would begin to ease after 1980, owing to an increase in electricity consumption, which would allow the most efficient use of

generating capacity. "But", the report notes, "none of these conditions have been realised."

Tout Nucléaire

When France's nuclear power programme was conceived in 1972, it was launched with the slogan 'tout électrique, tout nucléaire', the intention being that cheap nuclear-generated electricity would capture a significant chunk of the energy market, including that of domestic and industrial heating. The assumption was that growth in electricity consumption would top at least 7 per cent per annum — a doubling in demand every decade.

For electricity consumption to achieve that growth rate would only be possible, however, if electricity were seen to be competitive with traditional heating fuels such as oil and natural gas. As a result, EDF, with support from the French Government, set out to win electricity markets by manipulating tariffs and keeping the price of electricity down below the rate of inflation by at least one per cent.

EDF has been so successful in building up its nuclear programme that today it has the electricity capacity to meet all the growth that it projected. The irony is, however, that the projected growth has failed to materialise — for two prime reasons: first, because of the general turn-down in the world economy; and, second, because, even though electricity prices have been heavily subsidised, as a form of energy, electricity cannot in reality compete with heating fuels that can be used directly and with far greater efficiency in industrial and domestic boilers. In fact, the little success that EDF has had in penetrating the heating market, particularly in the domestic sector, through a hard, government-sponsored sales drive, has achieved the dubious result of making France one of the least energy efficient countries in western Europe.

Behind Target

Through its advisory service — Industelec — EDF has set out to persuade industry to install electric boilers and other appliances. The target is to sell an additional 40 TWh per year of electricity within France by 1990, on top of the 1984 consumption of 282 TWh. Industrial consumption has failed to grow as fast as hoped, rising at a rate of just 1.2 TWh per annum from 1975 to 1983 — as against EDF's target increase of at least 5 TWh per year.

On the domestic front, EDF, with government support, has been pushing for the use of electric heating in dwellings, the aim being to convert 170,000 homes per year to electric heating by 1990. In 1983, it only managed 66,000.

The drive to use electricity for heating, particularly in the domestic sector has had the unfortunate consequence of greatly increasing the peaks and troughs of France's electricity consumption. Thus, whereas, in 1971, the fluctuation in system demand between the *winter* and *summer* months varied between 200 and 310 gigawatt-hours per week, in 1983, they varied between 350 and 670 GWh per week, and the trend has been worsening. As a consequence, EDF has had to keep a large surplus capacity of power plants available for peak demands. In addition reactors of the 1300 MW series are being run in "Mode G operation", thereby enabling them to be taken up and down in power with considerable rapidity, and thus permitting them to be



In the US, where nuclear power is subject to the rigours of the market, numerous plants have been cancelled for economic reasons. Indeed, 1974 was the last year that a nuclear plant was ordered in the US and not subsequently cancelled.

used to load-follow. The cost of operating the reactors in Mode G will be accelerated ageing, perhaps at the expense of safety (see below) and added operating costs, owing to the less efficient use of capital.

Tariffs to Regulate Demand

In an attempt to control demand, EDF has been forced to introduce a complex system of tariffs. One peak-logging scheme is the "bi-energie" solution. Customers install dual-fired boilers which can be automatically switched from electricity to oil firing during times of peak demand. The technology exists for both industrial and domestic consumers. Under one tariff option, known as "EJP (Effacement Jour de Pointe) Interruptible", domestic consumers accept "interruptibility" for 18 hours a day for 22 days of peak demand, in return for a saving of 20 per cent on their annual electricity bill. A condition of the scheme, however, is that they have a bi-energie boiler for use during times of "interruptibility".

According to a study by Friends of the Earth UK¹, the bi-energie solution is back-firing for EDF. With fuel oil currently so cheap (at some 10 c/KWh equivalent, compared to 20–30 c/KWh for winter off-peak electricity), it is undercutting electricity not only in winter but throughout most of the year. Customers are thus switching their boilers manually to whichever fuel is cheapest at the time.

In fact, price variations between seasons are very large. Thus, as EDF's Industrial Tariff System for April 1986 shows, heavy industrial users on Green Tariff pay 3 to 4 times as much in winter peak periods as in summer off-peak periods. Small users pay up to 12 times as much (from 11.76 c/KWh in summer off-peak to 148.6 c/KWh in winter maximum peaks), and medium users on the EJP option pay 20 times as much in the winter peak as in the summer off-peak (9.62 c/KWh compared to 212.61 c/KWh).

As Y. Lenoir and J.P. Orfeuill point out in their paper *How France's Nuclear Programme Became a Handicap for the Economy*, electricity is not competitive in the heating sector which makes up some 40 to 50 per cent of the energy market. Indeed, the authors give fuel oil as costing between 4 and 6 times less on average when compared with electricity for heating (8.09 c/KWh for heavy fuel oil, compared to 35.90 c/KWh for continuous use electricity, and 49.2 c/KWh for semi-continuous use — both figures being for industrial sources).

Saving Less Fossil Fuel

Ironically, as Table 1 shows, France has reduced her

dependency on fossil fuels to a smaller degree than her European partners, this despite her nuclear programme. Thus France only achieved an overall 7 per cent saving in fossil fuels over the period 1975 to 1984, compared to 14 per cent for the EEC as a whole, which saved the same percentage of oil and coal, but replaced it with less gas than did France.

And what if France had built half as many nuclear power stations as she did? What would then have been the consumption of fossil fuels? In fact, France would have consumed in 1984 no more than an additional 2 to 3.5 million Tep (tonnes equivalent petroleum), 1 Tep being equal to 4,500 KWh. The country's energy bill would thus have been 6 billion francs higher. Yet, officially, it is claimed that by 1984 nuclear power had saved 40 billion francs in imported fossil fuels, with the predicted annual saving up to 1990 amounting to 60 billion francs. Those savings (really at 6 billion francs) were used to justify 500 billion francs invested over 15 years, as if the alternative to nuclear power consisted in producing the same amounts of electricity but by using oil. In terms of jobs, only a 200,000 minority has benefited from the nuclear programme. It is estimated that a non-nuclear strategy would have led to a fall in fuel consumption of up to 13 per cent (fossil and fissile fuels included).

Surplus Reactors

For much of the year, France now has a significant electricity generating surplus. The size of that surplus obviously depends on EDF's success in promoting the use of electricity, but Marcel Boiteux, a past president of EDF, has admitted that France will have 3–5 reactors too many in 1990. The trade union CFDT believes that France's electricity requirements in 1990 will amount to no more than 330 TWh: if so, then EDF will have 12 plants too many. According to *Nucleonics Week*², three reactors were shut down for extended periods in 1984 because their power was not needed.

TABLE 1

Trend in the use of fossil fuels over the period 1975–1984

	COAL	OIL	GAS	TOTAL FOSSIL
U.S.A.	8%	– 6%	–10%	– 4%
JAPAN	6%	–21%	50%	–11%
E.E.C.	–10%	–29%	18%	–14%
OECD	7%	–21%	–10%	–10%
FRANCE	–10%	–29%	83%	– 7%

One way to overcome the surplus is obviously to export electricity and, in 1984, EDF managed to export 23 TWh to its neighbours — equivalent to nearly 10 per cent of home consumption. In 1985, electricity exports had increased to 28 TWh, enabling EDF to make a profit of 90 million, its first profits for 10 years.

For EDF, the best way to operate its reactors is undoubtedly by keeping them at base load. The company can therefore afford to export electricity at prices which undercut the marginal generating costs of its electricity importing neighbours. In fact, Switzerland bought electricity from France for pump storage and sold the surplus to Italy, while making a profit.

Costs set to rise

Since the acceleration of the nuclear programme in 1973, investment costs in energy have doubled from 1,615 francs/KW to 3040 FF/KW (in 1976 francs). In 1983, the costs for a 1300 MW reactor were set at 3,650 FF/KW. These costs are based on a so-called 'reference' plant, where four units are built simultaneously at one location, under ideal circumstances, with no siting problems. According to M. Moynet, the head of EDF's budget department, the costs will continue to rise since all the 'easy' sites are taken and the trend is to have two units per site instead of four. The Civaux site required 1.5 years of site work to stabilise the ground before construction of the reactors could begin. Remy Carle, director of construction at EDF, has also said that construction time would be stretched out over 78 instead of

Underlying EDF's chronic financial problems has been an unwillingness to face the real economic costs of its nuclear programme. Moreover, France has reduced her dependency on fossil fuels to a smaller degree than her European partners, despite her nuclear programme.

60 months, with the result that nuclear units will be 20 per cent more expensive.

Safety and Security of Supply

The French nuclear industry has repeatedly pointed out that, by employing a high degree of standardisation, it has managed to keep down the capital costs of constructing its reactors when compared with other countries. Another advantage of standardisation, it is claimed, is that reactor operators can receive the same general training and, moreover, can learn from each other's experience. In theory, this shared experience also enables the manufacturer to modify all the equipment in the reactor.

However, these advantages would be entirely offset if it were discovered that the standard reactor suffered from a generic fault, either in its design or its equipment, which necessitated a shutting down of the entire system for modification. Indeed, a major accident in a reactor which was discovered to be the result of a design fault could well lead to France losing up to 50 per cent or more of its entire generating capacity.

Already several serious equipment faults have come to light. These include low quality control rod guide tube braces in the 900 MW reactor type. Since 1982, broken braces have been found in a number of such reactors: the consequence could be a failure during scram of the reactor's shut-down systems. At least 1000 kilometres of faulty control command cables have been installed in more than 20 reactors and, to date, not all of them have been repaired. Insulation failures could give rise to wrong information appearing in the control room, thus confusing operators and leading to incorrect procedures. Already, one potentially serious accident in the Bugey No.4 PWR in April 1984 was triggered by such an insulation failure. In addition, steam generator tubes are already showing the effects of corrosion, even though they have been in service for little more than 10 years at most.

The miracle of France's nuclear power programme is beginning to be seen for what it is, a massive financial burden which has completely distorted the country's economy. And whereas nuclear power in France was trumpeted as cheap energy, the truth is that French consumers are having an expensive energy form thrust upon them through government intervention, thus forcing a nation which prides itself on its technological prowess to become the laggard in the pursuit of energy efficiency.

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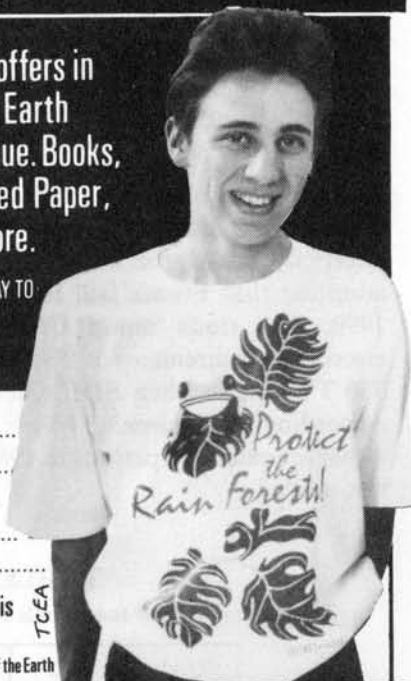
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The Collapse of Nuclear Economics

by J.W. Jeffery

Nuclear Power was born with the proverbial silver spoon in its mouth. So much so that in 1954, the Chairman of the US Atomic Energy Commission, Lewis Strauss, held out the prospect of nuclear electricity "too cheap to meter"¹. But the claim has proved utopian. Although subsidies and dubious accounting methods have been used to disguise the true costs of nuclear generated electricity, the truth is that nuclear power is more expensive than its alternatives.

The early economic calculations which supposedly showed nuclear power to be cheaper than conventional sources of energy were bolstered in nuclear's favour in two ways. Firstly, none of the enormous research and development (R and D) outlay expended on building the first atomic pile during the Second World War was charged to the civil nuclear programme. Yet the R and D on the pile, which was used to produce the plutonium for the Nagasaki bomb and the many tens of thousands of far larger bombs which have been developed since then, was essential for its civil use as a boiler to produce steam for electrical turbines. Indeed, without the wartime drive for plutonium, it is extremely doubtful whether the enormous expenditure on developing the first atomic pile would ever have been incurred at all.

Even the research carried out after the war by the UK Atomic Energy Authority (UKAEA) specifically for civil nuclear power was not, until recently, charged even partially to the nuclear programme. Yet, the £6.0 billion in March 1980 prices spent on nuclear research by the UKAEA up to 1980 is equivalent to 1.7 pence per kilowatt-hour (p/kWh) for all the nuclear units (360 TWh) produced in the UK by 1980². None of this expenditure, however, appeared in the calculations for nuclear electricity generating costs. If it had, it would have more than doubled the nuclear generating costs given by the Central Electricity Generating Board (CEGB) in 1980, making nuclear electricity more expensive than electricity generated by either coal or oil³.

The Plutonium Credit

A second method of dubious accounting was also employed to improve the

economics of nuclear power. Because the plutonium produced as a by-product⁴ of the civil programme could theoretically be sold for military use in bombs or for civil use in a Fast Breeder Reactor (FBR), which was seen as the next stage in nuclear power development, it was given an estimated value, known as a 'plutonium credit', which was then used to reduce the apparent cost of electricity from Britain's Magnox reactors. For a time, this was sufficient to disguise the uneconomic character of nuclear power. However, when it became evident that no plutonium 'market' did or could exist, the credit was first reduced and then phased out altogether for the AGR programme.

Historic Costs

By then, however, a more fortuitous phenomenon had come to the rescue of nuclear economics. Between 1965, when the capital costs of Magnox stations were being incurred, and 1979/80, when the CEGB was producing figures (widely reproduced in Parliament and the press) apparently showing nuclear electricity to be 20 per cent cheaper than that from coal, inflation reduced the value of money by a factor of four. So the CEGB, using historic costs, was able to charge only a quarter of the real capital costs of stations to the calculated unit cost of electricity. Since the capital costs of nuclear stations are roughly twice those of coal-fired plant, nuclear unit costs were reduced by twice the amount for coal, thus producing the spurious 20 per cent economic advantage to nuclear power.

Ditching the Long-Term Costs

Nuclear generated electricity has also been given a spurious economic advantage by the failure of the CEGB to take account of the cost of waste disposal, decommissioning and other

long-term costs. In this respect, the CEGB's 1965 assessment of *The Technical and Economic Aspects of Dungeness B Nuclear Power Station* provides a startling insight into the industry's clear lack of appreciation of the long-term costs which it faced — and still faces. The assessment was produced in the hope that the results "(would) be of value to electricity supply undertakings throughout the world"⁵. Yet it makes no mention of waste disposal or decommissioning: indeed, the last payment was assumed to occur at the end of the station lifetime, for the residual fuel discharged from the reactor. This was accounted as a credit, as the payment for the plutonium and depleted uranium was much greater than the cost of reprocessing⁶.

The problems of long-term costs have now been recognised to the extent that some provision is made for them in the CEGB's accounts, but this provision is so small, because of the effects of discounting, that it makes no significant difference to the calculated cost of nuclear power. Indeed, it is the effects of discounting on long-term costs that probably gives nuclear economics the greatest advantage relative to those of coal.

Discounting

Although discounting is a normal procedure, and takes account of the relation between immediate and future benefits and costs, this is on the assumption that the same people will enjoy the benefit or bear the cost. To take a personal example: when there is a nasty, dirty job to be done, which will disrupt my life and has the possibility of causing me injury, even though I employ others to do the work, if I can arrange to put the job off for 10 or 20 years, and spend the £1000 I have provided to cover the cost to get a better car instead, then I will probably do so. But I must make sure that when I do have the job

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done, at least the money is there to pay for it. I can invest money in the building society at 5 per cent compound interest. How much must I invest to provide the future £1000? For a 10 year wait, I must invest £614⁷; for a 20 year wait, £377; for a 50 year wait, £87; for a 100 year wait, £8. So I trade in my jalopy and get a somewhat better car, while putting £8 of small change in the building society. When the job comes to be done in 100 years time, it will be my great grandchild (or even worse, someone else's) who will be facing the difficulties and dangers of the job.

Theoretically, the £1000 will be there to pay for it, financial arrangements made now for 100 year's time are likely to be completely irrelevant when the time comes, whether it be an individual's £1000 or the CEBG's successors' £1000 million, even supposing the same currency still exists. The reality is that there will be a difficult and dangerous job to be done, requiring the diversion of human and material resources which our descendants would certainly prefer to use in other ways. Future generations, faced with the many difficult and dangerous nuclear jobs we shall have left them, will curse us all the more, because if we had used our energy efficiently, or had developed the means of harnessing the sun's energy (including the wind and the waves), or built coal-fired stations, they would not have been left holding the very dirty end of the stick.

Present Values

Discounting, which can make long-term costs disappear, also applies to benefits in the future. If you are left £1000 in trust, to be given to you in 10 years time, then a banker willing to accept 5 per cent on his money will give you £614 now for the reversion of this legacy when you finally receive it. Similarly, for 20, 50 and 100 years, you would get £377, £87 and £8 now. These values are called the 'Present Values' (PVs) of the future cost or benefit; that is, they are the amounts which, at 5 per cent compound interest, would amount to the sum involved by the time it is due.

In the CEBG's calculations, all costs (positive) and benefits (negative) are 'Present Valued' (or discounted) to the commissioning date for a new station — the capital costs have 'Interest During Construction' (IDC) added to construction costs to give their PV — and the

total of costs and benefits is the 'Present Value' of building the station. If the sum is positive, the costs are judged to be greater than the benefits; if negative, then vice versa.

The total Present Value is annuitised⁸ over the design lifetime of the station to give equal yearly costs or benefits, and the yearly amount is then divided by the design output in kW to give a 'Net Effective Cost'⁹ (NEC) for the station in /kW/pa. This figure enables comparisons to be made between stations with different design outputs and lifetimes. The NEC times 100 is divided by the number of hours of expected operation in a year ($24 \times 365 \times \text{Load Factor}$) to give cost per unit in p/kWh.

Problems with the Accounting Method

The CEBG's accounting method is standard and generally reasonable, but three problems arise if the time over which the calculation is made becomes too long. All of these problems apply to nuclear economics, and although the challenge was made at the Sizewell Inquiry, nobody has yet been able to suggest another economic activity to which they all apply to the same extreme degree. The problems are:

(a) Benefits may occur mainly at one end of the period and costs at the other. If the period is short, this will not matter much; but if the period is long, benefits or costs may effectively disappear, because of the exponential operation of compound interest (see (c) below).

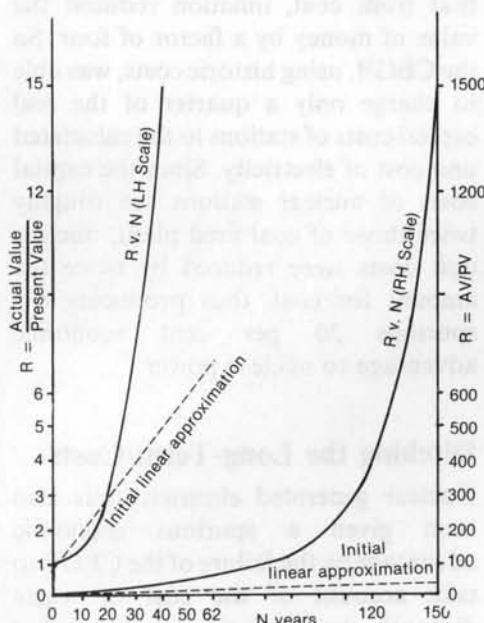
(b) Over long periods, one generation can receive benefits, while the costs are borne by succeeding generations (or vice versa). This destroys the principle on which discounting is supposed to be based — namely, the free choice of a given individual or group between short-term and long-term benefits.

(c) The ratio ($R = AV/PV$) of the actual value (AV) to the Present Value (PV) is an exponential function of time, that is, of number of years of discounting (N). The first part of this function is very approximately linear, i.e. R is roughly proportional to number of years (N) until the slope of the curve approaches one (45 with equal scales on the two axes). Around and after that point comes the runaway exponential increase, as the curves in the graph make clear. For a 5 per cent interest rate, the slope is one at 62 years discounting. For the first 20 years, the differences between the exponential and the proportional values are less than 0.2. At 30 years, the curve is already 0.5 (14 per cent) above the straight line, and at 40 years it is 2.2 (46 per cent) above. At 62 years, the excess is 13.6 (194 per cent), but at 100 years it becomes 120 (1118 per cent), and at 150 years it is 1492 (9443 per cent)! The graph in Diagram 1 brings home the meaning of these figures.

The Effect of Discounting on Nuclear Economics

The effect of this exponential accounting procedure ('discounting') has been worked out in detail for a particular case¹⁰. The CEBG now believes that the main, final stage of decommissioning a nuclear plant should be left to at least 100 years after commissioning. On this basis, if the final decommissioning for a 1 GW station costs £400 million, 2.5 per cent or £10 million of this will be paid for during the lifetime of the station (20 years), and £390 million will come from interest paid during the next 80 years after the station closes. Not all, even of this 2.5 per cent, is charged against the cost of nuclear electricity. Only £4.76 million out of the £10 million enters into the calculated price of nuclear-generated electricity, i.e. 1.2 per cent of the Actual Value. This is because the Present Value of £400 million, discounted over 100 years, is only £3.04 million, and this, annuitised over the 20 year lifetime of the station, is all that is included in the unit price. Consequently, the £400 million decommissioning cost contributes only just over one-tenth of one per cent to the unit cost of electricity. For comparison, £400 million of capital costs (discounted over zero years) contribute 17 per cent to the unit cost, or 130 times as much as the

The Distortions in Economic Evaluation brought about by Discounting over long Periods



same Actual Value (AV) of decommissioning.

Two other bizarre aspects of this example highlight the problems of exponential discounting. Half the final cost of decommissioning — some £200 million — is accumulated in the last 14 years of the 100 year period, whereas it takes the first 86 years to accumulate the first half. Secondly, the interest provided in the first year of accumulation (i.e. the first year of operation) is only £152,000, but in the next to last, 99th year, it is £18,141,000, or almost 120 times as great. Since this is a general method of accounting, not just peculiar to the CEBG, this implies that there will be 120 times as much investment taking place in 99 years after commissioning as there is at the start of operations¹¹.

A Reasonable and Valid Method¹²

If all the long-term costs of nuclear power had their AVs totalled instead of their PVs, and this total was spread evenly over the lifetime of the station, the present method of calculation would give a valid comparison with other methods of generation. There would still be a problem of whether to have a cut-off at 1000 years, 10,000 years or 100,000 years, but one might compromise at 1000, if further development of nuclear power were stopped. There would certainly be no economic reason for continuing with nuclear power if the full costs were taken into consideration, especially as, even with the present methods, coal-fired stations are at least as economic as nuclear stations, with conservation certainly far cheaper, and wind and wave power probably so.

Overcapacity and the Sizewell Inquiry

In spite of the indirect subsidies, the use of inflation apparently to reduce capital costs, and the effective elimination of long-term costs by the discounting method, the nuclear industry still has problems making out the economic case for nuclear power. This was evident at the recent public inquiry into the proposal (since approved) to build a Pressurised Water Reactor (PWR) at Sizewell in Suffolk.

At the time, the CEBG had an enormous overcapacity of power stations. It had already rushed, with indecent haste¹³, into building the



Sizewell B construction site. The decision to go ahead with the station was based on unrealistic coal price forecasts and an accounting system heavily biased in nuclear's favour.

Heysham II reactor, even though it was known (and not refuted by the CEBG) that by the time Heysham II was due to be commissioned, the CEBG would have at least 7 GW surplus to requirements even without the station operating. Nevertheless, the 1978/79 *Annual Report* of the CEBG (para. 159), after referring to Heysham II, stated, "There will be requirements for further plant perhaps to a maximum of 2.5 GW per annum - beyond the current programme..." Similarly, the 1979/80 *Annual Report* (para. 106) states, "The Electricity Supply Industry had advised the Government that, even on cautious assumptions, they would need to order at least one new nuclear power station a year in the decade from 1982, or a programme of the order of 15,000 MW over ten years". The Government then adopted this programme as its own.

Although, by the time of the Sizewell Inquiry, the CEBG had already started its campaign to close coal-fired stations

prematurely (in order to reduce its gross overcapacity, which made its demand for new stations look absurd), it had not yet got to the stage where it could plead a spurious capacity need. The case for Sizewell B and the nine stations to follow had therefore to be made on the basis that it would be *economic* not only to build a new nuclear station, but also to close down the older coal-fired stations that would be replaced.

This was difficult to demonstrate, not least because there was very little saving to be made by closing down older stations. It was thus vital to show that building Sizewell B would make more savings than the additional costs involved: in other words, the station had to have negative 'NEC'. The costs were primarily the high capital costs of a nuclear station, which are very inflexible. The savings were the cost of coal saved by replacing coal-fired stations, less the much smaller costs (partly because of discounting of

reprocessing and waste disposal) of nuclear fuel. Nuclear fuel costs were taken as fixed, so that the only way to boost the savings above the capital costs was to assume a very high price of coal to be saved.

Future Coal Costs

The CEBG spent a considerable amount of time speculating on the immediate and long-term future prices of coal. It concluded, predictably, that in future the price would be uneconomic. Significantly, this was the only major aspect of the CEBG's case that the Inspector did not accept. Estimating the longer-term future price of a commodity is a difficult problem for the forecaster, but it is perhaps surprising that CEBG was forecasting a 37 per cent increase in the price of coal up to commissioning date, at the same time as it was negotiating an 'understanding' (now an agreement) with the National Coal Board (NCB) to keep the price of coal stable over the beginning of the same period. The latest agreement, extending and developing this understanding, means that 'marginal' coal (i.e. coal additional to its main take) can be bought at world market prices, that is very much lower than the average price. This, and the failure of the Inspector to accept the CEBG's longer-term future coal price projections, meant that the economic case for Sizewell B was gravely weakened even at the Inquiry. The subsequent fall in fossil fuel prices has demolished it altogether.

The CEBG's Fall-Back Case

The CEBG's failure to substantiate its basic economic case for Sizewell became increasingly obvious as the Inquiry proceeded. Nonetheless, the CEBG continued to speed up its programme of premature closures. Nearly a year after the Inquiry started, an additional 5GW of premature closures was announced, and the Inspector himself noted that "the CEBG advanced the retirement of 10.7 GW of plant in 1981/82-1984/85". Although the Inspector failed to comment or, apparently, to realise the significance of this retirement — equivalent to the destruction of ten Sizewell Bs — it was clearly designed to allow the CEBG to plead a capacity need for Sizewell B.

By the end of the Inquiry, the CEBG was concentrating on the capacity need

"The CEBG's failure to substantiate its basic economic case for Sizewell became increasingly obvious as the Inquiry proceeded."

case almost exclusively, although "this did not form a material part of the CEBG's initial evidence" (82.3)¹⁴. Indeed, as the Inspector noted, "Since capacity need did not form a material part of the CEBG's original case, it was not explored in any detail during the Inquiry." (81.4) In spite of this, capacity need became the crucial aspect of the Inquiry.

In dealing with capacity need and future demand, the Inspector was faced with the following problems:

- The question of capacity need had not been on the agenda until near the end of the Inquiry and consequently had not been considered in any detail (see above).
- Evidence on demand forecasts from the Electricity Council was not available¹⁵.
- The CEBG resisted disclosing its efficiency assumptions, which are essential for estimating future demand¹⁶.
- The substantial effect of government action on the improvement of efficiency, which is also crucial to the estimate of future demand, could not be predicted with confidence¹⁷.
- There was evidence showing that future demand was still being grossly overestimated by the CEBG especially for 'Scenario C', the CEBG's central case¹⁸.
- There was evidence of a paranoic determination by the CEBG to go ahead with nuclear power stations at any cost¹⁹.

In spite of these problems, the Inspector found no difficulty in deciding that the CEBG's "Scenario C projections provided a reasonable general basis for assessing whether the need for new capacity materially affects the case for Sizewell B", (82.24) and that there was a "very low probability" of capacity need arising later than 1995. He concluded that it was therefore necessary to start a new station by 1987²⁰.

The Inspector then decided that, even with his lower coal prices, there was a 40-1 probability that a nuclear station would be more economic than a coal-fired station. These odds have since been reduced to 7-1 in the 'calculations' carried out by the Department of Energy, on the basis of even lower predicted coal prices. The Department had been forced to adopt the lower

prices by the collapse of fossil fuel prices since the Inquiry finished. Although the odds have been reduced, the alleged economic superiority of a nuclear station was still the basis on which the Secretary of State justified giving his consent to the construction of Sizewell B.

Inaccurate Calculations

It is an extraordinary fact that, despite all the expert assistance available to him from civil servants at the Department of Energy, the Inspector was unable to get simple calculations done to assess accurately the effect of the lower coal and oil prices which he adopted. Since, in every other aspect of the calculations, he adopted the same figures as the CEBG, it was only necessary to recalculate the savings made by a new station (net savings for coal) to get an accurate value of the NEC. Instead, a very approximate method using 'sensitivities', based on doubtful figures produced from various sources during the Inquiry, was used. The Inspector himself assessed the 'degree of imprecision' of his method as + or - £15/kW/pa²¹. In fact, when the accurate calculation was undertaken²², the nuclear NEC was shown to be +£11/kW/pa, whereas the Report's figure was -£14/kW/pa, an 'imprecision' of £25/kW/pa in favour of nuclear power, thus well outside the Inspector's own estimate of his inaccuracy.

The Department of Energy claims to have recalculated the Inspector's figures for the coal prices it used; but repeated requests have failed to get the Department to reveal the method and results of these calculations. Even the request for the figures used for coal and oil prices was met with the sort of 'resistance' noted by the Inspector in relation to the CEBG's efficiency assumptions²³. However, persistence eventually produced sufficient information for independent calculations to be made. These have now been done, and full information, including work sheets and results, have been sent to the Department of Energy. So far, there has been no response, although the results show that the Department's advice to the Minister was incorrect. In all six credible cases for which the calculation was undertaken²⁴, a coal station proved more economic than a nuclear station, both under present circumstances and assuming credible future coal prices.

Rethinking the Sizewell Decision

It is now evident that the Department of Energy based its calculations on the coal price figures in the Inspector's report, merely downgrading the report's assumptions one stage for each projected scenario. Thus, for its 'High Case' scenario, the Department used the coal prices employed by the Inspector for his 'Central Case'; for its 'Central Case', it used the Inspector's 'Low Case'; figures; and for its 'Low Case', the Department used figures 25p/GJ below its 'Central Case'. Knowing this, one is entitled to assume from the Department's refusal to reveal its methods and results that it employed the same inadequate and inaccurate method as the Inspector used, to give nuclear power a false apparent advantage of £25/kW/pa.

If the Department had done accurate calculations, it would have had to have given the Minister very different advice over Sizewell B in particular, and nuclear power in general: namely that,

● If and when a new station becomes necessary, it should be coal-fired, since this will be more economic than a nuclear station;

● Since all the smaller coal-fired stations that the CEBG has been prematurely retiring and destroying would be more economic than a new station of any kind, as many as possible should be saved and used. Where possible such stations should also be used for district heating. Where the stations have been destroyed, consideration should be given to building new, clean coal-fired Combined Heat and Power (CHP) stations on the site, rather than a new, large, central station, since this will improve efficiency enormously;

● Since improving efficiency in energy use is far more economic than building new supply units, this should be developed by government action as a priority;

● Resources spent on nuclear Research and Development should be transferred to R and D on alternative, particularly renewable, sources of energy;

● And, finally, that nuclear power should be phased out altogether by the year 2000.

This article is partly based on a fully referenced paper: J.W. Jeffery, "Dubious Economic Advice for the 'Decision' on the Sizewell Report", *Energy Policy* (in press). Points not covered, or difficult to find in that paper are referenced here. Until the paper is published, copies of the typescript can be obtained at cost from the author, on request.

Notes and References

1. David Taylor, 'Cheaper energy from nuclear power was always a myth', *The Listener*, 15 October 1987, p. 5.
2. Uncontested evidence at the Sizewell Inquiry; Inquiry reference, SSBA/P/1, its Note 58, p. 62, corrected by the addition of the nuclear units produced in Scotland.
3. CEBG *Annual Report*, 1979/80, Table 22, p. 38, gives generation costs of nuclear, coal and oil as 1.30, 1.56 and 1.93 p/kWh respectively.
4. Calder Hall was specifically designed to produce plutonium for bombs, and its electricity was really the by-product, but the Magnox stations were also designed so that weapon's grade plutonium could be produced in them. In spite of the secrecy still surrounding the production and use of plutonium, it is clear that some plutonium produced by CEBG has been earmarked for military use.
5. Uncontested evidence at the Sizewell Inquiry, SSBA/P/4, p.32.
6. Uncontested evidence at the Sizewell Inquiry, SSBA/P/1 (ADD 5), p.7. Although the plutonium credit is no longer used, the CEBG's Sizewell B fuel costs assumed a long term depleted uranium credit, based on a future natural uranium real price of some five times its present price. Even after discounting, this inflated credit produced a significant improvement in the nuclear economic assessment.
7. For a 5 per cent compound interest rate the capital at the beginning of any year has to be multiplied by 1.05 to get the capital at the beginning of the next year (the original capital plus the years interest). For ten years the starting capital must be multiplied by 1.05 ten times, i.e. $614 \times 1.05^{10} = 614 \times 1.629 = 1000$.
8. This is exactly the same process as is used to get equal annual house mortgage repayments. The early payments are mostly of interest, with a little capital repayment. As the capital is repaid, the interest falls and later repayments are mostly of capital.
9. There are minor variations in the detailed calculations, see SSBA/P/1, Note 39, p. 56.
10. J.W. Jeffery, 'Who Pays for the Long Term Costs of Nuclear Power?', *Energy Policy*, Vol 15, No 3, June 1987, pp 376-378. Corrigenda and Addenda in Vol 16, No 1, February 1988.
11. 3.04 million at year 0 is invested at 5 per cent to produce 400 million for decommissioning in 100 years time. Each year the interest earned during the previous year is also invested at 5 per cent. At the beginning of the first year (year One) 152,000 of interest is invested. In year 98, 18.1 million of interest must be earned and invested at the beginning of year 99 to help produce the final 19 million of interest to make up the 400 million by year 100. The 18.1 million supposedly invested at the beginning of year 99 is almost 120 times as great as the 152,000 invested at the beginning of year One. Since this is a general method, it implies that investment opportunities would increase 120 times by year 99, i.e. that there would be 120 times as much investment taking place.
12. See reference 10 for a theoretical justification and more details of this proposal.

13. J.W. Jeffery, 'The Nuclear Economic Fraud', *The Ecologist*, Vol 12, No 2, Mar/Apr 1982, p. 82.
14. The numbers in brackets, in the text and in the Notes, are references to the Sizewell Report, and give the chapter and paragraph.
15. 'The medium-term forecasts were not examined in any detail. Nor did the Electricity Council provide evidence on its forecasts' (of restricted ACS maximum demand). (82.3)
16. The CEBG "did not prepare its evidence in the same detail (as CPRE) and resisted requests to provide a breakdown of its efficiency and usage assumptions" (82.15).
17. The Inspector stated that "The rate of improvement in the efficiency of energy use which can be achieved will, in my opinion, be substantially affected by policies adopted by the Government. Government policy over the next decade or two cannot be predicted with confidence." (82.16).
18. J.W. Jeffery, "The Fatal flaws in the Sizewell Report; a review of the economics of Sizewell B", *Energy Policy*, Vol 15, No 5, October 1987, p. 459. See also: J.W. Jeffery, 'The Sizewell Report: A Foregone Decision. A review of Frank Layfield's Sizewell Report and Peter Walker's "Quasi-Judicial Decision"', *The Ecologist*, Vol 17, No 2/3, March/June 1987, p. 105.
19. J.W. Jeffery, 'The real cost of nuclear electricity in the UK', *Energy Policy*, Vol 10, No 2, June 1982, Note 15, p. 87. See especially the statement, in what was originally an internal document, that if the government in 1979/80 had refused to adopt the 15 GW nuclear ordering programme, "we see no reason for not pursuing our present strategy of developing nuclear capacity as quickly as practicable, and we could continue to plan on a nuclear programme of about 1.5 GW per annum or more." See also J.W. Jeffery, op.cit, supra reference 13.
20. J.W. Jeffery, op.cit. *Energy Policy*, supra reference 18, its note 12, p.459.
21. Ibid, p.457.
22. See J.W. Jeffery, 'Dubious Economic Advice for the "Decision" on the Sizewell Report', *Energy Policy*, In press. Points not covered or difficult to find in that paper are referenced here. Until the paper is published, copies of the typescript can be obtained at cost from the author on request.
23. See Reference 16.
24. J.W. Jeffery, op. cit., supra reference 22.

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Heat Electric?

by John Bennet

Electricity is essential to our way of life. However, it is generated at great cost in terms of the energy sources required and the pollution caused. The use of our primary fuels to generate electricity, with all the energy losses that this entails, only to convert it back into heat, makes ecological nonsense. Such heat is not the cheapest available to the consumer. Electricity should be accepted as expensive high-grade energy to be reserved for special applications.

Nearly 80 per cent of Britain's electricity is generated in coal-fired power stations. Of the rest, some 17 per cent is generated by nuclear power stations, at those times when they are not out of commission, and a mere 2 per cent by hydro-electricity. The high capital cost of nuclear power stations limit their use to supplying base load: they are therefore run at maximum possible output continuously, in an attempt to cover costs.

The average difference between day-time and night-time demand on the system as a whole is over 10GW in the summer and about 15GW in the winter. Most of the changes in demand are met by varying the output of the larger coal-fired stations and by running the less efficient stations during the day time only.

Exacerbating the Winter Peak

There are two ways to even up the load so that expensive plant does not have to remain idle for long periods. One is to use more electricity at off-peak times and the other is to use less electricity at times of peak demand. The winter peak is most expensive from the CEB's point of view because it requires having plant available which is underused for most of the year.

Much of the winter peak is due to extra heating in houses, shops and offices. This is being exacerbated by the current campaign urging us to use electricity for heating. We are told to change to 'Economy 7', which supposedly enables us to heat water and our houses cheaply. We are able to use electricity at the cheap rate with the option of a boost during peak hours — a

"Fiscal measures could be used to deter people from using electricity for heating purposes."

boost that can only add to the winter peak. "Lashings of hot water can be obtained at economical prices", say the adverts. The two years of free credit offered on water heating packages and storage heaters also encourages the use of electricity for heating.

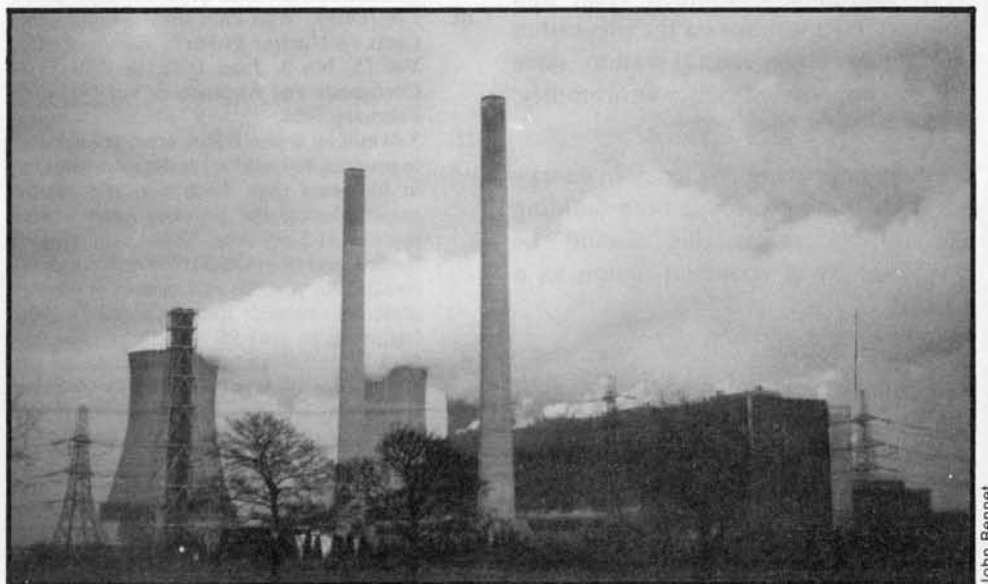
The domestic and commercial loads on the national grid are mainly for heating and account for about 60 per cent of units sold: most of the rest is industrial load. The current promotion drive will obviously contribute to a higher demand during the winter peaks, thus helping to fulfil the CEB's 'prophecy' of electricity shortages — shortages which they blame on the planning delays caused by public

resistance to their nuclear programme.

A Waste of Energy

Using electricity for heating is an extravagant use of our energy resources, because, apart from the very small hydro-electric contribution, we use heat-hungry steam turbines to turn the generators that produce our electricity. In steam turbines, the steam is raised by heating water by means of coal, oil or nuclear energy. The steam driving the turbines is then condensed and returned to the boilers to be used again. This re-use increases the heat efficiency from below 10 per cent in older steam engines, where steam was blown directly into the atmosphere, to an average of 35 per cent for modern power stations. Nature decrees that it is not possible to make a significant improvement: latent heat must be removed in order to convert the steam back into water.

In short, over 95 per cent of our electricity comes from about one-third of the heat available in the primary fuel.



Two-thirds of the energy used to generate electricity goes directly into the atmosphere through cooling towers in the form of steam.

John Bennet is a former engineer for Yorkshire Electricity Board and a lecturer in electrical engineering.

The rest is wasted, except in those countries where the heat is used in Combined Heat and Power stations. Britain has no CHP stations, however. Most of the energy from the primary fuel is thus used to heat up our rivers, or the sea, or the atmosphere via cooling towers.

Not so Cheap

From the economic point of view, too, using electricity for heating makes little sense — despite the claims of the advertisements. A comparison of the costs (including a percentage of each standing charge) of using 'Economy 7' and gas shows that it is one-fifth cheaper to use 'Economy 7' alone, than to use gas. However, a very limited supply of electrically heated water is obtained using an unmodified tank and an expensive day-time boost is usually required. An adequate day-time boost would make electricity more than twice as expensive as the higher performing gas system.

The conclusion for the consumer is that 'Economy 7' used with an existing installation is fine for water heating so

"We have electricity. . . and all we can do is burn it. This profligate waste of resources must stop."

long as only a limited amount of hot water is required. Where it is installed, gas only must be used during the day. Starting from scratch, the two systems may be as expensive to install and run as each other, although there is no such thing as a competitive electrical installation that does not get uncomfortably cool in the evening in winter. In addition, there is always the danger, as reports suggest, that a new privatised electrical supply company will change the rules for off-peak supplies, as the Central Electricity Generating Board (CEGB) has done in the past.

What is to be Done?

Efforts by the government should be

made to push domestic and commercial users to use electricity only for purposes for which it is uniquely fitted — namely, powering electronic equipment, lights, pump refrigerators and other motor driven appliances.

In his April 1988 Budget, Nigel Lawson, the Chancellor of the Exchequer, made a small move in the right direction when he adjusted the tax on petrol to make lead-free petrol cheaper than leaded petrol. Fiscal measures could also be devised to deter people from using electricity for heating purposes. In general, the use of fiscal measures appears to be among the most effective methods of combating ecological vandalism. In the case of using electricity for heating, however, unfettered market forces alone should be sufficient to prove that electricity is a singularly expensive energy source.

It is perhaps typical of our civilisation that we are willing to waste electricity in the way that we do when it has to be obtained at such a high ecological cost. We have electricity, without which our civilisation would grind to a halt, and all we can do is to burn it. It is time for this profligate waste of resources to stop.

Soil Use and Management

Published for the British Society of Soil Science

Editor

Dr R. Webster *Soils Division, Rothamsted Experimental Station, Harpenden, Herts. AL5 2JQ, England*

This journal provides those who use the soil with a means of keeping up-to-date with current research, and brings to their notice such solutions to problems as now exist. Papers and reviews cover the agricultural (including horticultural) management of soil, dealing with problems such as those that result from intensification of use of fertilizers, pesticides and heavy machinery. An important feature is the interpretation of soil and land surveys in planning optimum use of the land. Practical issues of soil restoration, reclamation and conservation are also covered. The journal deals primarily, though not exclusively, with soils and problems of the humid temperate region.

Subscription Information

Soil Use and Management is published quarterly. Subscription rates for 1988 are, for individuals £30.00 (UK), \$61.00 (USA & Canada), £36.50 (elsewhere), and for institutions £40.00 (UK), \$82.00 (USA & Canada), £48.00 (elsewhere) post free.

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Lim Jee Yuan

Traditional Malay house in Malacca. The house exemplifies the skills and sense of aesthetics of traditional craftsmen and builders.

Traditional Housing: A Solution to Homelessness in the Third World The Malaysian Example

By Lim Jee Yuan

The traditional Malay house is cheap to build, well adapted to the local climate and perfectly integrated into Malay culture. By contrast, modern western-style housing is expensive, uncomfortable, ecologically inappropriate and culturally alienating. Moreover, the adoption of modern housing has led to a severe housing crisis. Nonetheless, the traditional house is denigrated as 'primitive' and 'inferior'. It is high time that it were rehabilitated, for traditional housing provides a key to solving the problem of homelessness.

Most developing countries in the world today are facing a serious crisis in housing. According to the World Bank, about a quarter of the world's people do not have adequate shelter and 100 million people have no housing whatsoever. The Bank also estimates that a quarter of the urban population in most African and Asian cities cannot afford even minimal housing. A major cause of this housing crisis is the adoption of modern western-style housing.

Although attempts are made to adapt such housing to local conditions, the houses are ill-suited to the local climate and create social settings and living conditions which are alienating and which do not fit the local culture. The most devastating effect of such housing is that it is expensive and thus denies the majority of the population, who are poor, access to housing by concentrat-

ing the housing resources in the hands of a few.

The vogue for western-style housing was made possible largely by the erosion of confidence in traditional housing, which is still portrayed as 'primitive' and 'inferior'. By contrast, western housing is promoted as being 'superior' and 'modern', and has been adopted as a universal panacea to the housing crisis. A huge pool of traditional knowledge is thus being gradually discarded in the name of progress.

is it extraordinarily well-adapted to local climatic conditions, but it also allows a multi-functional use of space, with great flexibility of design. In addition, a sophisticated system of prefabricated screens allows the house to be extended at will, in line with the needs of a growing family. Indeed the traditional Malay house exemplifies a self-reliant, autonomous approach to housing that is especially appropriate for housing the poor.

The Traditional Malay House

The traditional Malay house makes a rich contribution to Malaysia's cultural heritage. Designed and built by ordinary villagers, in response to their actual housing needs and aspirations, the traditional house bears witness to the creative and aesthetic skills of the Malays. It provides a near-perfect fit to local socio-economic, cultural and environmental requirements. Not only

Malaysia's Housing Crisis

Malaysia, like most developing countries, is faced with massive housing problems. Poor housing conditions, acute housing shortages, spiralling house prices, speculation, bad housing designs, unrealistic housing standards, and malpractice in the housing industry plague the Malaysian housing scene.

In 1980, 66 per cent of the households in Malaysia were in rural areas. Ten years earlier, the figure had been 73 per

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cent. The fall clearly reflects the rate of urbanisation now taking place in Malaysia.

Rapid urban in-migration during the 1970s has resulted in the growth of squatter areas in the country's major towns which are characterised by overcrowding, poor living conditions and inadequate amenities. It has been estimated that the squatter population in the federal capital of Kuala Lumpur alone is now nearly a quarter million — some 26 per cent of the country's total population. It is also estimated that 40 per cent of the population in Kuala Lumpur lives in slums and squatter settlements, which means that nearly half of the city's population lives in generally unhealthy and inadequate housing, reflecting the acute housing problems of Malaysia's towns and cities.

Spiralling House Prices

According to the Fourth Malaysia Plan, nearly a million houses (923,300) would have to have been built between 1981 and 1985 in order to satisfy the housing needs of Malaysians. As a result, the Plan set an ambitious target of building 185,000 housing units a year for the 1981-85 period. However, the completion rate was only 406,070 units, a shortfall of some 56 per cent. In the case of low-cost housing programmes, the shortfall was even larger, amounting to 66 per cent.

Closely related to the housing shortage is the problem of spiralling house prices, which have shot up so high that even an average middle-class family is now unable to buy a house. In the ten years between 1970 and 1980, house prices in the urban areas rose by 200 to 400 per cent. This is two to four times the overall inflation rate for consumer prices over the same period (about 96 per cent), making housing an extremely good form of investment.

Whilst the sharp price increases benefit wealthy housing speculators and investors, they are clearly detrimental to the majority of the population who want to buy a house for use rather than for investment. According to a report by the Urban Development Authority, the cost of the cheapest unit built under the government's housing scheme is beyond the financial reach of at least 80 per cent of the lower income group of the urban population.

The Traditional Alternative

The extent of the current housing crisis is clear evidence that official housing policies have largely failed to solve Malaysia's acute housing problems. Houses today are beyond the pockets of most Malaysians and the situation has become so acute that even low-cost houses are beyond the reach of the majority.

Conventional housing policies also tend to block the poor from access to housing resources and to concentrate control and power over housing resources in the hands of rich and powerful businessmen, professionals, and the state. In addition, such policies fail to recognise the ability of the poor to house themselves and of the informal sector to provide housing for the poor. This is unfair, since people have for generations been building houses for themselves in both traditional and spontaneous settlements. It has been estimated that traditional houses constitute about two-thirds of the total housing stock in the world.

It is often argued that such 'self-help' housing is sub-standard. But the main reason why squatters, for example, suffer from poor housing is not an inability to build good houses, but rather because the lack of security of land tenure and of resources prevents them from investing in their houses and improving them. The lack of amenities and services in these areas also exacerbates the poor housing conditions.

On the other hand, traditional Malay houses, built without architects, not only display a good fit to the culture, lifestyle and socio-economic needs of local householders, but also ensure both the efficient use of materials and appropriate climatic design. Indeed, provided people are given access to resources like land, finance, and the freedom to build, traditional housing can provide houses of high quality with a good living environment. Designed and constructed with minimal intervention from external agents, either governmental or non-governmental, the traditional Malay house thus reflects the importance of self-initiated, self-supported, self-financed and self-managed housing programmes.

The Traditional House Form

The traditional Malay house is a timber

house raised on stilts. It is basically a post and lintel structure with wooden or bamboo walls and a thatched roof. Windows are plentiful, lining the walls and providing good ventilation and views from the house. This quality of openness is also reflected by the large open interior spaces, which have minimal partitions.

The traditional Malay house was evolved by the Malays over generations, adapting to their needs, culture and environment. It may not possess the grandeur or ostentatiousness found in modern buildings designed by modern self-conscious designers but it reflects other qualities lacking in the modern buildings — notably a clear expression of the way of life and culture of its users.

Depending on nature for its resources and reflecting a deep knowledge of ecological balances, the traditional house is efficiently designed to suit local climatic requirements, using various ventilation and solar-control devices, and building materials with a low thermal capacity.

Design and Layout

The traditional Malay house is divided into the front and back portions which are centred around the *rumah ibu* (the core house) and the *dapur* (kitchen) respectively. At the entrance of most traditional Malay houses, stairs lead up to a covered porch called the *anjung*. The porch acts as a transition space between the public and the private domains.

From the entrance porch, one enters into the *serambi gantung* (hanging veranda). The *serambi gantung* is a long narrow area situated next to the *rumah ibu*. This is the place where most guests are entertained. The headroom here is relatively low due to the roof which leans onto the *rumah ibu*, the largest area in the house where most activities are conducted. Sleeping, sewing, praying, ironing, studying, and even feasting (*kenduri*) all occur here. The importance of the *rumah ibu* is expressed by its floor level, which is the highest in the house.

Flanking the *rumah ibu* is the *serambim samanaik*, a closed veranda. This space is similar to the space in the *serambi gantung*. Both this area and the *serambi gantung* are used as circulation spaces leading to the *selang* (walkway), which joins the kitchen. Praying, sleeping and resting commonly take place here.

The *selang* is a closed walkway used to link the kitchen and the *rumah ibu* together. The side entrance to the kitchen is also located here. Besides being a circulation space, the *selang* is often used by the womenfolk as a space to chat and socialise. The *selang* is a very effective linking device, leaving an open space between the back and front of the house and allowing good ventilation and lighting for the house.

The *dapur* (kitchen) is always situated at the back of the house and is on the lowest floor level. Preparation of food, cooking, eating, and washing are all undertaken here. The womenfolk also often group here to chat.

The Conceptualisation and Use of Space

The interior layout of the traditional Malay houses is molded by the culture, values and lifestyle of the Malays. The low priority accorded to personal privacy and the preference for communal intimacy; the seasonal needs of feasting and other cultural activities; the lack of regard for ostentatious living; and a deep understanding of how

best to design for optimum thermal comfort have all led to the traditional Malay house having an open, flexible interior.

The interior of the Malay house is generally not defined by the use of the space but rather by the houseform itself. Apart from the kitchen and the toilet, there are no areas named after specific activities, unlike modern western-style houses, which have their 'living-room', 'bed-room', 'dining-room', 'hall', 'drawing-room', or 'study'. This reflects the multi-functional and non-specialised use of space in the Malay house. This flexibility allows the optimal use of space and is consistent with the inclination towards simple living.

Such non-specialisation in the use of space means that the same space is used for many different purposes at different times of the day and year. A living area can be used at night for sleeping on a mat which in the morning can be rolled up and stored. This same space can then be used during the day for sitting, for prayers, for entertaining friends, for sewing or for other activities. During a marriage or other ceremonies, the same space may even be used for feasting.

The interior of the Malay house is not defined by partitions or walls, but rather by less obstructing minor change in levels. A change in levels of up to seven inches (one step up) is used to define certain areas. This allows the defined spaces to be merged and provides a larger expanse when the occasion calls for it. With walls and partitions, the spaces cannot be merged unless the partitions are removed.

The Malay house is, thus, an example of economical, flexible and optimal use of space. Openness and emptiness are the essence of the interior of the traditional Malay house. Such qualities also facilitate good ventilation, lighting and visibility in the house.

Adapting to the Climate

One of the main characteristics of vernacular houses in general is that they are designed with a deep understanding and respect for nature. A comprehensive knowledge of nature's ways and of ecological balance is prevalent in all traditional societies, largely because villagers rely heavily on nature for most of their resources — their food, medicines, building and household materials being obtained directly from the natural environment. This characteristic of 'designing-with-nature' is best reflected by the use of design to regulate the climate of the house.

The climate of Malaysia is warm, humid and equatorial, being characterised by high temperatures and humidity. Air temperatures average between 22°C and 32°C — that is near but seldom above normal skin temperature. Humidity is high throughout the year, averaging about 75 per cent or more. Although heavy cloud cover and a high water vapour content in the air reduces direct solar radiation, it can still be strong enough to cause painful sky 'glare'. Wind speeds are generally low, although strong winds can occur with the rains. Rainfall is also high throughout the year averaging 250 to 300 cm annually.

The main causes of climatic stress in Malaysia are high temperatures, solar radiation, humidity and glare. To achieve climatic comfort in the Malaysian home, these factors must be controlled. The house must also be protected from rain, floods and occasional strong winds.

For thermal comfort, heat produced by the human metabolic process must be

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Vacant high-rise flats in Tanjong Tokong, Penang, Malaysia. The flats were built to resettle local villagers, but they refused to live in them, preferring their traditional houses. Many of the villagers are fishermen and traders, and the flats have no compounds in which to keep their fishing gear, hawker carts and so on. The villagers are still negotiating for new housing, their own village lands having been taken over to build a commercial centre.

dissipated from the body to the environment in order to maintain a balanced and constant body temperature of around 37°C . Heat gain by the body through solar radiation or warm air must also be minimised.

Heat is dissipated from the body to the environment by convection, radiation or evaporation, and to a lesser extent, by conduction. However, heat loss through conduction, radiation and convection is negligible in the Malaysian climate because the air temperatures are continually close to skin temperature. Similarly, because of high humidity, evaporative cooling and perspiration are greatly reduced and even inhibited. The evaporation of sweat from the body in humid climates quickly forms an 'envelope' of saturated air around the body. This envelope prevents any further evaporation from the body and undermines the last means of heat dissipation.

Thus to achieve some degree of thermal comfort, the saturated air envelope around the body must be removed. Air flowing across the body helps dissipate the saturated air and accelerates evaporation. However, this

is insufficient because without ventilation (air exchange) both the temperature and humidity in a room will build up to very high levels, leading to very uncomfortable conditions. This temperature and humidity build-up is caused by the heat and sweat of human bodies within an enclosed space. Thus, in the Malaysian climate, adequate ventilation is the most important means of dissipating heat.

Designing for the Optimum Climate

From the preceding, it is obvious that to attain the optimum climate indoors, houses in Malaysia should:

- Allow adequate ventilation for cooling and reduction of humidity:
- Use building materials with a low thermal capacity so that little heat is transmitted into the house:
- Control direct solar radiation:
- Control glare from the open skies and from the surroundings:
- Protect against rain:
- And, ensure adequate natural vegetation in the surroundings to provide for a cooler micro-climate.

Traditional vs. Modern Houses

To demonstrate fully the climatic value of the design of the traditional Malay house, it would be best to compare its climatic design with that of modern houses. Take, for example, a house on a modern housing estate. Constructed of brick and tile, imported from the West, the modern house is of a design which has been imposed upon us, with little adaptation to Malaysian conditions and which has led to very uncomfortable living conditions.

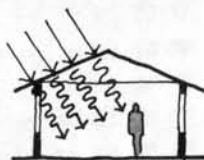
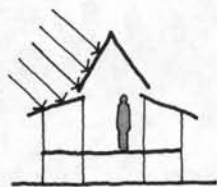
Box 1 compares the traditional Malay house to a modern estate house. From that comparison, it can be seen that the modern estate house is not only badly designed in terms of indoor climate, but that it is built in a way which actually militates against thermal comfort. Significantly, recent research suggests that the use of inappropriate building materials and the lack of surrounding vegetation cause adverse 'microclimates' in housing estates and in urban areas. Studies reveal that temperatures in new housing estates with limited mature trees are constantly high, averaging between 25.5°C and 27.3°C , which is considerably higher

Climatic Traditional

Building Materials

◀ Traditional Malay houses use lightweight construction of wood and other natural materials. The lightweight construction of low thermal capacity holds little heat and cools adequately at night. The attap roof is an excellent thermal insulator. Glazed areas are seldom found in the traditional Malay house.

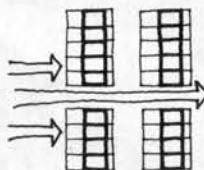
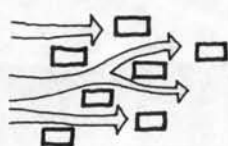
▶ Modern housing estate houses use bricks, tiles, concrete and other materials of high thermal capacity. These materials store up heat and reradiate it into the house, causing considerable discomfort. Glazed areas are usually abundant in these houses.



Layout

◀ Traditional Malay houses are randomly arranged. This ensures that wind velocity in the houses in the latter path of the wind will not be substantially reduced.

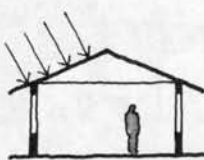
▶ Rigid patterns in the arrangement of housing estates create barriers that block the passage of wind to the houses in the latter path of the wind.



Ventilation of Roof Spaces

◀ Roof spaces in the traditional Malay house are properly ventilated by the provision of ventilation joints and panels in the roof construction.

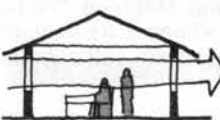
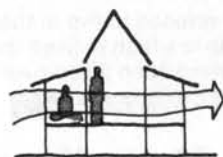
▶ Roof spaces in the housing estate house are insulated by trapped air instead of being ventilated. Such construction requires a high ceiling to be effective.



Ventilation at Body Level

◀ The body level is the most vital area for ventilation for comfort. The traditional Malay house allows ventilation at the body level by having many full-length fully openable windows and doors at body level.

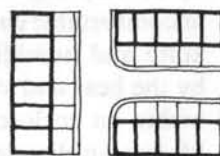
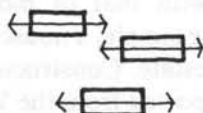
▶ Ventilation in the housing estate house is often only directed at the upper part of the body because windows and other openings are located at higher levels to provide privacy.



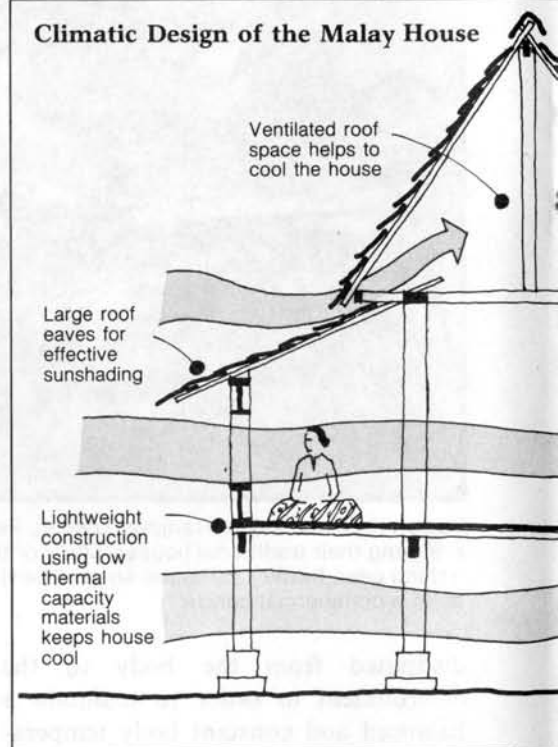
Orientation

◀ Traditional Malay houses are often oriented to face Mecca (i.e., in an east-west direction) for religious reasons. The east-west orientation minimizes areas exposed to solar radiation.

▶ For profit motives, housing estate houses often disregard orientation for minimizing solar radiation and the orientation of the houses often becomes a jigsaw puzzle of fitting the most units into the site within permissible densities.



Climatic Design of the Malay House



than the 20.6°C and 22.8°C considered comfortable. In the urban areas, temperatures are considerably higher than temperatures in the more natural surrounding areas, resulting in the 'heat island' effect. In 1980, the temperature in the commercial centre of Kuala Lumpur was 7.8°C higher than that outside the city.

Flexibility of Design

The flexibility of design of the traditional Malay house caters well to the varied needs of its users. This flexibility is exemplified in the 'addition system' of the traditional Malay house,

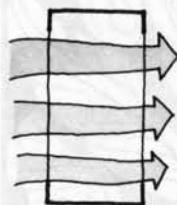
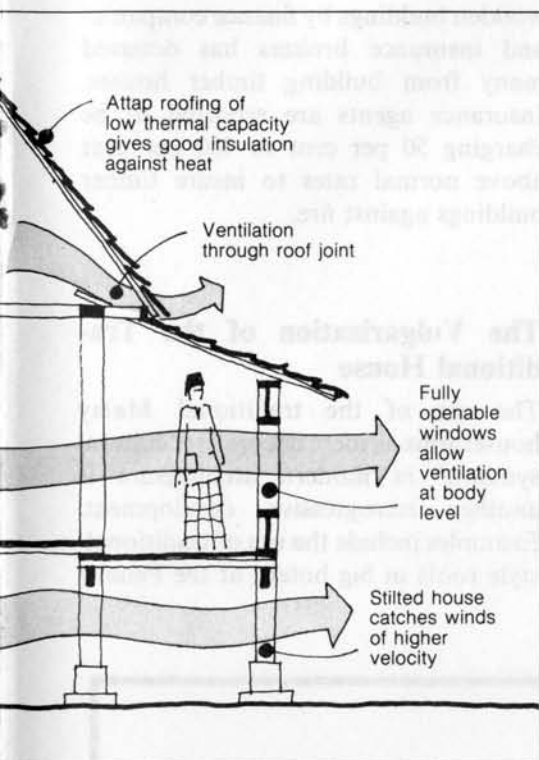
whereby extensions are added on to the basic core house. The basic building blocks of the addition system are lean-to houses of various sizes, which are built in juxtaposition to the main building.

The new extensions may be built at various stages and times, as and when the need arises, for instance when the family grows in size. The system grew out of the needs, means, constraints and socio-economic circumstances of traditional Malaysian villagers. It is not only sound in terms of design, construction and aesthetics, but it also causes minimal disruption to the original house.

The traditional Malay house is the creature of a rural society, where the main economic activities of the people are farming and fishing. The seasonal patterns of work leave the villagers with much spare time for housebuilding, mending nets and boats, making household implements and doing other part-time economic activities. The addition system is well-suited for this seasonal pattern of work, facilitating house building during the off-seasons, and thus allowing houses to be built up gradually at a pace controlled by the householder.

The addition system also fits well

Design: vs Modern



Cross Ventilation

◀ The elongated open plans of the traditional Malay house allow easy passage of air and good cross ventilation. There are minimal interior partitions in the Malay house which restrict air movement in the house.

▶ Plans of housing estate houses are of more complicated shapes, and the partitioning of the house into different rooms and areas restrict air movement and cross ventilation in the house.



Overhangs and Exposed Vertical Areas

◀ Large overhangs and the low exposed vertical areas (windows and walls) in the traditional Malay house provide good protection against driving rain, provide good shading, and allow the windows to be left open most of the time for ventilation.

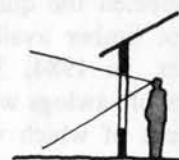
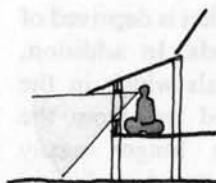
▶ The higher and larger exposed vertical areas of the windows in the modern house are often penetrated by direct sunlight and cause considerable discomfort. The walls which act as direct sun-shading devices get heated up and in the evenings reradiate heat into the interior areas.



Glare

◀ Glare in the traditional Malay house is controlled by large roof overhangs and low windows which exclude the open skies from the visual field. Glare is also lessened by the less reflective natural ground covers and wooden walls of neighbouring houses.

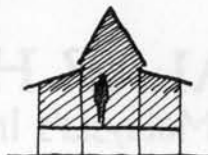
▶ Glare is usually more evident in the housing estate house due to the open skies which are not excluded from the visual field because of the use of bigger and higher unshaded windows. Glare from paved concrete areas and brightly lit exterior walls of other houses also causes considerable discomfort.



Lighting Level

◀ The traditional Malay house tends to be underlighted. This gives the psychological effect of coolness. The underlighting, however, can be remedied by artificial lighting.

▶ Lighting levels in the housing estate house are generally higher than the lighting levels in the traditional Malay house because of the use of lighter coloured paints and the location of windows at higher levels. In fact there is a tendency towards overlighting and uncontrolled glare.



with the economic means and needs of villagers. Additions can be made to the house as a family accumulates savings over time, or as the family needs grow larger, or simply because of a desire for a larger dwelling place. By thus allowing the householder to build according to his financial resources over time, the addition system does not commit him to debt.

The addition system in the traditional Malay house is not an *ad hoc* system of extensions like those made to modern houses and other non-traditional houses such as the spontaneous squatter house. On the contrary, it follows certain well-

established principles that integrate the extensions well with the *rumah ibu*, which forms the central core of the house.

Under Threat

The traditional Malay house is undergoing many changes and its continued existence is under constant threat. The economic and sociocultural values promoted by modern development have lowered the status of traditional Malay houses, which are being vulgarised and replaced by modern houseforms. The use of appropriate local building materials and

the coherent and holistic design principles of the traditional Malay house are being undermined by modern influences.

While house styles should change to fit the changing needs of householders, modern changes in the Malay houseform are disruptive and inappropriate because they are often imposed as a result of external pressure and are not understood by the local communities. Moreover, the changes often disregard local socioeconomic, cultural and environmental conditions.

A major cause of this problem is the erosion of confidence in local tech-

nologies and products as a result of western-style models of development. The bias towards modern science and technology by policy makers, academics, researchers and professionals has led to the neglect and decline of local technologies and cultural forms. In the case of the traditional Malay house — and wooden houses in general — their status is lowered by the overglorification of western-style houseforms and modern building materials. Mud buildings which provide shelter for more than half the population in the developing countries of Asia, Africa and the Americas have also come under the same threat, due to the low status accorded to mud as a building material.

Besides the problem of the low status of wooden houses, there are various other reasons for the decline in the popularity of wooden houses in Malaysia. First, the Malaysian timber industry is heavily export-oriented. This has affected the quality, quantity and cost of timber available for the local market. In 1984, 31.1 million cubic metres of sawlogs were produced, 53.4 per cent of which was exported. The export-oriented timber industry has



Elaborate carvings and grilles are found in various parts of traditional Malay houses, as can be seen from the example above.

pushed up local timber prices and since most of the high quality timbers are exported, the local market is deprived of high quality hardwoods. In addition, many building materials which in the past could be gathered free from the environment are no longer easily accessible because of the despoliation

caused by the encroachment of development projects and agriculture.

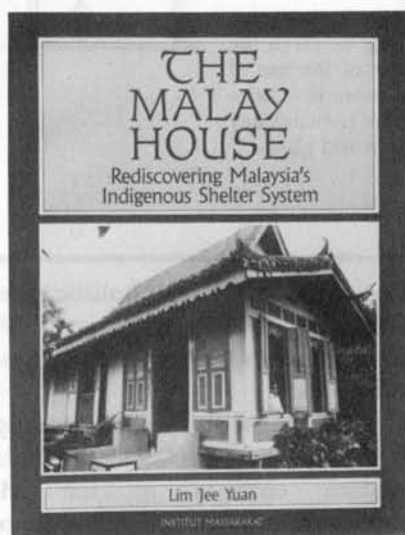
Secondly, restrictive, archaic and over-stringent building by-laws to control fires have deterred the building of timber houses in the urban areas. The uniform building by-laws, which were based on British Standards, demand a high degree of treatment of the timber. Unless the timber used meets these requirements, the house would be classified as a temporary dwelling.

Thirdly, the discrimination against wooden buildings by finance companies and insurance brokers has deterred many from building timber houses. Insurance agents are reported to be charging 50 per cent to 400 per cent above normal rates to insure timber buildings against fire.

The Vulgarisation of the Traditional House

The use of the traditional Malay houseforms as mere decorative 'cultural symbols' in modern architecture is another retrogressive development. Examples include the use of traditional-style roofs in big hotels, at the Penang

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THE MALAY HOUSE

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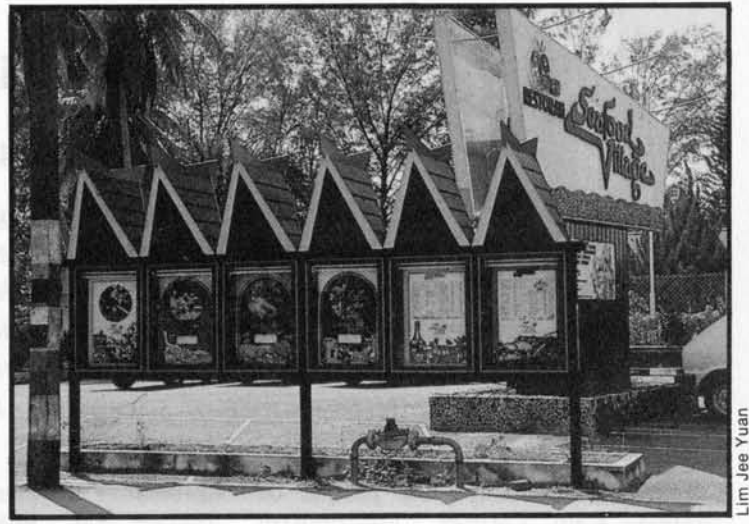
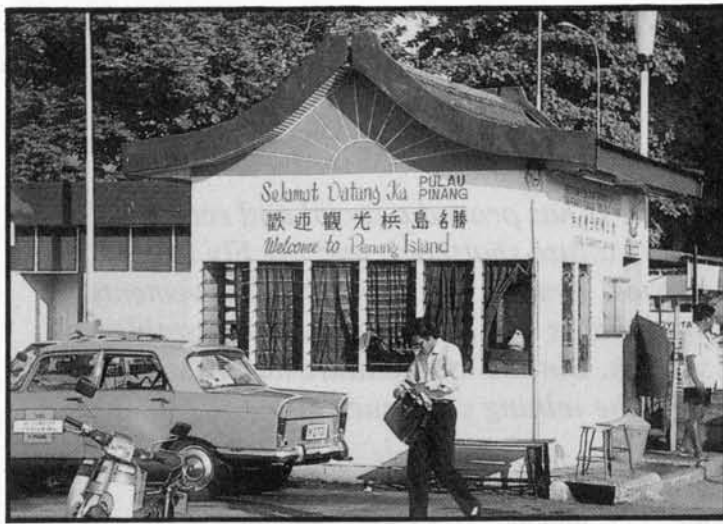
THE MALAY HOUSE book brings to you one of the finest and richest components of Malaysia's cultural heritage.

Fully illustrated by over 250 full-colour photographs and three-dimensional drawings, this book documents the architecture of the Malay house, giving details of the various house-types, the construction systems, the climatic design and the adaptations of the house to the social and cultural needs of the Malays. It also traces the many forces that are working against the survival of this excellent housing solution.

The Malay house is extremely well designed to suit the warm and humid Malaysian climate and also for the optimal and multi-functional use of space. It also has a sophisticated and flexible construction system which allows the house to be extended to meet the growing needs of the family.

This book is essential for those interested in Malaysian culture, indigenous architecture and the future of housing for people in the Third World.

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Modern architecture has reduced the traditional Malay houseform to a vulgarised, ugly "symbol", used (left) to promote a commercial restaurant and (right) a taxi stand.

Airport complex, at the Bank Bumiputra headquarters in Kuala Lumpur, at other commercial and recreational buildings, and even the local police bases and taxi stands. This attempt to create a 'Malaysian' architecture is not only superficial but vulgar. The traditional Malay house has been brought down to the most simplistic and vulgarised form — reduced to a mere decoration, and denied its deeper cultural significance.

The Threat of Building By-Laws

Another threat looming over the traditional Malay house is the imposition of inappropriate building by-laws in the rural areas. In 1978, the Penang State Government, for example, drafted laws to bring rural areas under the jurisdiction of building by-laws which were formerly applicable only in urban areas. The by-laws were drawn up with modern, urban buildings in mind and were wholly unsuited to rural houses, which are predominantly of traditional design.

The traditional Malay house is designed, managed and financed by those who actually live and work in it. It is built by the householders themselves and by village carpenters. But the building by-laws require that formal building plans be drawn up and approved by the local authorities before a house can be built or extended.

Such plans have to be prepared by registered architects, very few of whom have any deep knowledge of traditional Malay houses. In rural areas where the rate of poverty is high, most villagers cannot afford the expensive services of architects. Besides, traditional Malay house users and carpenters do not build

according to plans but by experience: indeed, many are unable to read or to follow formal house plans. Consequently, commercial contractors from the urban areas have to be employed to construct the house according to plans.

This goes completely against the underlying ethos of the traditional Malay house where the user controls the design and construction of the house. Indeed the extension of the by-laws poses a serious threat not only to the continued existence of the traditional Malay house, but also to those involved in its construction — namely, the carpenters, craftsmen, attap weavers and others who will eventually be displaced by contractors, developers and professionals. This erosion of traditional skills is one of the most destructive aspects of the demise of vernacular building for it threatens the very existence of the informal housing sector that at present provides three-quarters of the houses in the Third World. Indeed, according to Constantin Doxiadis, a Greek architect, only 4 per cent of the world's buildings receive any input from trained architects.

Inappropriate Materials

The use of modern materials like zinc, asbestos, cement, bricks and louvre windows have significantly changed Malay houseforms. Zinc and asbestos are replacing the attap roofs, creating very hot and cold interiors in the daytime and night respectively and also very noisy interiors when it rains. They also allow the creation of complicated hybrid roofs which are difficult to be roofed by attap. These modern roofing materials are unsuitable for the Malay

house because of their high thermal conductivity and because the low roofs of the Malay houses have no ceilings.

The use of cement and bricks has significantly changed the traditional Malay house: most notably, the kitchens have been dropped from being on a raised platform on stilts to being on ground level. Such extensions change the proportions, scale and character of the house creating a more solid looking building, uncharacteristic of the traditional house which is light and airy.

Louvre windows have replaced the traditional full-length wooden windows which opened fully. By contrast, the louvre windows, with their iron bars, create a barrier which diminishes proper ventilation and obstructs the view. Modern furniture has also cluttered up many traditional Malay houses which have been known for their large open and uncluttered interiors.

Conclusion

Ecologically, culturally and economically, the traditional Malay house — like indigenous houses everywhere — is being crippled and destroyed by modern development. Replacing it are houses which are both anti-people and anti-environment. For the ethos behind the traditional Malay house is very different from that behind modern housing: it represents a conservator culture rather than a consumer culture; use value as against exchange value; decentralisation as against centralisation; and basic needs as against luxury needs. Such values are critical to the future of the Third World: it is vital that they are rediscovered before they can be destroyed by the maelstrom of modern development.

Ok Tedi: New Guinea's Disaster Mine

by David Hyndman

Ok Tedi is the South Pacific's largest mining project. It has proved a social and ecological disaster. The local people have been alienated, their culture shattered, and the Fly River is now heavily polluted with chemical and other wastes. Among the major cult movements which have emerged in response to the social upheaval is one which seeks to re-establish traditional social values—at present with some success. But the local culture has little long-term chance of survival so long as the mining continues.

For the Mountain Ok people of central New Guinea, colonialism started in 1948, when an Australian patrol post was opened near the "Telefolip", the region's most sacred cult house and focus of cultural identity.

In 1964, the Olsobip patrol post was opened to administer the Wopkaimin and the other southern Ok peoples. In that year, Patrol Officer Hoad declared that the Wopkaimin were "so far removed from and devoid of resources that they simply have no potential for development." However, the first census, completed in 1966, reported that some streams seemed to contain deposits of copper, and early in 1968, Kennecott, the American transnational, took out prospecting authorities on Wopkaimin land. Later that year, Patrol Officer Eggleton observed that western clothing, tobacco, steel axes and knives and Melanesian Pidgin English had spread rapidly among the Wopkaimin, as well as amoebic dysentery which had killed five to six per cent of the population.

Mining a Mountain

The economic "development" of Wopkaimin land and the exploitation of their resources started with Kennecott test drilling on Mt. Fubilan in 1969, the location now commonly referred to as the "Pot of Gold" (from the title of the popular book about the project written by the geographer Richard Jackson). To the Wopkaimin, Fubilan is a sacred mountain, sitting on top of the land of the dead. To the exploration geologists, it was a 2000-metre peak of hidden resources. Exploration determined that an extremely

ambitious engineering project could convert Mt. Fubilan's 137 million tonnes of ore (containing 0.88 per cent copper with 0.66 grams per tonne of gold) into a profitable mining project.

The plan envisioned a three-stage extraction process whereby gold would be taken from the top of the mountain for about the first five years; then gold and copper would be removed from the middle of the mountain for the next five years; and finally, over a remaining period of some twenty years, copper would be extracted until the mountain was transformed into a 1200-metre deep mining pit. The mined copper was to be transported to a mountain mining town, Tabubil, and trucked and piped more than 150 kilometres to Kiunga on the Fly River, to be put on barges for transport to a new ocean port at the mouth of the Fly.

Mining Begins

Kennecott never mined the pot of gold. Having their copper mines in Chile nationalised by the Allende government frightened Kennecott into abandoning the Ok Tedi project shortly before Papua New Guinea achieved independence in September 1975. However, soaring gold prices led to the creation of a transnational consortium, Ok Tedi Mining Limited (OTML), in 1981 (with Papua New Guinea taking a 20 per cent share; Australia's Brokenhill Pty. Ltd. and America's Amoco taking 30 per cent each; and a German industrial conglomerate taking 20 per cent). The project has been nothing short of an environmental disaster. Weak protection plans, coupled with a long series of ecological disasters starting in 1984, have endangered the natural resources which sustain over 40,000 indigenous peoples living near the Ok Tedi and Fly Rivers.

Pollution

At best, pollution from suspended sediments and heavy metals exceeds US Environmental Protection agency standards by 10,000 per cent and threatens subsistence staples (such as fish, crustaceans, turtles and crocodile) and gardens and sago palms growing along the riverbanks and backswamps. In January 1984, a 50 million tonne landslide, measuring over one kilometre, on the Ok Ma River destroyed all prospects of a permanent tailings dam as a limitation to pollution problems. Sediment, tailings, and chemical wastes (including cyanides, copper and other metals) are routinely discharged into the headwaters of the river system. Meanwhile, a barge transporting OTML chemicals overturned in the Fly River estuary on the 14th of June, 1984, losing 2,700 60-litre drums of cyanide, the single largest loss ever of one of the world's most dangerous poisons. Only 117 cyanide drums were salvaged. Five days later, a by-pass valve was left open for two hours and twelve minutes, releasing 1,000 cubic metres of highly concentrated cyanide waste into the OK Tedi River, a spill which OTML was silent about for two weeks until dead fish, prawns, turtles, and dead crocodiles started appearing far downstream of the mine.

Leasing away the Future

The Wopkaimin initially lived away from the Kennecott prospectors and continued to maintain their own subsistence autonomy in their Kam Basin homeland. When the prospectors arrived, the Wopkaimin surrendered small portions of communally-owned land in expectation of receiving western food, medicine, money and beer. They continued to do so willingly because they perceived the promised employment, education and health facilities as beneficial, but they had no

Dr. David Hyndman is senior lecturer in Anthropology at the University of Queensland. He has 15 years of research experience with the Wopkaimin people.

clear idea of the requirements of the Ok Tedi project or of the substantial impact it was to have on their way of life and lands.

OTML eventually leased 16,530 hectares, with the Wopkaimin alone losing 7,000 hectares, or more than seven per cent of their land. In return, the 700 Wopkaimin receive a cash payment of about one dollar per day per person and an equivalent sum that is placed in a communal trust account.

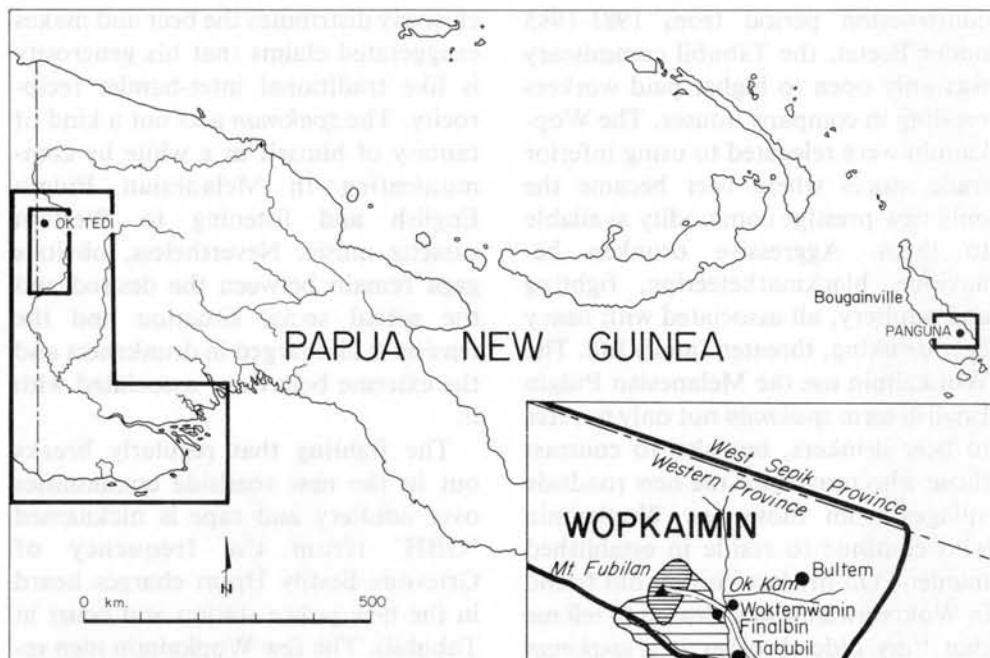
The Wayside Villages

About a dozen Wopkaimin workers and their families lived for several years in Tabubil until 1981, when Bectel, the American transnational, transformed the entire surrounding plateau into an instant township with over 5000 construction workers. As white executives and their families moved into Tabubil, all Wopkaimin workers with their families were forced into Woktemwanin and Finalbin, two temporary base camps for sago processing and hunting and fishing expeditions which quickly grew into major roadside villages. Although about half the Wopkaimin remained in their traditional hamlets during the first year of construction, almost every family had moved by 1985 to the new roadside villages, each of which had over 350 residents. By Wopkaimin standards, their two new roadside villages are extremely congested. Residents are predominantly Wopkaimin but include other Ok peoples, especially the Telefolmin. Non-Wopkaimin are permitted to reside in the roadside villages but not to hunt or garden, so they are totally dependent on buying food and other commodities for their subsistence.

Villagers use the term *corners* to refer to the discrete neighbourhoods that make up each roadside village. Corners have been reformed around previous residential and descent group affiliations. Each corner has a trade store and commodities like rice and tinned meat and fish have become dietary staples. Between the 1970s, when they were entirely "subsistence-oriented" and self-sufficient in food, and the 1980s, the Wopkaimin have become increasingly dependent on a diet without "subsistence" foods.

Cultural Breakdown

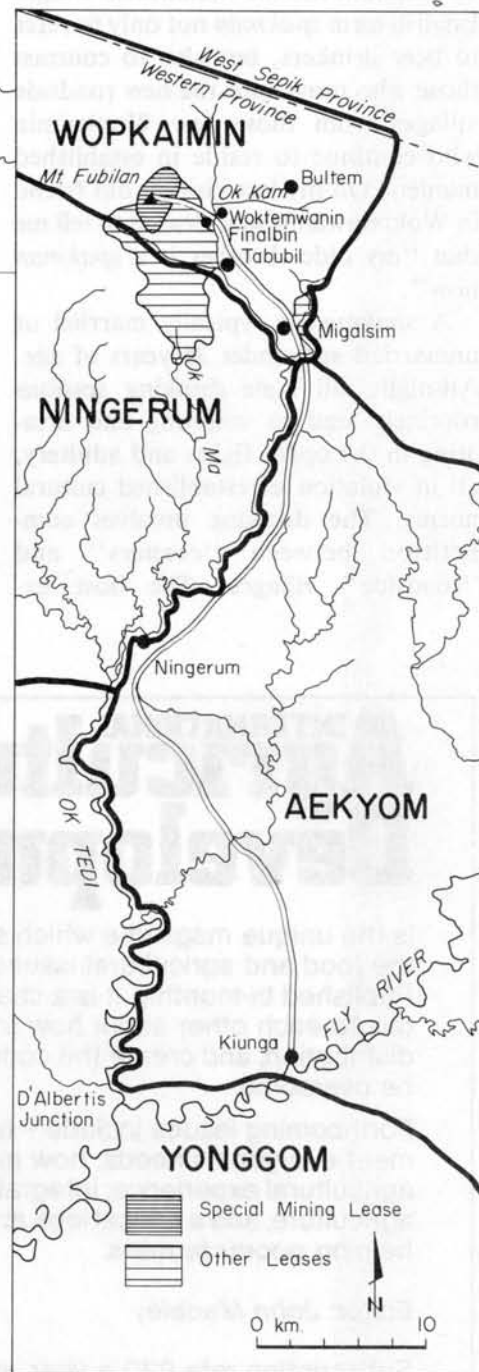
In the new roadside villages, there is an ongoing breakdown of many as-



Map (above) showing the location of the Ok Tedi and Panguna mining projects in Papua New Guinea. (Right) Map showing Wopkaimin land and roadside villages near the Ok Tedi mine.

pects of Wopkaimin culture as well. Traditionally, Wopkaimin culture was centred on male reciprocity. The Wopkaimin believed their way of life was founded by the 'great mother' Afek, who built their most sacred cult house, the *Futmanam*, second only to the *Telefolip*. The *Futmanam* integrates the Wopkaimin into a male initiatory cult. It is a permanent sacred site where youths are housed and transformed into men. Great mother Afek nurtures her Wopkaimin children, in return for their maintaining the sacred relics and performing rituals and animal sacrifices to the ancestors inside the *Futmanam*. Reciprocity among initiated men ensures prosperity for all. The *Futmanam* excludes women, and in fact men and women reside separately in women's houses and the men's-house, instead of in family units. Elaborate prohibitions specify food acquisition and consumption by gender. Reciprocity between different hamlets is mediated through the Afek cult complex.

In the new roadside villages, however, families live together and the men no longer have a men's house in which to congregate at the expense of conjugal ties. Food is no longer segregated by gender and all food prohibitions have been abandoned. Household sovereignty in consumption reverses the Afek cult pattern of inter-hamlet reciprocity. Foods are com-



modities to be sold rather than shared, even among "corner" residents.

Alcohol: A Major Problem

Major social problems were spawned in the new roadside villages with the introduction of alcohol, absent in traditional Wopkaimin diet. During the

construction period from 1981-1985 under Bectel, the Tabubil commissary was only open to higher paid workers residing in company houses. The Wopkaimin were relegated to using inferior trade stores where beer became the only new prestige commodity available to them. Aggressive drunken behaviour, blackmarketeering, fighting and adultery, all associated with heavy beer drinking, threaten family life. The Wopkaimin use the Melanesian Pidgin English term *spakman* not only to refer to beer drinkers, but also to contrast those who move into the new roadside villages from those few Wopkaimin who continue to reside in established hamlets. On my last visit an old friend in Woktemwanin was pleased to tell me that "my older brother is a *spakman* now".

A *spakman* is typically married or unmarried and under 35 years of age. All-night, all male drinking sessions routinely lead to vomiting and urinating in the open, fights and adultery, all in violation of established cultural norms. The drinking involves competition between "corners" and "roadside" villages. The host ex-

clusively distributes the beer and makes exaggerated claims that his generosity is like traditional inter-hamlet reciprocity. The *spakman* acts out a kind of fantasy of himself as a white by communicating in Melanesian Pidgin English and listening to Western cassette music. Nevertheless, obvious gaps remain between the desired and the actual social situation and the tension is discharged in drunkenness and the extreme behaviour associated with it.

The fighting that regularly breaks out in the new roadside communities over adultery and rape is nicknamed 'GBH' (from the frequency of Grievous Bodily Harm charges heard in the new police station and court in Tabubil). The few Wopkaimin men remaining in their traditional hamlets view becoming a *spakman* with ambivalence because they are fearful of subjecting their wives to GBH, while the *spakman* living in the roadside village is fearful that if he leaves temporarily to garden and hunt, his wife, left alone, will likewise be assaulted.

Money now enters prestations at marriage. One Woktemwanin man has

already paid 3500 kina for a second Wopkaimin wife and another has paid 9000 kina for a wife from Central Province. Women are becoming ranked according to inflated money prestations at marriage, and marriage manipulation has become a form of business development, devaluing women in the eyes of their men and themselves. Adultery and prostitution have become easier as women's sexuality is alienated from themselves and controlled by men.

An Alienated Workforce

The lack of experience in mining and construction work relegates Wopkaimin men to a peripheral, unskilled wage-earner role in the Ok Tedi project. Although over half of the Wopkaimin men worked for Bectel during the construction phase, in early 1983 the Wopkaimin went on strike protesting both against outsiders taking semi-skilled employment they perceived themselves as capable of performing, and against whites and other Papua New Guinean nationals moving into Tabubil with their families whilst they were forced to move to the new roadside villages. The Wopkaimin returned to work after receiving higher wages but their other grievances remain unsettled.

The death of a construction worker from the Central Highlands precipitated another protest strike by the Wopkaimin. The man was killed when he was thrown from his vehicle (which lacked seatbelts and doors) during a road accident. Wopkaimin workers went on strike with other Papua New Guinean nationals demanding immediate improvement in safety conditions and compensation for the dead man.

For the Wopkaimin, the confrontation was an occasion to express their resentment against the inequality of their new status. Earlier, complaints over safety concerns were dismissed by white bosses with *yu husat manki*, a Melanesian Pidgin English phrase implying they were only boys and not entitled to complain. Safety helmets symbolically mark status; yellow ones are worn by unskilled Wopkaimin workers and white ones are worn by white bosses. During the confrontation the Wopkaimin insisted that whites throw their helmets in the mud, asserting that helmets are for safety not for status.

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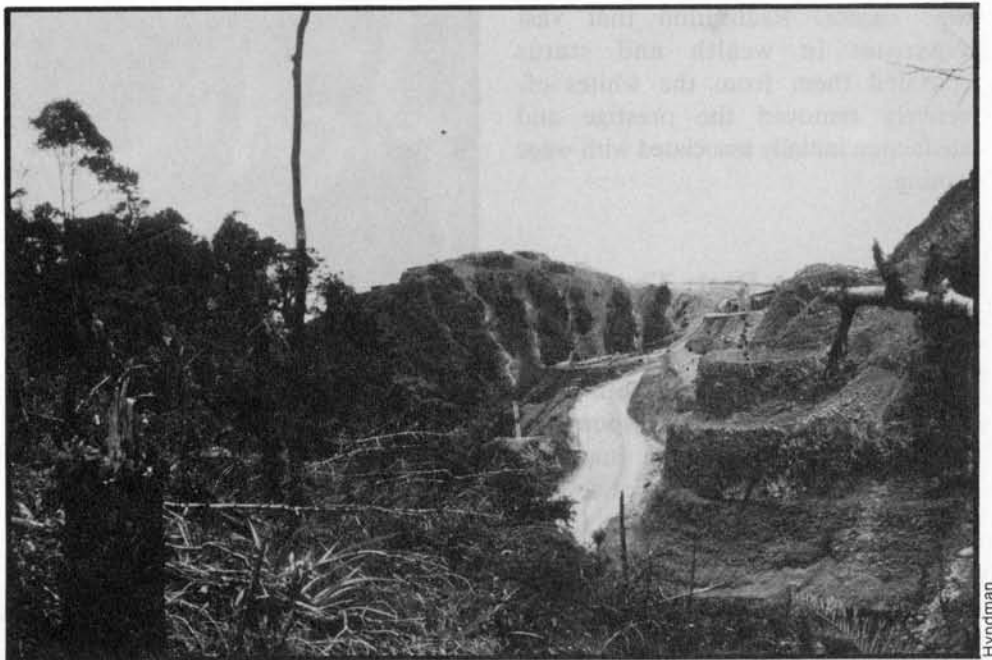
Growing Conflict

By 1988, squatters from the Enga and Southern Highland Provinces in the Central Highlands had settled near the mine without permission of the Wopkaimin landowners. The murder of a Telefomin man by the squatters early in 1988 precipitated another protest strike. Over 300 of the Wopkaimin felled trees over the mine road and again closed the project demanding that squatters be repatriated back to the Central Highlands; that contracts for the mine be given to Ok peoples; and that more mining jobs be localised. Prime Minister Paius Wingti ordered Wopkaimin leaders to be arrested and the project to be reopened. Leaders from the Western and North Solomons Provinces, where the Ok Tedi and Panguna mining projects operate, were highly critical of the Prime Minister's actions. The premier of the Western Province, Nobert Makmop, stated: "Mr Wingti seems to be trying to suppress the domestic rights of the people to air their grievances". Michael Laimo, a Member of Parliament from North Solomons, declared, "The decision demonstrated the irresponsible attitude of the national government towards the ordinary citizens of PNG who struggle to protect their environment from foreign exploitation".

A limited number of Wopkaimin men have become white helmet workers and have all been allocated houses in Tabubil. The Wopkaimin are distrustful and suspicious of these men and tend to view their white helmet status as a contradiction in terms. One white helmet worker exploits the ambiguity of his status, by using his "broker" position to build personal wealth through the control of the largest trade store in Woktemwanin. This only succeeds in alienating further the villagers, who do not feel that local entrepreneurs enhance their quality of life ("the *spakman* lives off compensation and gardens, the businessman lives off everyone").

"The Place Without Work"

Once Bectel departed in 1984, with the phasing out of construction and the phasing in of gold processing, the Ok Tedi project became known to the Wopkaimin as the "place without work". However, even before gold processing started, many Wopkaimin men became dissatisfied with the role of unskilled

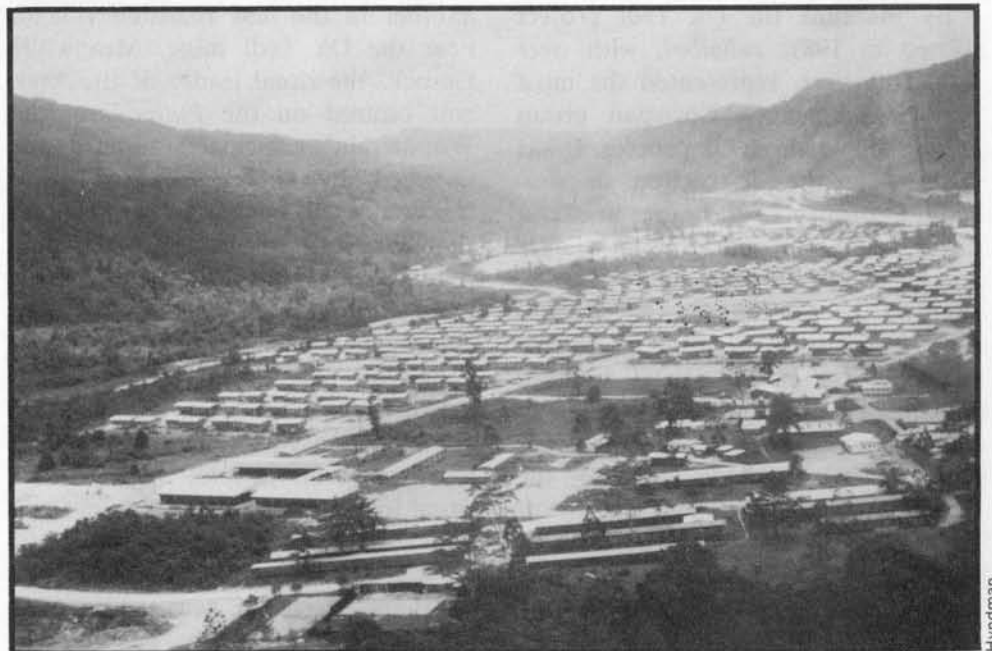


Hyndman



Hyndman

(Top) Mining begins on the tip of Mount Fubilan. (Middle) A new roadside village: fighting, drunkenness and prostitution plague the new villages as traditional cultural values break down. (Bottom) Tabubil Mining Town has brought an influx of over 5000 outsiders.



Hyndman

wage earner. Realisation that vast disparities in wealth and status separated them from the whites effectively removed the prestige and satisfaction initially associated with wage earning.

Destroying the Past: The Rebaibalists

Two disparate social movements have emerged among the Wopkaimin and other Ok peoples, in response to the colonial and economic invasion. Following the establishment of a Bible College by the Baptist mission in the Ifitaman Valley, a spectacular local evangelical movement emerged among the Telefomin people. Many abandoned the Afek cult and replaced it with an indigenous Christian revival movement, commonly referred to as "*rebaibal*" in Melanesian Pidgin English. Collective ecstatic outbreaks first occurred among the Telefomin, especially the women, in 1974. And, in 1977, a Telefomin student of the Bible College experienced ecstatic seizures, triggering mass seizures, body shaking, crying, glossolalia, prophecy, healing and exorcism and the rapid spread of *rebaibal* as the first popular indigenous acceptance of Christianity. *Rebaibal* completely rejects Afek and established cultural patterns. Cult houses and sacred objects are destroyed and formerly secret knowledge is revealed. Gender roles are altered and women acquire more equal terms. Food prohibitions and the reciprocity of the Afek cult are abandoned in favour of nuclear families, working, residing and consuming together.

By the time the Ok Tedi project started in 1981, *rebaibal*, with over 3000 followers, represented the most popular indigenous Christian group among the northern Ok peoples. It has resulted in the destruction or desecration of men's cult houses in over a dozen Telefomin and Tifalmin villages and the end of the traditional system of regionally organised initiations, centred on the Telefomin's supremely sacred *Telefolip* cult house. *Rebaibalists* argue there is nothing in the Afek culture relevant to the problems posed by money, especially the development of the Ok Tedi project. An underlying theme of the *rebaibal* ideology is to legitimise *household autonomy* in opposition to *community reciprocity* in the use of cash.



Gesock, the ritual leader of the Wopkaimin, and the man who heads the movement to revive the traditional culture.

Reviving Traditional Culture

The Wopkaimin never experienced missionary proselytising from whites but *rebaibalists* from the Telefomin to the north, and Catholic catechists from the Enkaiakmin to the east, are now competing for converts with one another in the new roadside villages near the Ok Tedi mine. Meanwhile Gesock, the ritual leader of the Afek cult centred on the *Futmanam*, the Wopkaimin's principal cult house, was appalled by the *rebaibalists*' destruction of cult houses. In the 1980s, as the Wopkaimin established their roadside villages near the mine, Gesock insured his followers continuing commitment to traditional belief and ritual by establishing interpersonal networks, manipulating the flow of secret and sacred information, and reaffirming his peoples' belief in the ritual legacy bequeathed to them from Afek. He hosted a major refurbishment ceremony of their *Futmanam* in 1981 and started a new sequence of male initiations in 1983.

Gesock also organised construction of a new helmet near the mine, at Bombakan, along traditional lines, with residentially segregated women's houses and a men's house. A core of over thirty residents have moved from the roadside villages to live with Gesock in Bombakan, and others visit or live nearby. Bombakan is like a safety valve from the new stress of life in the roadside villages. Previously, the Wopkaimin only came together for short-term rituals, but the new roadside communities have been maintained for a much longer time, creating significant social stresses among those forming them. By decentralising to Bombakan, the Wopkaimin not only relieve these stresses but are reforming their relationships with the transnational intruders into patterns comprehensible to them in terms of the established obligations of the Afek cult which underlie their own social relationships. The Wopkaimin are reinstating established patterns of interhamlet reciprocity in Bombakan and establishing extensive subsistence gardens in the vicinity. Many value decentralisation as a way of ensuring that their boys are initiated and of preventing the loss of cultural knowledge, particularly that relating to ritual and to traditional subsistence cultivation.

A Conflict of Cultures

The future prospects for the two social movements among the Wopkaimin is uncertain. Currently, the indigenous Christian movement, started by the *rebaibalists*, and the decentralisation movement, started by Gesock, do not interact in common social protest over the intrusion of the Ok Tedi project; rather they are mutually exclusive. The *rebaibalists* started precisely because they rejected the past in favour of rapid development. The Wopkaimin instead are protesting against the consequences of rapid development. They find little appeal in the *rebaibalists*, not only because they threaten the Afek cult, but also because they wish to unite the Ok peoples into a separate province under Telefomin leadership, which jeopardises the status and leadership the Wopkaimin now exert regionally as the indigenous land owners of the mine. The *Futmanam* continues to provide the Wopkaimin with cultural identity as a people and to elevate their status in the regional system of male initiations.

"The state is committed to transnational mineral extraction and it appears the Ok Tedi project will continue early into the next century."

In December 1984, the Wopkaimin refused to allow OTML to acquire new leases upstream of the project for possible relocation of the collapsed dam. The Wopkaimin pointed out that compensation was inadequate for the land which OTML had already destroyed; that the proposed new leases threatened their ancestral heartland; and that the Bombakan hamlet and their new gardens were at the confluence of the Ok Tedi and Ok Kam Rivers, upstream of the project. Through decentralising and continuing their commitment to the *Futmanam*, the Wopkaimin are carrying past traditions forward to retain a sense of cultural identity.

The Mining Continues

Because of low world prices in copper, OTML did not want to proceed to "Stage Two" of the project once they had stripped the gold from Mt. Fubilan in 1985. The PNG Government thus forced the project to close for several months, insisting that OTML and other transnationals honour their contractual obligations. Eventually OTML reopened the project, implementing the second stage and two more decades of copper mining and state royalties. The motivation behind Prime Minister Wingti's decision in 1988 to use the police force to suppress Wopkaimin grievances against continuing squatters, social disturbances and environmental pollution is expressed in his statement that

"investor confidence and the country's credibility would be affected deeply but at least the investors know that the government is firm".

The state is committed to transnational mineral extraction projects and it appears the Ok Tedi project will continue early into the next century. So far, the Wopkaimin have retained autonomy for self-determined cultural policies and choices. Whether they can successfully withstand another two decades of impact from the Ok Tedi project remains to be seen.



(Above) The Futmanan cult house in Bultem, after the 1981 refurbishing ceremony. Many cult houses have been destroyed by members of the *rebailalist* movement, which is opposed to all things traditional. (Below) The Mafumbam initiation ceremony in Bultem. (Bottom) Paradise Lost: Bakonabip hamlet in the Kam Basin, with Mount Fubilan in the background.



From Fragmentation to Wholeness: *A Green View of Science and Society (Part:II)*

by Alwyn Jones

Quantum physics has undermined the classical view of sub-atomic reality, revealing a world whose parts cannot be understood separately from the whole but only in terms of the interrelationships between them. As such, quantum theory both complements and reinforces the message of the ecological movement, which sees Nature as a delicate web of interconnections. Indeed, the two levels of reality are best reconciled by adopting a 'Green Perspective'.

There is no doubt that the developments in physics in the twentieth century are deeply indebted to the work of Einstein. But, despite his reformulations of Newtonian physics in the special and general theories of relativity, he nevertheless retained an unshaken belief in an ultimately determined world.^{1,2} This set him apart from quantum theory which posed the greatest threat to the classical world view.

Quantum Theory

Quantum theory relates to the *sub-atomic* world. It was a presupposition in classical physics that the basic building blocks of the universe were *material* particles, that is atoms. But the work of Rutherford and others at the beginning of the twentieth century showed that, far from being solid material particles, atoms consisted mainly of space in which an infinitely small nucleus was orbited by other tiny particles, known as 'electrons', which are bound to the nucleus by electromagnetic forces. Not only are particles in a state of continual motion, and here there is consistency with the classical view, but they also show propensities to interact with other particles on the basis of a never-ending series of energy exchanges. This is a fundamental aspect of sub-atomic reality; instead of the classical view of particles being *externally* related together to make the whole, we have a new picture emerging of *reciprocal interrelationships* in a dynamic process in which the parts are *indistinguishable* from the whole.

The notion of energy exchanges needs some explanation. According to Zohar, quantum theory has shown that the orbit of an electron represents a given 'energy state', but if it is to change its state

"it (the electron) must first either absorb or give off some energy, and it must do so in units of *discrete quanta*. And since the energy to be absorbed or radiated itself exists only in discrete units, it follows that the movements of the electrons from orbit to orbit would have to be represented as a series of discrete jumps instead of (continuously) as would have been supposed in any model offered by classical physics".³ (my italics)

Cause and Effect

The discovery that changes in the sub-atomic world take place spontaneously and unpredictably in discontinuous quantum jumps, or 'jerks', as Zohar puts it, contravenes the widely held view in classical physics, and in science as a whole, that change is continuous along chains of causation,

in which effects follow causes smoothly and sequentially in even flowing linear time. This notion of causation is the 'bedrock' of modern science and reflects what Zohar calls the "real life movement" of continuous events which underlies human experience in the everyday macroscopic world.

The discontinuity revealed by quantum theory represents for Zohar a "fundamental conceptual change" by making explicit the inconsistencies between the microscopic and macroscopic visions of reality. Moreover, it highlights the point at which the two perspectives are perhaps at their greatest variance: the issue of causation.

The critique of causation implicit in quantum theory can be understood by reference to three *interconnected* themes: (1) the 'Uncertainty Principle'; (2) 'Wave/Particle Duality'; and (3) 'Non-local Causation'. We shall discuss each of these issues in turn.

The Uncertainty Principle

It was Einstein himself who discovered that particles of light, which he called "photons", could be understood in terms of energy quanta in common with other sub-atomic particles. But the fact that light has this property immediately poses a problem for the observer who wishes to locate simultaneously the position *and* the momentum of an orbiting electron. In the very act of observation, light must be transmitted to the electron if it is to be observed: but the absorption of the photon by the electron energizes it so that it immediately changes its momentum. In such circumstances, one can locate its *position*, but one will not know its *momentum*. Conversely, by reducing the light quanta one will be able to discover the electron's *momentum* but will blur its *position*.

The outcome of this dilemma is what has become known as Heisenberg's 'Uncertainty Principle':⁴ we can never establish *both* the location and the momentum of a sub-atomic particle. The observer is thus forced to make a choice between one or the other, but, as Zohar says, knowledge of both is necessary if we are

"to say anything meaningful about the electron's movement. And that is the nub of the 'Uncertainty Principle': that at a certain level of reality we come up against a barrier beyond which it is impossible ever to make a full set of exact measurements, and hence impossible ever to *know* exactly just how the constituents of matter are behaving".⁵

Waves or Particles

The problem is compounded by the dual properties possessed by all sub-atomic particles, including light

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Davies' analogy is a good one for understanding the peculiarities of waves in the sub-atomic world. The notion of a crime wave tells us nothing about the *actual existence* of crime in any *specific* location within the area affected by the wave; it merely indicates its likelihood or degree of statistical probability. We cannot say whether a crime exists, or

"We can never say that an atomic particle exists at a certain place, nor can we say that it does not exist. Being a probability pattern, the particle has *tendencies to exist* in various places and thus manifests a strange kind of physical reality between existence and non-existence. We cannot, therefore, describe the state of the particle in terms of fixed opposite concepts. The particle is not present at a definite place, nor is it absent. It does not change its position, nor does it remain at rest. What changes is the probability pattern, and thus the tendencies of the particle to exist in certain places".⁹ (my italics)

As long as we make the assumption, as classical physics does, that reality is composed of separate and isolated

Full list available on request.

entities, it seems perfectly reasonable to suppose that connections between them, in the absence of any mediating factor, can only be understood in terms of local and immediate causes. Indeed, such a position would seem to be unproblematic and consistent with Hume's notion of "contiguity and succession" at the macroscopic level of reality. But the situation in the microscopic world of sub-atomic phenomena is quite different; not only does quantum theory claim the inseparability and interconnectedness of the part with the whole, but it also asserts that particles have the capacity to spread out in space in wave-like fashion. In such circumstances, everything is connected to everything else and any change in any one part of the whole has, contingently if not actually, an immediate and instantaneous effect on every other part, even though the parts are spatially and temporally distanced from each other. This is what is known as 'Non-Local Causation', or 'Action-at-a-Distance', and reflects, perhaps more than any other points so far made, the indeterministic nature of sub-atomic reality.

Non-Local Causation has been at the centre of a bitter debate since Einstein, Podolsky and Rosen published their critique of quantum theory in 1935 — in the so-called 'EPR Paradox'. Although some experimental evidence^{10, 11} gives support to the principle, perhaps, as Powers¹² has argued, the real issue is not whether non-locality exists — "for it is enough that it has been demonstrated at all" — but how it should be *interpreted*.

It is this question of the *interpretation* of quantum theory which is relevant to our purposes here. Because science and life in advanced industrial society are so inextricably interwoven, it is a central feature of our argument that quantum theory should be interpreted as making an important contribution to a critique not just of scientific epistemology, but of the whole basis of life itself.

The Greening of Science and Society

I have been at pains to emphasise the existence of the *one* reality and the need for a change of perception so that we can grasp this oneness in our consciousness. Quantum theory has shown us that in the microscopic world of sub-atomic phenomena, it does not make sense to say that the whole is composed of separate entities or 'building blocks', and that a knowledge of these will ultimately give us knowledge of the whole. Ontologically speaking, it is only the *whole* which is real; what this implies is a collapse of all dualities — such as cause/effect, subject/object and part/whole — with the emphasis being placed instead on the total interrelationship and interconnectedness between all things. Reality is thus seen as a dynamic process of inextricably interconnected interactions, in which reference to the part must by implication mean reference to the whole. But the apparent mysticism which this perspective implies does not seem to match with our understanding of the world at the macroscopic level of reality. Indeed, it can be argued with

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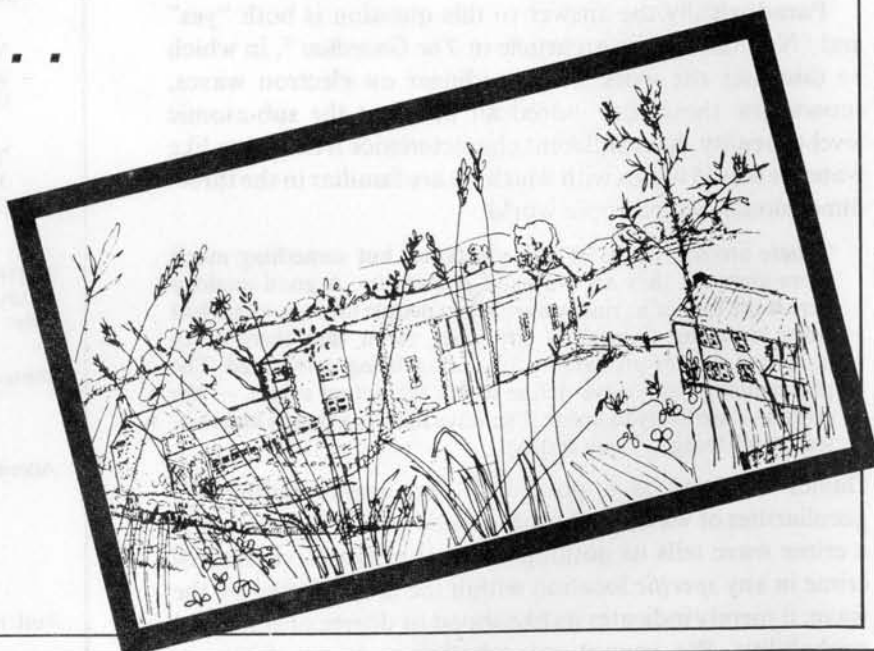


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some justification that the Newtonian world view is consistent with events as they occur in everyday life. For instance, it gives us a basis from which we can predict with some considerable degree of accuracy what would happen if we slipped on the edge of a cliff, or put a hand into the heat of the fire.

But are we justified in making the assumption that knowledge of the microscopic level of reality has little or no relevance in our everyday lives? I would argue that acceptance of the Newtonian world view as a basis for understanding events in the macroscopic world is valid to a superficial level only; once we probe beneath the thin surface of life as we experience it in the material world, and prise open the door to Bohm's implicate order, we begin to see the delicate patternings and interrelationships reflective of the microscopic reality which lies beyond the immediacy of consciousness. And, I would contend, it is through the principles of ecology, and in particular 'deep ecology', or what we are calling here 'the green perspective', that the crucial link between these two different levels of reality can be made. In short, an ecological perspective at the macroscopic level both complements and reinforces our understanding of the microscopic level gained from quantum theory.

Commoner's Laws

In order to set out the broad parameters of the 'green view', we could not do better than allude to Commoner's reference to four broad generalisations, or 'laws', which for him lie at the centre of ecological thought:

- Everything is connected to everything else;
- Everything must go somewhere;
- Nature knows best;
- There is no such thing as a free lunch.¹³

The supposition that "everything is connected to everything else" immediately recalls the point we made earlier in our discussion of quantum theory: namely that parts cannot be understood separately from the whole, but only in terms of interrelationships between them. From this perspective, nature is seen as a delicate web of interconnections between many and various life forms. Each element is dependent on every other element, with change at any one point in the overall set of relationships having implications for the system as a whole. In the words of Commoner:

"Each living species is also linked to many others. These links are bewildering in their variety and marvellous in their intricate detail. An animal, such as a deer, may depend on plants for food; the plants depend on the action of soil bacteria for their nutrients; the bacteria in turn live on the organic wastes dropped by the animals on the soil. At the same time, the deer is food for the mountain lion".¹⁴

But the very method of modern science does not predispose the scientist to such ecological sensitivity. For instance, the use of the controlled experiment in the laboratory means that knowledge of the relationship between specific elements of reality is gained at the expense of knowledge of the whole. Thus it may be shown that a particular chemical is effective against an agricultural pest, but until it is introduced into the environment the overall implications arising from its use cannot be determined. Examples of the impact on the environment of pesticides such as DDT and Dieldrin immediately come to mind, but are too well known to

Industrialization interferes with the ecosystem in a myriad of different ways and on a colossal scale. We need to take into account not just major disasters but also the millions of everyday individual acts which are damaging the environment.

elaborate here. But the point needs to be made that ecology, by emphasizing total interconnectedness in nature, is asserting that there is a fundamental indeterminism at the macroscopic level of reality which parallels that of the sub-atomic world.

Cycles of Interaction

Commoner's second 'law' of ecology that "everything must go somewhere" implies that there is a continual exchange between the different elements of an ecosystem, a process analogous to the energy exchanges between sub-atomic particles. For instance, what is excretion to one creature is food to another; the exhalation of carbon dioxide by animals provides nutrition for plants; and death of individual life forms represents nutrition for bacteria and is the basis of new life. What we find is a never-ending cycle of interactions in which nothing can leave the system and there is no waste. But problems emerge when humans introduce alien substances into the environment, in the mistaken belief that when used they can be thrown away; moreover a broader notion of causation will be necessary if connections are to be established between such actions and their possible effects. It is worth quoting Commoner at length on this point:

"A dry-cell battery containing mercury is purchased, used to the point of exhaustion, and then 'thrown out'. But where does it really go? First it is placed in a container of rubbish; this is collected and taken to an incinerator. Here the mercury is heated; this produces mercury vapour which is emitted by the incinerator stack, and mercury vapour is *toxic*. Mercury vapour is carried by the wind, eventually brought to earth in rain or snow. Entering a mountain lake, let us say, the mercury condenses and sinks to the bottom. Here it is acted on by bacteria which convert it to methyl mercury. This is soluble and taken up by fish; since it is not metabolized, the mercury accumulates in the organs and flesh of the fish. The fish is caught and eaten by a man and the mercury becomes deposited in his organs, where it might be harmful. And so on".¹⁵

We have here an example of an event which is commonplace in the modern world. Industrialization interferes with the ecosystem in a myriad of different ways and on a colossal scale. Thus we need to take into account not just major incidents such as the Chernobyl disaster, but also the millions of everyday individual acts such as the use of the motor car, aerosol sprays and refrigerators all of which may well be making a contribution to the destruction of the ozone barrier which protects all life forms from excessive ultra-violet radiation.

But the indeterminism which we find in nature means that the implications of such intervention are incalculable; indeed, as Commoner's example shows, the link between the purchase of a dry-cell battery and illness from fish poisoning would seem a highly improbable connection at a common sense level. Indeed it is only within the framework of non-local causation that a connection can be made at all; but for that we need not only ecological sensitivity but a deep understanding of the underlying reality in which

intervention at any one point in the system must have implications for the whole.

Nature Knows Best

We shall take the respective points raised by Commoner's third and fourth laws together. For him, "nature knows best" means that any *major* human intervention is likely to have deleterious consequences; and "no such thing as a free lunch" asserts that human actions which deplete the environment for gain, such as drilling oil, mining or deforestation, can only be achieved at a cost. And the more extensive the intervention the greater the cost. The basic assumption underlying the third law is that, over millions of years, the planetary ecosystem has developed mechanisms by which it can maintain itself in a state of stability and balance. By way of example Commoner shows how this balance is maintained in the chemical composition of living systems:

"One of the striking facts about the chemistry of living systems is that for every organic substance produced by a living organism, there exists, somewhere in nature, an enzyme capable of breaking that substance down. In effect, no organic substance is synthesized unless there is provision for its degradation; recycling is thus enforced".¹⁶

But, as the scale of human intervention increases, these delicate mechanisms which serve to maintain stability and balance will be under greater and greater threat. This is Commoner's fourth 'law' and there is an ultimately incalculable factor here: at what point does human intervention have irreversible consequences and thus threaten all life on earth? As Lovelock has argued, humans are an intrinsic part of the living system by which life is maintained: this fact must be recognized so that we will take on responsibility for preserving the earth's life support systems proportionate to the growing power we have over them:

"As the transfer of power to our species proceeds, our responsibility for maintaining planetary homeostasis grows with it, whether we are conscious of the fact or not. Each time we significantly alter part of some natural process of regulation or introduce some new source of energy or information, we are increasing the probability that one of these changes will weaken the stability of the entire system, by cutting down the variety of response".¹⁷

Shallow versus Deep Ecology

Lovelock's point brings us to the distinction we wish to make between what has been called 'shallow' and 'deep ecology'^{18, 19}. 'Shallow ecology', or 'shallow environmentalism' as Capra puts it, is an attitude to the world which puts humans at its centre. Generally speaking, such an attitude reflects the Cartesian division between mind and matter, with nature 'out there' to be used as a resource to meet human needs. Ecological principles are applied in the management and control of the environment so that it can be more effectively utilized for human benefit. Specific campaigns against lead in petrol and acid rain would not be inconsistent with this approach. On the other hand, and this is where Lovelock's point is important, 'deep ecology' collapses the division between humans and nature and assumes humans to be *part of the living system itself*. The notion of 'deep ecology' is thus based on the biological principle of ecosystems in which "animals, plants, microorganisms, and inanimate substances are linked

through a complex web of interdependencies involving the exchange of matter and energy in continual cycles"²⁰. The adoption of this world view will mean that consistency will have been achieved between consciousness and the indeterminism reflected respectively by quantum theory and ecology at the microscopic and macroscopic levels of reality.

The conscious realisation that we live in an indeterminated world, of which we are an integral part, will have profound implications for science and society. It will in particular release those powers of intuition suppressed by the dogmatism of modern science, which assumes its superiority over all other forms of knowledge. Once we become aware that we can *never* know what will be the overall effect of our actions on the environment, we will appreciate the need to contain them at a scale at which we can retain ultimate control. The lessons of Chernobyl, Bhopal and similar disasters will become writ large in the new consciousness as indications of the counterproductive tendencies of industrial growth and progress. Questions will be raised about the validity of equating the *quality* of life with ever-rising material standards of living, with the resultant devaluation of the spiritual and moral dimensions of human existence. Finally, and very importantly, greater attention will be given to the problem of what has been referred to as "diachronic competition"²¹, which emphasizes the degree to which the continuity of the industrial system depends on the use of non-renewable resources. As the earth's resources become irreversibly depleted the relative stability of societies today will be gained at the expense of the increasing instability of societies in the future. Whether this crisis will be resolved must ultimately depend not just on the transformation of consciousness, but on the merging of the any interconnected themes within the Green movement as a whole, so that its position can be established within the framework of a fully coherent and integrated philosophical base. Only in this way can the Green vision of the future move from utopianism to actuality.

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Save the Forests: Save the Planet

A Plan for Action

Some Comments

From: Dr David Bellamy.

Bishop Auckland, County Durham

I agree with all you say, and fully support *The Ecologist's* Tropical Forests "A Plan for Action."

From: Dr Richard Sheldrake.

Hampstead, London

Thank you for your letter about *The Ecologist's* Forest Campaign. Indeed I would like to support action to save the forests, but have some reservations about *The Ecologist* campaign being overstated, and hence less likely to be effective.

The most important change would be in the wording of the glossy 'Plan for Action' print 2—"trees selected for their ecological, rather than commercial value." "Rather than" should be replaced by "as well as" or some such phrase. The ideal would be trees that are both ecologically valuable (however that is to be defined) and commercially valuable. I am not convinced that they need to be exclusive; and putting it this way would encourage research for an optional combination, rather than making them as polar opposites. Of course if both ecological and commercial interests could coincide, there would be a greater chance of success. This should surely be the goal: a policy of confrontation may be necessary sometimes but is not in itself the ideal.

Another change is in the ending of the petition. To say it is "the gravest emergency ever to face mankind" immediately makes me question this—I would put the nuclear threat as the gravest emergency. It is not necessary to use this exaggerated style. For me, and for many others, to say "one of the gravest emergencies" would be just as effective, if not more so. For the same

reason, I think it would be better to use the slogan "Save the Forests" alone, rather than with "Save the Planet" added to it. Even I, who am sympathetic, am put off by this kind of extreme slogan.

So my main worry is that the case will be spoiled by overstatement, just as I think *The Ecologist's* "Blueprint for Survival" years ago was spoiled by overstatement.

I am not disagreeing with the objective, but only with the tactics. I am all in favour of the objective, as I am sure millions are.

From: H.E. Prince Sadruddin Aga Khan.

The Bellerive Foundation, Geneva, Switzerland

The plan for action has my full support and is probably the best articulated inventory of what needs to be done to avert a major ecological disaster.

The constraints are those which face conservationists everywhere: it is the governments that call the shots. This has been the problem of the International Tropical Timber Organisation (ITTO), the International Whaling Commission (IWC), and every other inter-governmental body that is designed to promote sustainable harvesting of natural resources. The difficulties are compounded even more when there are geo-political interests such as the Antarctic Treaty where the priority for the Parties appears to be to keep everybody else out.

In addition, forests and their use has become a North-South confrontation linked with the debt and with the New International Economic Order.

This is why I am not too optimistic about multi-lateral action. Govern-

ments seldom agree on anything at the UN and forests, unlike the ozone layer, are seen as valuable and exploitable resources. Traffic moves slowly at the UN. It has become a heavy bureaucracy and leadership is sadly lacking. We should not feel too optimistic therefore about repeating UNEP's success with a protocol on CFCs.

We must try, of course, and I will be happy to join in your efforts to call for an emergency meeting though I am not sure the call would be heard unless it were backed by world public opinion similar to that which is triggered in an emergency and which produced responses such as Bandaaid, Liveaid and Aid for Africa.

From: Dr Daniel H. Henning.

Professor of Political Science, Eastern Montana College, Billings, Massachusetts, USA

My congratulations for your excellent letter and plan on tropical forests.

I do feel that your major four point programme should contain another one about training. Some of the reasons for this training inclusion are contained in my submitted paper as well as on the sheet on in-service training strategies for Asian tropical forests. The big point is that it is the most economical, effective, and practical way to reach large numbers of tropical forest decision makers under the critical and immediate time frame of the next few years (rather than wait for economic changes to filter down). A possible training recommendation would be: "That environmental in-service training programmes for tropical forest decision makers at all levels be implemented worldwide and based on holistic, interdisciplinary, value, and ecological orientations."

From: C.G. Breed.

Impact, Manila, Philippines

I heartily endorse your four phase plan. In a way, I think it should even be tougher, and to make those who benefited from logging in terms of millions of dollars also pay substantially for the cost of reforestation, especially those who failed to reforest. Most of the logging concessionaires are highly placed government persons, or their friends, which would mean considerable lobbying on our part, either in the UN or among world governments, to make some impact.

I cannot comment on the four phase plan, as that requires more knowledge than I have. Some of the points raised under point 3—viz to return land taken from peasants for large plantations—will require legal experts, or what measures can be taken to this effect. It is a very laudable suggestion, but we should be prepared to show how it can be done.

Governments willing to sponsor an emergency debate in the UN can probably be found where public opinion to protect the environment is vocal and strong, the Scandinavian countries, Sweden, possibly the Netherlands, New Zealand. Or countries where deforestation has been going on: the Philippines may be willing to sponsor it if approached in the right way. Even Japan may be anxious to do so to brush up its public image and to spend some of its surplus huge dollar reserves. Japan is thinking of a Marshall plan for Third World countries to spend these reserves. Or you may think of a country behind the Iron Curtain (Roumania or even USSR) to show goodwill in so "innocent" an endeavour as to save the world's forests. It is an intriguing question. The way you approach these governments is an important factor, especially here in the East. If you want prestigious governments to sponsor it for reasons of more chances of success, then the superpowers may be considered or approached.

If possible, I think the four phase plan should include a more thorough and complete "Ecological Preservation Plan" or campaign, especially when you plan to call an emergency debate in the United Nations. There is so much destruction and

vandalism going on, which requires the world's attention; for example the dumping of toxic and nuclear wastes in oceans or inhabited land areas. We need a more united effort from all NGO's all over the world to make a small impact on ecological preservation. Organisation-wise we may not be ready for it yet, but it is worthwhile keeping it in mind and preparing for it in order to start this ball rolling in a modest way.

From: Jeffrey Sayer.

*Senior Programme Adviser,
Tropical Forest Conservation, IUCN,
Glands, Switzerland*

Copies of your recent letter and action plan for tropical forests have been passed on to me by some of my colleagues here in IUCN. As you are certainly aware IUCN was very much involved in the preparation of both the WRI Call for Action and the FAO Tropical Forest Action Plan (TFAP). We continue to monitor closely the implementation of TFAP and have been able to make major inputs into the coordination of this process and the development of country TFAP programmes.

We have always expressed reservations about TFAP, particularly in so far as it represents an evolution of existing development assistance programmes rather than an attack on the fundamental weaknesses of international development aid.

Notwithstanding this, IUCN has taken the decision to work within the TFAP process to bring about the changes which we feel are necessary. We have drafted a set of guidelines addressed to agencies implementing TFAP and continue to maintain a dialogue with the bilateral agencies and the countries receiving the aid.

I think that your campaign can serve a useful purpose in creating broader awareness of the need to reform aid programmes but I also believe that you have not fully appreciated the extent to which TFAP is itself reasonably innovative. I think that a close study of TFAP and greater involvement by you in its implementation would make you realise that many of the problems that you raise are already being

addressed in the process of TFAP implementation.

I would also warn you that specialists will easily find fault with some of the elements of your plan for action. For instance, it is quite unrealistic to think that debt for nature swaps alone can solve either debt or conservation problems in developing countries. Your call for massive reforestation with trees selected for their ecological value is quite naive. Firstly, the emphasis should be on maintenance of natural and near-natural forests, secondly, the problem with any sort of plantation is that the institutions needed for their establishment and maintenance do not exist.

From: Dr Ronald I. Orenstein.

*Project Director, International
Wildlife Coalition, Toronto,
Canada*

Thank you for the copy of your action plan proposal; I am delighted to see our Statement of Concern quoted. Of course, I agree wholeheartedly with the points you raise. I have discussed the plan with our Vice-President, and the International Wildlife Coalition will certainly consider endorsing the plan. We feel, however, that we cannot commit to it in its present form.

At the outset, we remain unconvinced that another global master plan directed at governments will accomplish much in practical terms. Many governments in rain-forest countries are, I submit, simply unwilling to trade centralised power and a commercial structure favouring the ruling elite for the kind of local autonomy and self-sustaining social structure needed to not only accept such a plan but to implement it. Perhaps what is needed instead is a way to reach past central governments to local grassroots organisations, and to give them the clout they need to be heard at the levels of power.

Accepting, for the purposes of argument, that an action plan of the sort you propose may be desirable, I have the following additional comments:

We are concerned that general statements of principle or broad calls for major social and economic change

of this sort may not be as effective as specific, project-oriented proposals. Action plans are valuable as organisers and directors of activity when they are prepared for organisations already committed to the general aims they espouse. I am not as convinced of their coercive value. I wonder how many countries have "adopted", say, the World Conservation Strategy without abandoning development schemes completely at odds with its aims. If a plan is too general it may risk being co-opted—in other words, countries could endorse it and pay lip service to it without actually doing anything unless it is specific enough that failure to live up to it can be easily demonstrated.

In fact, it may be that the relative success of the Tropical Forest Action Plan (TFAP) may have more to do with the amount of money involved and the follow-up mechanisms for addressing details than with the plan itself.

Therefore we hope that the final text of *The Ecologist* plan will not merely reflect the aims stated in the editorial, but will both be and appear to be feasible, workable, and attractive to governments. The emphasis should be on specific action rather than generalised statements of principle, however worthy. At the very least there should be a specific mechanism permitting the plan to grow and acquire detail.

I believe that the most valuable role international agreements or statements of principle may play is to permit NGO's to focus attention on the conduct of uncooperative governments. An excellent example is the International Whaling Convention. Its text is hardly a conservationist's dream—but it may lead to the end of whaling because it set up a mechanism that anti-whaling forces could co-opt. In the same way I believe that the most important role for an action plan may be to provide an international forum highlighting NGO activity and bringing the destroyers of the forest under international scrutiny. Perhaps the International Tropical Timber Organisation (ITTO) will serve this function, though.

I would hope that the plan as it will be presented to the UN will be much more detailed and specific than the general outline set up in your edito-

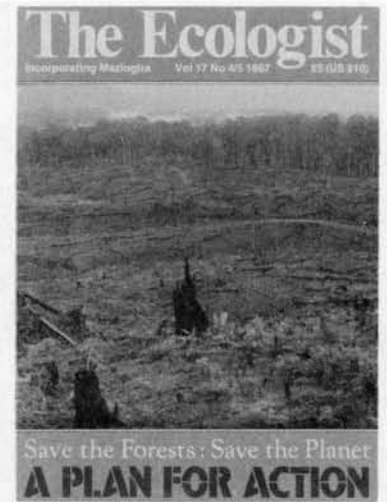
rial, and will be backed by thorough documentation and examples showing exactly how our goals can be put in place in specific cases.

In that context I wonder if a frontal assault on the General Assembly is the right approach. I realise the urgency, but if the plan were first accepted at, say, an IUCN or ITTO meeting and endorsed by some appropriate governments it might come to the General Assembly with stronger credentials. Furthermore, if the plan were to be worked up at a series of international workshops before arriving at the UN, chances are that it could be presented there in a much more thorough fashion. If this plan is intended to compete with the TFAP it should make as strong a case as possible.

I am very concerned that the plan as you state it is far too negative, with too much emphasis on costs of implementation and far too little on potential benefits, including economic and political benefits. This plan is not directed at environmentalists but at state governments who are not eager to embrace self-sacrifice. I think the plan should emphasise such positive benefits as the fostering of cottage industries or potential improvement in food production on a per-acre basis, instead of the down-side of our present behaviour and the sacrifices we need to make. To get this plan accepted we need carrots as well as sticks. I see little point in preparing or endorsing a document that will not attract those not already converted.

In general, I would like to see the document make reference to the World Charter for Nature, which the UN has already adopted and which provides a moral context for saving tropical forests. I would like to see less emphasis on the word "development", particularly in the context of "sustainable development" as this carries with it the concept of change. A better phrase might be "sustainable interaction", implying that in some areas the best approach is to leave things as they are.

I believe that the plan should deal with regional priorities in as much detail as possible—or at least propose an analytical mechanism that would suggest what priorities ought to be in any given area. As an example, in areas such as southeastern Brazil or



northern Australia, where rainforest exists in tiny patches with remnant species at marginal population levels, total preservation in reserves, to be established and funded as rapidly as possible, is vital so that there will be something left to benefit from more broadly-based social changes. In other areas, such as Amazonia, reserve establishment should not be a first line of defence on the grounds that—as Jose Lutzenberger has pointed out—this may give the message that forests outside the reserves are fair game. Perhaps a series of critical areas and suggested first-line approaches could be included in the plan or its background documents.

A specific comment in relation to reafforestation; I agree but would go further. Firstly it must be made absolutely clear that what we are talking about is reclamation of degraded lands, *not* replacement of existing intact forests. Secondly, in many parts of the world trees selected for reafforestation are chosen on the basis of available forestry information and experience—in other words, the priority is "plant what you understand" instead of "plant what is suitable and learn about it". One result is that the goal of providing a suitable habitat for native *fauna* is rarely considered. An example I always like to give is that in many areas eucalyptus is planted at the expense of native vegetation, and the result is a zoological desert as the native insects, etc cannot utilise it and therefore insectivorous birds do not live in the plantations either, and so on. In Australia, eucalypts tend to be replaced by pine, in which few Australian eucalypt-adapted organisms can live.



have debts—what of these? Do you propose the IMF and banks should be treated in the same way? Do you think that the United Nations can regulate arrangements made between governments and foreign banks? Have you made any kind of economic trade-off between (1) financial losses due to phasing out of deforestation schemes and (2) financial losses due to debt interest? Are you sure that the losses in (1) and (2) would affect the same bodies? I am all for a special session of UN on forests, and I see the drawbacks of the WRI plan, but I think you've got to do your financial homework better as your plan will be judged in this light.

From: Alice Hungerford.

Weetah Forest Trust, Tasmania

Thank you for sending us a copy of your paper *Tropical Forests: A Plan for Action*. Congratulations on your initiative and forward thinking! Yes, indeed we do endorse the plan. I would also like to suggest a small change which may be useful to a number of states/countries such as our own.

Certainly, biologically, tropical forests are the most threatened, and perhaps they are the most influential over the planet's weather, soils, etc. but, here in Tasmania, and throughout most of southern Australia which still has some forest cover, our forests are classified as *Temperate*, or *cool Temperate*. They consist of a rare form of rainforest, only found in Chile, New Zealand, and here in Tasmania; and Eucalypt forests (comparable to North America's Old Growth Forests). Both are endangered. Both are suffering wholesale slaughter, especially the Eucalyptus forests, and their complete removal in Tasmania can be expected in the next 20-30 years.

Companies and the government's Forestry Commission are going all-out on mining the remaining native forests in order to satisfy some short-term woodchip deal with Japan. Wastage of the adjoining rainforests, and soon in virgin rainforests, sees these timbers mostly burnt with a

small proportion only being wood-chipped. Of course, the long-term aim is to eradicate rainforests and replace them with tree farms.

Tasmania is suffering a severe drought at present, which can only be attributed to wholesale removal of our island's treecover, combined with more global factors.

My suggestion is that you broaden the plan to cover all native forests, including those cool temperate forests here, and elsewhere around the planet such as northern America.

Part 4 of the Plan could include clear-felling, or clear-cutting as some people call it, as well as plantation schemes, dams etc. Here, often only a small proportion of the logged out forest is re-planted.

From: Indira Kalayanasundaram.

Department of Botany,
University of Madras, India

Our governmental agencies circulated a copy of your editorial article and your appeal for signatures. The article is thought-provoking. I have discussed the matter with some of my colleagues, and wish to convey some of our views to you in this letter.

Firstly, we feel that it is western man's greed for wealth and power that has been largely responsible for the sad situation of the present. Let me elucidate.

The spirit of adventure—which is perfectly laudible—caused western men to undertake difficult voyages to explore the world. They came across many countries, whose vegetation, people and their ways were very different from their own. Could they not rest content with describing these marvels and accepting the difference? No: with their misguided sense of their own superiority, they set about either to systematically annihilate these people and set up their own men there, or to civilise the people of these lands after their own fashion. These people had been living in perfect harmony with their environment. Western man came and destroyed this environment and their culture, turning pasture land into crop fields and forests into plantations, in his unmitigated greed

Therefore a major factor in the selection of any tree for re-afforestation should be its suitability for native fauna. Thus reafforestation in South America should be done with South American trees, not Indian or African, and so on. Obviously this means that there will be no "wonder tree" suitable for all areas of similar habitat. The importance of this point to the plan is that a preliminary step in a global reafforestation scheme must be intense research to identify suitable trees from *local* ecosystems. This will require research that may seem to involve, from the traditional forester's point of view (or even from the point of view of a programme looking only at soil and water retention or local human needs), unnecessary duplication. The plan should, in this context, provide a scheme of priorities for reafforestation research, preferring multiple species to monocultures, and indigenous species to exotics.

From: Bishop Hugh Montefiore.

London

I sympathise greatly with your plan; and certainly something must be done. I fear however that more work is needed on the practicalities. Third World countries have contracted debts to the International Monetary Fund (IMF), World Bank, Governments, and banks and financial corporations. What is wrong about these debts is not the repayment of the original debt, but the accumulating interest which is still stifling growth in the Third World.

But not all Third World countries

to expand his domain and amass wealth.

Your editorial blames the destruction of forests on the setting up of plantations. I hope you are aware of the responsibility of your own country in this. Let me speak with reference to my own country: Forests have been an integral part of the Indian way of life. In fact one finds several marvellous descriptions of the forest ecosystem in the *Ramayana*—one of our ageless epics. We have had Muslim conquerors before. They destroyed many of our temples, but they did not destroy our forests. It was the British who introduced the cultivation of coffee and tea, and in the process destroyed much of our forest wealth. It was the introduction of Western Civilization that led us into the excessive use of wood in buildings and furniture. The oldest and largest of our temples, which have withstood the ravages of weather for centuries, were built entirely out of granite, steel and stucco, the heavy doors alone being made of carved wood.

In traditional buildings, carved trellises served for windows and archways for doors. Interiors of houses, uncluttered with furniture, always appeared spacious, with rush or palm leaf mats or carpets for seats. Furniture, if any, was kept to the barest minimum. Now, in the name of civilisation, all our buildings are cluttered with wooden furniture, and furniture making is a big industry.

Let us look at another product of Western Civilisation that comes through the destruction of trees—paper. No one can deny that paper has been one of the greatest gifts of the West. But how are we using this gift today? We are surrounded by a great deal of unnecessary paper: wrappers, paper towels, advertising posters, handbills, invitations, greeting cards, calendars and what not. Their usefulness is very shortlived. Where do they all go, once their purpose is served? Is not most of it dispensable? Can we not substitute a card with an oral or telephonic message, and hundreds of paper packets with a few shopping bags?

Our country was once famous for its hand-made textiles: cotton and silk. No forest has to be cut down in the making of these. And then the

West introduced rayon, to spell disaster to the forests.

I may stop generalising here to be more specific and speak about the destruction of forests and of 'ethnocide' in my own ethnic group. I come from a little district called Coorg in the Western Ghats. The Coorgs, a tribe forming the major ethnic group in the area, grew rice in their valleys, and got all the rest of their requirements from the forests that surrounded them. Every village had a large protected forest dedicated to God, which was left untouched. The people had their own special culture and traditions which they guarded with the fierce pride characteristic of tribals.

Into this utopia came the British, and introduced the cultivation of coffee. This soon caught on, and people started converting their forest lands into coffee plantations when they realised that there was money in it. Soon they wanted to convert all possible land into coffee plantations. Not being trade-oriented, they did not know initially what to do with the trees cut down. Seeing this, wily-minded tradesmen from neighbouring areas started a timber business, as there was a demand for Indian timber in European countries.

The coffee-growing people of Coorg soon became richer and started imitating the British in many ways, including cluttering up their houses with wooden furniture. This gave a further boost to the timber business, and when there was no further expansion of coffee plantations, the unsated avarice of the timber traders turned to illegal felling of trees from government protected forests, often with the collusion of unscrupulous officials and politicians. This has happened to such an alarming degree that the land, which used to have a continuous monsoon lasting nearly four months, is facing a drought. The consequences of this drought are not limited to this land but are felt over a vast area extending to the east coast, which is fed by the river Cauvery, which originates in Coorg.

Fortunately, the people of Coorg have realised the seriousness of the situation and are rising in protest against this denudation of their forests. Unfortunately, the political situation has changed. Coorg, which

was a State by itself, is now only a district of the large State of Karnataka, with which it was merged during the reorganisation of States in 1956. Hence the people of Coorg have to fight their battle within the Government of Karnataka, in which Coorg is very poorly represented. The future of their forests depends on the success of this battle.

You talk of Third World countries exporting their precious raw materials in exchange for arms from advanced countries. Who is responsible for this situation, other than the advanced countries that make these weapons, and try to keep the Third World countries perpetually at war, so as to keep up their arms trade? The US policy on Nicaragua is a glaring example. Or, if you take India, who are the enemies against whom we have to arm ourselves? These were created from our own midst by the British with their 'divide and rule' policy which ultimately led

The Men of the Trees

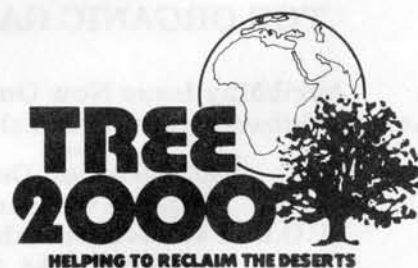
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Please make cheques payable to "TREE 2000". Thank you.



to the division of the country itself.

I hope the advanced countries will have the moral courage to accept the role they have played in the destruction of the natural ecosystems of the world, in the name of 'Civilisation'. Calling for an emergency meeting of the UN without having a concrete plan of action will not help. We shall have to take drastic steps on a war footing, restricting the production and use of materials that necessitate the felling of trees, wherever possible, mainly wood, paper and rayon.

This can be done in many ways:

- (1) Cut down the use of wood in door and window frames, cabinet shelves, etc. which can be replaced by metal frames and concrete or stone slabs in future constructions.
- (2) Cut down the production of wooden furniture, which may be replaced by aluminium, steel and plastic.
- (3) Wage a relentless war against the wastage of paper: Bar unnecessary packaging of goods; use washable cloth in the place of tissues; re-use envelopes; recycle used paper.
- (4) Provide armed protection for those forests in which illegal felling or poaching are rampant.

(5) Develop technologies for making paper from waste materials such as paddy husk and straw. The Tamil Nadu Government is trying to develop a technology for making paper from biogas. The technologically advanced countries can help in such projects. If we could develop a technology of making paper from litter of leaves, many of the problems, including that of increasing the carbon dioxide content of the atmosphere by burning these leaves, will be solved.

(6) There are some usages of wood, that cannot be stopped. The most widespread of these is firewood, which is the sole fuel of the poorer sections. This can be tackled to some extent by having plantations of species suitable for this purpose, which can be grown in land unsuitable for other cultivation, for example *Casuarina* in sandy stretches. But we must also concentrate our efforts on using alternative sources of energy. Gadgets harnessing solar energy, which have not hitherto gone beyond newspaper headlines, should be made to do so.

There are also certain cottage industries dependent on wood, which are a part of our culture—for example, wood carving, inlay and toy making. There are

certain aspects of construction and industry where wood is necessary. These ought to be provided for by developing plantations of those species of trees best suited for these purposes.

- (7) Re-forestation of destroyed forests is said to be a difficult or impossible task, as the soil has been depleted of nutrients. We may have to look at this problem from a different angle. It may be futile to expect a new forest identical with the original one to develop in the denuded area, even after hundreds of years, if the soil has really become almost infertile. But some plant species are certainly capable of colonizing such soils. Plants are highly versatile, and any given habitat is bound to be able to support certain plant species. It is up to us to find these plants, introduce them in such sites and then wait for a natural succession to proceed. It is an experiment worth trying.

These letters, rather than answering them individually will be answered collectively in a later issue of *The Ecologist*.

The Ecologist "Save the Forest" issue (Vol 17, No 4/5) is available for £5.30 including P&P.

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Books

EEC and Britain

EEC ENVIRONMENTAL POLICY AND BRITAIN (2nd Edition), by Nigel Haigh, Longmans, 1987, £25.00/\$49.00

When the first edition of Nigel Haigh's *EEC Environmental Policy and Britain* was published in 1984, it was hailed as both an invaluable reference work on current EEC law and a penetrating analysis of the differences between the environmental protection philosophies of the UK and the rest of Europe. This second edition, commissioned by William Waldegrave when he was Britain's "Green(ish) minister" reinforces Haigh's reputation as an outstanding communicator in a field where prose is often soporific at best and anaesthetic at worst.

Concise descriptions of EEC instruments of legislation and the four "Action" plans on the environment are followed by a short essay on approaches to pollution control. Emission standards, environmental quality standards, the "bubble" concept and the other types of standard, current or proposed, are described and a brief discussion of the advantages and disadvantages of quality standards versus uniform emission limits is included. Nigel Haigh notes—as have many who have followed the debate between Britain and the EEC over the preferred approach in the water sphere—that the two approaches are not mutually exclusive nor practised to the letter in reality.

The main body of the book is a description and analysis of all EEC statutes relating to the environment and how they affect policy and practice in Britain. The development of each directive or regulation and the binding dates are included as is the history of relevant national legislation. The story of Britain's compliance—or lack of it—with EEC requirements is lucidly analysed and in many cases it is a sorry story. The

result is a handbook that guides the reader through the labyrinth of EEC law and its development with clarity and efficiency.

Missing from this edition is much of Haigh's original essay discussing the similarities and differences between British and EEC policies and practices and analysing the influence of the Community on the UK, although the debate over environmental quality standards/uniform emission levels is summarised. This is a pity and those requiring a fuller discussion may still wish to consult the first edition.

There is no doubt that Community legislation has had a profound influence on British environmental policy. It would have had a greater effect, sooner, if British governments had not worked so assiduously to dilute, avoid or ignore EEC law. This policy was exemplified by Britain's derisory approach to bathing beach pollution, continued with the wilful misuse of the derogation procedure over nitrate levels in drinking water and is in full swing today with the storm over emissions of sulphur compounds to the atmosphere. In several instances, Britain's reputation as the "dirty man of Europe" is shown to be justified and current events underline this.

Recognition that national boundaries are meaningless where the long distance transport of pollutants is concerned is growing. Yet Britain maintains an insular position on too many environmental fronts. Power station emissions, discharges from titanium dioxide plants and motor vehicle emissions are but three examples where the UK has stood against its neighbours in arguing that stringent controls are unnecessary. As Nigel Haigh notes "Nationalism, even of a benign kind, and regard for the facts have never been easy bedfellows"; when that nationalism is fuelled by the self-interest of the motor industry or the CEEGB, it is easy to see why Britain has opposed controls which would be of general benefit to the European environment as a whole, arguing that there is no problem here.

Campaigners such as Friends of the Earth and Greenpeace are looking increasingly to European legislation and courts when they have no redress against polluters through Parliament and the British legal system. Nigel Haigh's book is therefore an invaluable campaigning tool and reference book as well as a thought provoking analysis of policy and practice.

Brian Price

Organic Futures

THE PACE OF CHANGE IN FARMING: The Organic Option, Collected Conference Papers, Applied Rural Alternative Publication No. 1, £4.50

A change to sustainable organic systems of farming increasingly seems the obvious answer to over-production, nitrate pollution of water, rural population loss, and other issues, as well as the only long-term solution to the inherent unsustainability of modern industrialised agriculture.

This report consists of four papers which present both the reasons for change towards organic farming, and some practical experience of farmers who have made the change, given at a one day conference held in November 1986. It conveys clearly some personal experiences of the organic option.

The industrial and economic forces maintaining the current "high input" system in agriculture are strong. Nevertheless, the economics of farming in the EEC are undergoing forced changes, and there is a hurried search for short-term solutions. Political recognition of the real changes which are needed is slow to come. These papers illustrate some of the pressures for change, and the practical difficulties of achieving rapid change to organic farming 'in the field'.

Prof. A.H. Walters shows up the problems in the EEC of official attempts to what should be a varied and adaptive pattern of agriculture across the Community. There is a tension between the *hi-tech efficiency* of northern agriculture, and the *social efficiency* of the more southern agriculture; EEC policy tends towards encouraging the former at the expense of the latter. With money as the main consideration, the EEC seems to be missing out on appropriate technology and appropriate marketing. Rural maintenance is a declared aim in the report that Prof Walters analyses ('Perspectives for the Common Agricultural Policy' Com (85) 33) but the EEC has little concern for research into low-tech and organic farming systems which would promote this aim. He discusses other issues such as "set-aside" land being converted to ecological corridors under the ownership of public authorities, and the vagueness of the income aid schemes. At present, the EEC has shown little interest in encouraging sustainable, locally diverse agriculture, with smaller farms generating more rural employment.

Sir Richard Body's paper presents his now familiar arguments for a

return to market forces in farming, cushioned by some financial support, via establishing Environmentally Sensitive Areas (ESA) or some similar scheme, to encourage farmers to fulfil society's wishes for stewardship of the land. Perhaps the whole of the UK should become an ESA? Recent experience shows subsidies being milked by the chemical industry, and research biased in the direction of hi-tech productivity. The "chemico-industrial complex" has created an economic drive away from stewardship and long-term responsibility. Farmers should be encouraged to get off the treadmill by accepting taxpayers' help for what taxpayers want, which is a reduction in nitrates and pesticides, and more care of the landscape.

Sir Julian Rose describes how he was "converted" to organic farming and the structure and running of his farm. He admits that running an organic system is a complicated matter, and shows that effectively selling organic products is as important as growing them. For this, the relationship with the local community is fundamental. Sir Julian expresses optimism that the ecological stability and economic viability of mixed sustainable organic systems will be shown to be profitable. If a serious change to organic farming is to take place, more than "converts" are needed, and there is still a lack of training opportunities. There is also the "quite appallingly imbalanced equation in modern forms of accountancy".

Finally, C.B. Wookey shows how he converted Rushall Farm to an organic system, and gives some insight into his personal response to the change. He prefers the term "sustainable" to "organic" and makes it clear that, for him, conventional farming is wrong ecologically, economically, ethically and environmentally. Going organic is difficult at present, without advice and the information from chemical salesmen which supports the conventional route.

This compilation of papers gives several insights. Because of the need for food security, politics will remain involved with agriculture. Unfortunately, the current brand of politics has no long-term vision, and the pace of change to organic is slow. From the chemical withdrawal symptoms of a field, to the necessary accumulation of experience in a variety of environments, to the development of training schemes, all is slow. Sustainable organic farming is the ultimate solution, but no technical fix. It has to change at the pace of natural systems—and social systems too. Chemicalisation was rapid in terms of the history of agriculture but a reversal is bound

to be slow. All this will mean a long-term process which politicians will need to aid and not to hinder. A complete reversal may have to wait for another generation of farmers—how many of the current generation are temperamentally suited to organic methods?

So what happens now? We have an agricultural system which is no longer economic and which is accumulating chemicals in soil and water and foods, causing health time bombs yet to be defused. All these need rapid action. The sustainable solution is by nature a slow process. In the meantime we need agricultural "first aid" with decisions and policies to encourage the right moves.

To date, little consideration has been given to short- and long-term priorities, or mechanisms to help agriculture through the inevitable withdrawal symptoms. Sustainable farming needs sustainable politics, and there is not much sign from those in power nationally or in the EEC that they understand this.

John Porter

A Guide to Good Living

THE GREEN ALTERNATIVE, Peter Bunyard and Fern Morgan-Grenville (eds), Methuen, 1987, £2.95.

When I was a boy I treasured a book called *Five hundred and one questions you always wanted answered*. The questions—how does an electric motor work? or How do we know the world is round?—were posed in simple terms and answered in a series of practical paragraphs. Dipping into the book at random gave hours of pleasure.

Peter Bunyard and Fern Morgan-Grenville have produced a book in much the same style. *The Green Alternative Guide to Good Living* also poses some five hundred questions and answers each in a pithy, unfussy style.

To give some examples, of the questions at least: "What is really happening to the forests of Europe?" "Are deserts spreading?" "Can we stop them?" "What is holistic medicine?" "Is nuclear waste disposal really such a problem?" "Why do we need to transport so many goods?" "Is education producing crippled or healthy minds?" "Are Greens against computers and microelectronic developments?" "Is climate the root cause of the present crisis in Africa?"

To anyone familiar with the arguments of the Green movement the answers are basic. Space does not permit the two editors to examine some of the subtleties of the issues examined and to explore the numerous ways in which the matters discussed under the various headings inter-relate. For the beginner however, someone just starting to realise that there must be ideas beyond the conventional political and economic debate, the book is an ideal introduction.

The reader can start in familiar territory by looking at the chapter headings: Energy, Health, Education, Transport. But then, if he or she, starts exploring some of the Green solutions a new dimension to the old political debate opens up. The chapter on education serves as a good example.

"What is the purpose of education?" is the first question asked. The answer:

"The purpose of education is to bring out the potential qualities of a child, as well as of an adult, in the physical, spiritual, intellectual and psychological fields. In its broadest sense, education is the process of discovering the essential nature of our beings and our place in the universe. In that sense we all attend this earthly 'school of life'.

Education has, however, come more narrowly to mean the preparation of the young for life in their particular culture. This is increasingly taken to be the role of the state through the provision of formal educational structures, designed to prepare participants for a consumer society."

To those familiar with the Green movement, the answer could be seen as stating the obvious. Yet it must not be forgotten that the vast majority of people rely for their picture of the world on the tabloid press and television news and if they ponder the purpose of education, they are unlikely to go beyond the idea that schools exist to teach children skills to prepare them for getting a job. The idea that conventional schooling might make most people very poor learners by concentrating on the left-brain mode of consciousness or that the learning process could involve the use of relaxation, meditation guided fantasy and intuition, would be totally alien to most western people. That there must be something better than the present schooling system is evident given the system's own failure rates. In 1981, 49 per cent of all boys in the UK left school without passing a single 'O' level.

Each chapter in turn asks basic questions and finds answers which go beyond the conventional political

and economic debate but without going into realms of the mystical and impractical which can serve to alienate the inquiring layperson if too alarming, obscure and unfamiliar.

In the final chapter, the editors ask, "Are Greens living in the real world?" This is a key question if the book is to be accessible to a readership beyond those already converted to a Green Way of thinking. And the answer to the question?

"The 'real' world is made up of earth and rock and coal and water and crops and grass—in contrast to the phoney world of money markets, capital transfers and petro-dollars, of hollow promises, political myths and notional levels of economic growth. There are children in school today who don't know where milk comes from . . . there are politicians who don't understand the miracle of topsoil . . . To question and criticise what counts as reality today is to be the ultimate realist!"

Ted Harrison

The Pulse of Uncertainty

NEW RENAISSANCE: Essays In Search of Wholeness, by Maurice Ash. Green Books (1987), £5.95.

It is a pleasure to welcome the innovative publishing house of 'Green Books' through this attractively presented collection of essays. His central theme is pursued philosophically and politically, and with particular reference to his experience of planning, education, and the countryside.

Our minds, he argues, are so locked into a dualistic approach that we have lost all sense of meaning and scarcely recognise the true nature of the crisis we have caused. Thus we multiply our problems by our very attempts to solve them. "We have put a torch into a blind man's hands and called it the Enlightenment".

Readers familiar with Green issues will be at home with this world view, but not necessarily with its rigour. Ash does not hesitate to challenge ecology, environmentalism, holism, Green politics and progressive education as readily (though with more affection) as he attacks individualism, the Nation State, idealistic thinking, the Enlightenment, rational humanism, romanticism, socialism, capitalism, and the education system. Always there is the attempt to find new ways, not just to prophesy doom; but Maurice Ash is determined first

that we should face the problem and look clearly into the mirror.

The analysis constantly delights by its range and consistent depth; all problems relate to the conquest of knowledge over meaning founded in a language which controls both self and world. Thus inner and outer illusions are equally and simultaneously grist for his mill:

"Yet the evidence is now cumulative, that it is not false ideals that have brought us to our present pass, but idealism itself: the very certainty it presumes and the detachment of the idealist from the actual world."

Many of the essays are concerned, after analysis, with nurturing the forces for beneficial change which Maurice Ash has supported for many years. Here not every reader will be satisfied. Some will feel the remedies can not bear the hopes put upon them, others that they are not activist enough. The author, perhaps, is torn between activism and quietism, between a longing to help, and an honesty which compels him to accept the limits on growth and action inherent in the crisis—recognising that nothing unsoundly based will, in the end, help, however much commitment humans give. He suggests an intelligent watching brief on the inevitable process of the self-destruction of most aspects of the Nation State, whilst drawing on the best inspirations of local planning, Green politics, and environmental concern, and new visions of the potential of small-scale community open to rural values. But none of his suggestions are conventionally or casually made, and the danger of new idealisms is constantly in mind.

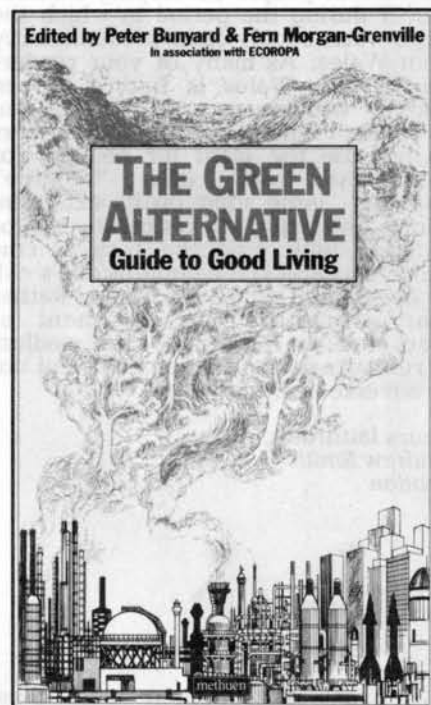
The essays have been collected over many years and do not entirely avoid a certain unevenness. Certain key themes necessarily recur repetitiously as the ground of each essay is prepared. Some, however, challenged to come to grips with the author's demands, will welcome this. Though readable, and not requiring "expert" knowledge, this is not an easy book. Some will find parts hard to penetrate; those committed to our present system will have great difficulty in debating with an author who questions the very language of the debate as the source both of the system and the crisis. But those who are unsure how to proceed will find constant openings and illuminations. It is, indeed, another guide to the perplexed, re-emphasising those spiritual aspects of Schumacher's work which are less explored than its material implications.

It is also an austere book. There are no easy answers, nor easy inspirations. It is the language of offering answers—'fixes'—which is

itself in question. Indeed some of the book's exhilaration comes from the tracing of the way in which the paradigms of certain knowledge, if not deeply understood, will take over all challenges, whether planning, holism, ecology, environmentalism, or Green politics. And yet it is not pessimistic, despite the immensity of the changes required. It is in the very consistency of its non-attachment that the energy and the strength of *New Renaissance* rests.

And finally *New Renaissance* is about Beauty as Truth—a sense of aesthetic and of place as a surer guide than the certainties or hopes of idealistic thought, in humanistic or religious guise. And thus it is a deeply religious book, in the accurate sense of "binding back together". It is concerned with the "God beyond God" that freedom from language may reveal; with the recognition that "whole" and "holy" have one root.

Brian Nicholson



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Letters

Bracken: A Poison?

Dear Sirs,

Upon reading "Bracken: Friend or Foe?" (Vol 17, No 6) by Marjorie Sykes, I was surprised that she did not make reference at all to its carcinogenic qualities as a plant. Currently spreading at a rate of 126 square miles a year, bracken (*Pteridium aquilinum*) now covers 4,200 square miles of Britain and tests have shown that it not only induces stomach cancer in mice from its spores and leaves, but that it may also cause cancer in humans.

It is public knowledge that in Birmingham there was a significant increase in people developing stomach cancer during the period in which the city's water supply came predominantly from Wales. As many of your readers may know, Wales is like a "green desert" with respect of its bracken cover. So it is not surprising that farmers do not use the plant for bedding for animals and treat it like a "scourge" spending "large sums on its extermination", as Marjorie Sykes points out, for drinking milk produced from a cow which eats bracken heightens one's risk of developing stomach cancer. Rather than promoting the treatment of bracken as an indigenous craft medium in rural areas, should you not point out its adverse health effects?

Yours faithfully,
Andrew Smith
London



Marjorie Sykes replies:

I did say that bracken could cause death to animals which develop a taste for it, though I gather it is not very usual for them to do so. I should of course have made it clear that it is because bracken contains small amounts of a carcinogen. Richard Mabey mentioned this in his appendix on poisonous plants in his *Food for Free*, though he clearly regards the plant as only marginally toxic. He says that bracken has been "eaten safely in the past", though it would be unwise to consume it in any quantity.

No one, however, is suggesting that bracken should be used as food for either animals or humans. I am afraid I have not the necessary technical knowledge to say whether handling the plant constitutes any hazard, nor do I know the basis for Mr Smith's statement that a significant increase in stomach cancer in

Birmingham has accompanied the use of drinking water from Wales. One would need to know something of the research underlying this assertion. Perhaps publication of his letter may serve to elicit it.

Meat and Forests

Dear Sirs,

Further to Joanne Bower's article (Vol 17 No 6), which I wholeheartedly agree with, intensive livestock rearing as well as being cruel and unhealthy is ecologically destructive.

In the same way that the myth that the human body needs meat and dairy produce is perpetuated, ecologists are often quicker to point out the damage caused by overgrazing and extensive cattle schemes than that caused by intensive livestock rearing.

For instance, in the article by James D. Nation and Daniel I. Komer (Vol 17 No 4/5), the authors say that instead of financing extensive beef cattle production in rainforest areas "funds should be funnelled into ecologically sound systems of food and fibre production including intensive cattle production". I believe there is hardly anything more ecologically harmful to funnel funds into.

In addition to grazing land, about 80 per cent of the cultivated land in this country is used to grow animal feed. If this were not enough, cereals, soya and other high protein crops are imported for animal feed, much of it from the Third World. In the industrialised West, and increasingly elsewhere, heavy machinery, artificial fertilisers and pesticides are used to grow these crops, leading to large scale erosion. Significant resources are used in transporting feed and housing animals. As well as containing residues of pesticides, hormones and antibiotics, animal wastes are often not in a fit state to use as fertilisers and are simply dumped causing vast pollution of rivers and lakes.

If plant food is eaten directly by humans, far less land is cultivated and much pollution is avoided. Soil erosion, desertification and rainforest destruction would not be nearly so severe. In warmer climates and possibly in ours, people could be fed almost entirely by tree crops.

Notwithstanding the need for land reform, the best way of reducing the agricultural pressure which forces landless people to migrate to cities, rainforests and marginal land would be to reduce the area of land used to grow animal feed, particularly as cash crops in the Third World. As Jose Lutzenberger says (Vol 17 No 4/5), soybeans are grown in Southern Brazil to feed cows in the Common Market.

I only eat plant foods, 90 per cent of them grown in this country and am very healthy for it. There are many second and third generation vegans in this country who show no signs of ill health and of course the majority of people in the world have always lived with little or no animal food.

Yours faithfully,
Tim Turner
Redland
Bristol

The Debt Crisis

Dear Sirs,

There seems to be an air of futility about the ecological movement as a whole. No one, however appears to look at the reasons for this.

Whilst the world is dominated by the present International Financial Debt System, there is no possibility that ecological considerations will bear any weight.

This International Financial Debt System (IFDS) generates financial capital (credit) out of nothing—except human greed—and appropriates both capital and interest.

Money, in the form of loans is created, but the interest or loan charges are not, and must perforce be obtained from further loans. If further loans are not forthcoming, then the victims are faced with destruction and slavery (wage or otherwise).

In order to obtain further loans, it is necessary to demonstrate "profitability". To be "profitable", it is necessary to mine whatever resources are available, animal, mineral, human, tangible or intangible.

No politician, or businessman, under this pressure of debt dare deviate from this simple but ultimate response. If he does, he is very soon lost from sight. Anyone who has the temerity to expose the nature of this Financial System is even sooner silenced.

But, unless we expose the true nature of International Debt Finance, and replace it with a system in harmony with the necessity for a sustained, viable, human environment, then all present "ecological" activities are doomed.

The failure of various "Green" political parties to make the IFDS the central issue thus condemns them to derision and contempt.

Yours faithfully
W.A. Favill
Leicester

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DIARY DATES

A CONFERENCE ON HOLISTIC HEALTH on 28 May to 31st May at Elmfield School, Love Lane, Oldswinford, Stourbridge, West Mids. (Tel. 0384-379740).

EUREM 88 EXHIBITION in Support of the 9th European Congress on Electron Microscopy. Held at York University, York, England from 4-9 September 1988. Tickets and details from: The Administrator, The Royal Microscopical Society, 37/38 St. Clements, Oxford OX4 1AJ (Tel. 808659 248768).

The Centre of Professional Advancement, Amsterdam are holding in June and July courses on Structural Ceramics and Composites, Adhesion Science and Technology, Organic Additives in Ceramic Processing, Advanced Refractories, Validation of Computer Systems for Pharmaceutical Research and Development, Effective Project Management, Safe Handling of Liquid and Gaseous Chemicals in the Semiconductor Industry. Write to Palestrinastraat 1, 1071 LC Amsterdam, The Netherlands (Tel. 020/62 30 50).

HOLIDAYS AND COURSES

The 1988 EUROPEAN SUMMER SCHOOL on Radioactive Waste Management will be held from 11th to 14th July 1988 at Christ's College, Cambridge, UK. For further information please contact: Katie Lye, IBC Technical Services Ltd., Bath House (3rd Floor), 56 Holborn Viaduct, London EC1A 2EX (Tel 01-236 4080).

The British Trust for Conservation Volunteers is offering over 150 short courses on ancient skills such as drystone walling, hedge laying, coppicing as well as modern ones of creating artificial ponds or operating a chainsaw. For more information write or phone: Jim Aberdein, The Brit. Trust for Conservation

Volunteers, 80 York Way, London N1 9AG. Tel. 01-278 4293.

The BRANTRIDGE FOREST SCHOOL is an adult organisation providing suitable study courses to those interested in various aspects of adult teaching. Courses offered range from Homoeopathy and Botanic Medicine to Diet and Nutrition, Psychology and Philosophy. For detailed prospectus please write to: BFS, Highfield, Dane Hill, Haywards Heath, Sussex RH17 7EX.

Desert Reclamation Research Charity offers WORKING HOLIDAYS in S. Spain: work 4 hrs. cost £3 daily (PGs £9): Green Desert Technology, Unit L. PO Box 2000, Cambridge.

DORDOGNE, FRANCE. Informal Holiday Course May and October. Over 25 species wild orchids within minutes of Farm. Rich limestone ecology. No collectors please. Self-catering except communal breakfast. Marcel Lewin-Poole, 11 Edward Road, Canterbury CT1 1UH.

Weekend Courses for 1987/88 at the Centre for Alternative Technology include Blacksmithing, Solar Collectors and Systems, Low Energy Buildings, Windpower, Organic Gardening, Healing Herbs and many more subjects. For information write to: Lesley Bradnam, Centre for Alternative Technology, Machynlleth, Powys, Wales SY20 9AZ or Tel. 0654 2400.

MISCELLANEOUS

ONLY FUNDAMENTAL CHANGE in motivation and lifestyle can save the planet. Send S.A.E. for details to M.C.L. Dept B. 47 Highlands Road, Leatherhead, Surrey.

Anyone interested to send me a photocopy of the following articles, (I'll pay the cost): UNDERCURRENTS, No 4: Chemicals from biological resources. No 5: Plastics—Have they a role in an alternative society? MAZINGIRA, 1978 (5) 50-55: An old answer to future food production. Write to: Bernard Estevez, 8301 des Belges, Montreal-QC, Canada H2P 2B1.

ECOLOGY MINDED BES COMPANY, Sailing Ships and Publishing, requires further investment. Details from Gramerley, Ball Hill, Hartland, Devon EX39 6BX.

PUBLICATIONS

Peace Pledge Union announce their latest publication: A STATEMENT ON DEFENCE. Sample copy SEA or £1.50 per 100 available from PPU, Dick Sheppard House, 6 Endsleigh Street, London WC1H 0DX.

SEMINAR PROCEEDINGS

Cambridge Bio-Soil Engineering Ltd were the organisers of a seminar entitled 'An Introduction to Biotechnical Engineering', held in October 1987 at Wolfson College, Cambridge. Proceedings of this seminar are now available at a cost of £12.50 including postage and packing.

The Proceedings are a series of seven papers giving the reader an insight into the concepts and techniques involved in bioengineering. Vegetation in combination with, or replacing, conventional engineering techniques is a valid and cost-effective method of combating soil erosion and slope instability. As an alternative to 'hard' engineering solutions, it requires an interdisciplinary approach to be effective, as is reflected by the range of professions represented in these proceedings. Papers from biological, ecological and engineering experts describe bio-engineering and make special reference to its application to various erosion and instability problems.

The proceedings are available from Cambridge Bio-Soil Engineering Ltd., Linden House, 40 Wilburton Road, Haddenham, Ely, Cambs CB6 3SX. Tel: 0353 741265.

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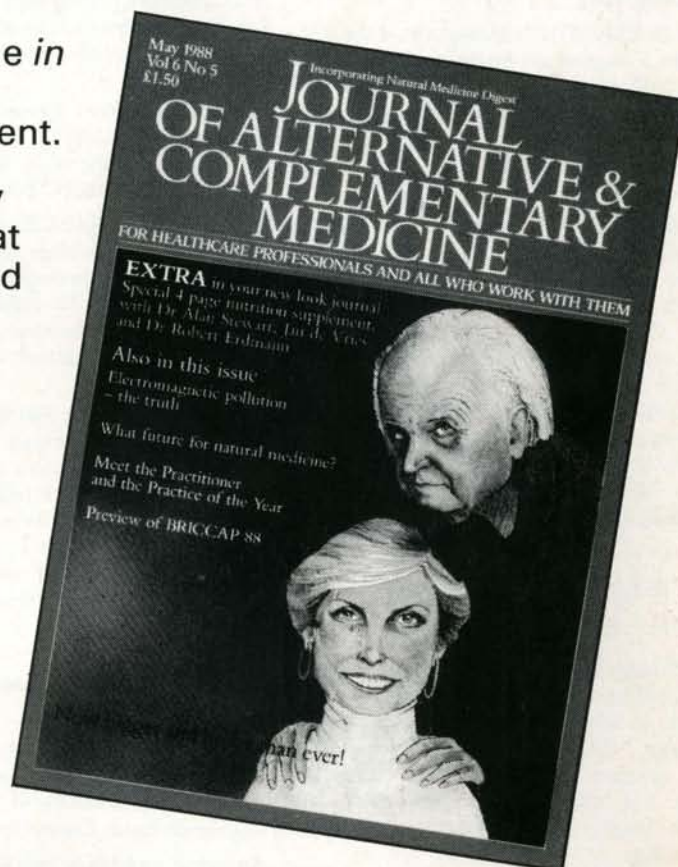
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