The Trap Chapter 6
Nuclear Energy: The Big Lie

You believe that it is possible to make a very major change in our energy policy?

Yes. Technology is now available which would allow us to transform the way we produce and use energy. If we seize the opportunity to make a radical change, the effects would be extraordinarily beneficial to the economy, the environment and public safety.

What has suddenly changed to make you so optimistic?

The Cold War has ended. During the Cold War, the principal weapons were nuclear. Nuclear energy was an extension of military research and both were to some degree controlled by the same state scientific elites, which for reasons of national security maintained secrecy even when the nuclear programme was extended to non-military projects. Successive governments believed that if problems arose in the civil project, these should be kept secret so as not to endanger the military programme.

At first it was thought that nuclear energy would be safe and unlimited, and therefore would put an end to western dependence on imported energy. It was also believed that electricity generated by nuclear means would be, as the Chairman of the US Atomic Energy Commission declared, 'too cheap to meter'.[1] Western governments devoted a major part of their resources to developing nuclear energy. Between 1979 and 1990 the member nations of the International Energy Agency spent nearly 60 per cent of their energy research budget on nuclear power. Only 9.4 per cent was devoted to developing renewable sources of energy and 6.4 per cent to methods for saving energy.[2]

With almost unlimited state backing, nuclear scientists and administrators operated in secret and above the law. These 'nucleocrats' formed a sort of state within the state. Even when it became obvious that nuclear energy was both uneconomic and extremely dangerous, the facts were hidden from the public.

Now, with the end of the Cold War, this could change.

What are the alternatives that we should consider?

The technologies needed to transform the use of energy already exist aId are commercially available. The USA is leading the field.

In America, energy is consumed in three main sectors of activity: residential and commercial demand, which accounts for 36 per cent of energy use; industrial activity, which accounts for 37 per cent; and transport, which accounts for 27 per cent.[3] It is now possible to reduce very substantially the energy consumed in all these sectors while providing unchanged or better services. The benefits would be numerous. First, economic growth would be de-coupled from energy consumption. At the moment, the conventional wisdom is that the use of energy increases in lockstep with the growth of the economy. That would no longer be true. In fact, we could dramatically reduce energy consumption per unit of output with corresponding financial savings. Second, the impact on the environment, including on global warming, would be similarly reduced. Third, dependence on imported energy could be progressively minimized or eliminated. Finally, new industries based on these new technologies would be a source of healthy economic growth.

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[1] Statement by Lewis Strauss, Chairman of the US Atomic Energy Commission, to the National Association of Science Writers in New York, 16 September 1954

[2] Rand, M" Energy Research and Development: A Story of Misplaced Priorities, Energy Series No, 5, London: Greenpeace International, March 1992,

[3] United States Department of Energy, Annual Energy Review 1991, Washington: Government Printing Office, 1991.

What opportunities exist to improve our use of electricity?

The North American utilities' think tank, the Electric Power Research Institute, estimates that the full use of new technology could reduce the consumption of electricity in the USA, through cost-effective means, by as much as 55 per cent.[4]

The US Department of Energy and the Environmental Protection Agency believe that as much as 80 per cent of the electricity now used for lighting could be saved by technological improvements.[5]

Rocky Mountain Institute estimates that 75 per cent of the electricity now consumed in houses, offices and factories in the United States could be saved by installing existing technology. This technology is cost-effective and would not reduce-indeed, would often improve-the quality of service.[6]

The largest US investor-owned utility, Pacific Gas and Electric Company, expects to satisfy 75 per cent of its new requirements for power in the present decade by increasing customer efficiency, and therefore reducing need. The remainder would be drawn from renewable sources of energy. The group expects never to have to build a new generating station and it has dissolved its civil engineering and construction division. As recently as 1981 it was planning to build ten major new generating stations.

How can we obtain these savings?

Rocky Mountain Institute has published documentation on electric efficiency which is extremely comprehensive, and which includes a multitude of examples.[7] For instance, Southwire, the largest independent wire and cable manufacturer in the USA, has reduced its consumption of electricity and gas by 40 per cent and 60 per cent respectively, per kilogram of production. The large Compaq Computer Corporation has already cut its electricity use by 50 per cent in its offices in Houston, Texas. Douglas Emmett, a property development company, has reduced electricity consumption in an office building in California by 75 per cent. Pacific Gas and Electric Company has achieved a similar reduction in its old office building in San Ramon, California, and in a new one in Antioch, California. What is more, they have recently completed an experimental house in Davis, California, where summer temperatures can reach 45 degrees centigrade. This ordinary-looking, mid-priced tract house needs neither heating nor cooling equipment and is expected to use only one-fifth of the energy prescribed by the strictest US building standards. If its innovations were Widely practised, it would cost about $1,800 less to build than a normal similar house.

The technologies used are numerous. They include new insulation methods; windows which admit light but which insulate from heat; lighting systems which while improving visibility reduce electricity consumption by 80 to 90 per cent; new air-conditioning systems which reduce the consumption of electricity per unit of cooling by more than 90 per cent; and so on.[8]

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[4] Spencer, D., 'A Preliminary Assessment of Carbon Dioxide Mitigation Options', Annual Review of Energy and Environment, 16:264, Snowmass, Colorado: Rocky Mountain Institute, 1991.

[5] Piette, M-A, Krause, F. and Verderber, R., Technology Assessment: Energy-Efficient Commercial Lighting, Lawrence Berkeley Laboratory, LBL-27032, 1989, and communications from John Hoffman, Director, Global Change Unit, US Environmental Protection Agency to Rocky Mountain Institute.

[6] Technology Atlas: Lighting (1988, 1994); Drivepower (1989, 1993); Appliances (1990); Water Heating (1991); Space Cooling and Air Handling (1992), Space Heating (1993); all from E SOURCE (Boulder, Colorado 80302-5114, USA) which updates the information with bi-monthly supplements.

[7] Ibid.; Lovins, A. and Lovins, H., 'Least-Cost Climatic Stabilization', in Annual Review of Energy and Environment, Snowmass, Colorado: Rocky Mountain Institute, 1991.

[8] Technology Atlas, op. cit.

The capital investment required if the US as a whole were to move over to these new systems has been estimated at about 200 billion dollars. The annual saving would be in the order of 100 to 130 billion dollars, a spectacular rate of return.[9]

Do the same opportunities exist in Europe?

The US has traditionally used more energy relative to its GNP than has Europe, principally because energy in the US has been cheap. But opportunities for vast savings also exist in Europe. Detailed studies have shown that it would be possible to save 50 per cent of electricity consumption in Sweden and up to 75 per cent of electricity used in buildings in Denmark. In Germany it may be possible to save up to 80 per cent of electricity consumed by private households. All these savings were shown to be highly cost-effective.[10]

What about transport?

About two-thirds of the gasoline consumed in the US is used in transport. Technology already exists which would allow a 50 per cent efficiency improvement in the performance of light vehicles, and the Big Three US auto manufacturers have agreed with the US government to develop tripled-efficiency models. Dr A. B. Lovins of Rocky Mountain Institute considers that the next, imminent, technological revolution will bring us what he calls the 'ultralight hybrid-electric supercar'. In a recent study Lovins describes how an ultralight vehicle for five passengers will be able to travel 100 kilometres using less than 1.6 litres of gasoline or other fuel. He claims that the vehicle will be safer, more durable, quieter and more comfortable than existing vehicles, yet will be no more expensive. According to Lovins, the progress that has been made in the fields of aerodynamics, polymer-composite ultralight materials, microelectronics, power electronics, advanced motor and energy storage technologies, computer-aided design and manufacturing and advanced software could reduce fuel consumption dramatically. Similar improvements are available in heavy vehicles. Together, they could reduce by five-sixths the consumption of gasoline by vehicles in the United States. Worldwide, they could save as much oil as OPEC now extracts.[11] This would also massively reduce the damage done to the environment by gasoline and diesel emissions.

How likely are we to see these new technologies put into practice?

In America changes are happening fast. Europe too can participate in this great revolution-except for those countries which are held back by the immense power of the nucleocrats. They are fighting for the survival of their industry and do so by disseminating false information about its cost and its safety. With state backing, they make wholly untrue claims in their propaganda and they do their best to cover up every dangerous incident that occurs. If we allow ourselves to be dominated by this powerful bureaucracy, then our nations' economies will be paralyzed by an aging nuclear industry. Countries such as France will become museums of obsolete technology.

What new sources of energy are coming into use in the US?

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[9] Fickett, A., Gellings, C. and Lovins, A., 'Efficient Use of Electricity', Scientific American, New York, September 1990, pp. 64-74.

[10] Sweden: Krause, F., Bach, W. and Koomey, 1., Energy Policy in the Greenhouse, Vol. l., El Cerrito, California: International Project for Sustainable Energy Paths, 1989; Krause, F., Koomey, J., Olivier, D. and Radanne, P., The Cost of Carbon Reductions: A Case Study of Western Europe, Vol. 2, El Cerrito, California: International Project for Sustainable Energy Paths, 1993; Bodlund, B. et aI., 'The Challenge of Choices: Technology Options for the Swedish Electricity Sector'; in Johansson, T., Bodlund B. and Williams, R., eds., Electricity, Lund University Press, 1989, pp. 883-947; see also Johansson, T. and Steen, P., I Stallet for Kamkraft: Energi Ar 2000, Stockholm: Industridepartmentet, DsI 18, 1983. Denmark: Norgard, 1., 'Low Electricity Appliances-Options for the Future', in Johansson, T., Bodlund B. and Williams, R., Electricity, Lund University Press, 1989, pp. 125-72; Germany: Feist, W., Electricity Saving Potential in Private Households in the Federal Republic of Germany, Darmstadt: Institute of Housing and the Environment, 1987.

[11] Lovins, A., Barnett, J. and Lovins, L., 'Supercars: The Coming Light Vehicle Revolution', paper presented at the European Council for an Energy Efficient Economy, Rungstedgard, Denmark, 4 June 1993; Lovins, A. and Lovins, H., 'Reinventing the Wheels', Atlantic Monthly, New York, in press for January 1995.

All of our present principal sources of energy-oil, coal and gas-damage the environment, and of course nuclear power is particularly dangerous. Combined heat and power technologies used in conjunction with conventional fossil fuels-especially natural gas, a relatively clean resource known to be abundant-will play a useful transitional role, given their economic viability and environmental benefits. (In a combined heat and power station the hot steam and water produced during the generation of electricity are reused to provide space or water heating rather than being wasted. Similar 'cogeneration' can provide valuable high-temperature heat for industry as a by-product of making electricity. Such practices roughly double the efficiency with which the energy stored in the fuel is used.)

However, the long-term solution, besides reducing energy needs sevenfold through more efficient use, is to develop the sustainable and clean sources of energy which in the past have been starved of research investment because attention has been concentrated principally on nuclear power. In the US, as in some European countries, progress has been made in the use of geothermal, wind and solar power. Together with biomass they now produce 11 per cent of California's electricity and cause virtually no air pollution.[12] All renewable sources now produce at least 8 per cent (unofficial estimates are higher) of total US energy, and have provided roughly a third of the net increase in US energy supply since 1979.[13]

Geothermal energy originates in the earth's crust, like the power beneath volcanoes. Worldwide geothermal generating capacity is growing fast. It provides 28 per cent of the power in Nicaragua, 26 per cent in the Philippines, and 9 per cent in Kenya.[14] The US Department of the Environment estimates that hydrothermal reservoirs, which are hot water and vapour systems trapped underground, are in theory able to provide thirty times as much energy as is currently used in the US.[15]

Wind is another growing source of power. Twenty thousand turbines have been installed throughout the world. The breakthrough allowing the use of wind power followed technological improvements such as advanced blades, improved transmission and generators, and larger turbines, all of which have reduced costs to about 6 cents per kilowatt-hour (the latest California competitive bids, unsubsidized, are 4.5 to 4.8 cents per kilowatt-hour).[16] Drs Michael Grubb and Niels Meyer, in their important study on wind energy, explain how wind power can become a substantial source of energy in America, where it now provides enough power to run San Francisco, and worldwide.[17]

Solar energy is the most important source of all. Large-scale solar thermal power plants promise to become highly economic producers. They receive and concentrate the sun's rays to heat liquids, producing steam for a turbine which in turn generates electricity. Already costs have fallen from 26 cents per kilowatt hour in 1984 to about 8 or 9 cents now.[18] As the example of the Davis house demonstrates, passive solar technology on a smaller and more individual scale is also a development with considerable potential. And tens of thousands of US buildings already obtain most or all of their electricity from photovoltaics (solar cells), now becoming competitive in many applications. Pacific Gas and Electric Company found, for example, that photovoltaics are cost-

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[12] Hamrin, 1. and Rader, N., Investing in the Future: A Regulator's Guide to Renewables, Washington: National Association of Regulatory Utility Commissioners, 1993; Personal communication from Karen Griffin, California Energy Commission, to WorldWatch Institute, 26 April 1994.

[13] United States Department of Energy, Annual Energ;; Review 1991, Washington: Government Printing Office, 1991.

[14] DiPippo, R., 'Geothermal Energy', Energ;; Policy, Oxford, October 1991.

[15] Department of Energy, US Geothermal Energ;; R&D Program Multi-Year Plan, 1988-1992, Washington: Government Printing Office, 1992.

[16] Hock, S., Thresher, R. and Williams, T., 'The Future of Utility-Scale Wind Power', in Burley, S. and Arden, M., eds., Advances in Solar Energy: An Annual Review of Research and Development, Boulder, Colorado: American Solar Energy Society, 1992.

[17] Grubb, M. and Meyer, N., 'Wind Energy: Resources, Systems and Regional Strategies', in Johansson, T. et al., eds., Renewable Energy: Sources for Fuels and Electricity, Washington: Island Press, 1993.

[18] De Laquil III, P. et al., 'Solar-Thermal Electric Technology', in Johansson, T. et al., eds., Renewable Energy: Sources for Fuels and Electricity, Washington: Island Press, 1993.

effective today for supporting a fully-loaded substation, and the Sacramento Municipal Utility District finds it cheaper to power alley lights with solar electricity than to connect to the power systems of adjacent buildings. Such advantages are rapidly spreading solar cells worldwide. A comprehensive US government study found in 1990 that combining these and other commercially successful renewable resources could cost-effectively meet most or all US needs for electricity and for total energy in 2030, about the retirement date of a conventional power plant ordered today.[19]

Nuclear was thought to be the energy source of the future. What are the arguments against it?

Let's start with the British experience. In 1988, the Thatcher government decided to privatize the electricity generating industry, including nuclear power.

Obviously, if it is to be sold to the public, an industry must give promise of a profitable future. The Thatcher government sincerely believed that this was the case with nuclear energy. The British nucleocracy had provided assurances and backed them with a multitude of figures. But it is a normal legal requirement that prior to privatization a full prospectus must be published which describes the industry, its results and its potential. The prospectus is prepared by independent investment bankers using independent accountants. Thus, the real facts started to emerge.

For example, on 5 July 1988 it was disclosed that the industry was proposing to change its accounting rules. Quite simply, it planned to prolong to 135 years the date by which nuclear power stations would be fully decommissioned and returned to green-field sites.[20] This accountancy trick made it possible to depreciate the power stations over a longer period and thereby artificially embellish the accounts.

On 27 July 1988, the Energy Select Committee of the House of Commons submitted its report stating: 'We are concerned about the costs of nuclear power . . . We are disturbed by the uneven treatment given to coal and nuclear by the Government; the problems of nuclear have been glossed over while there has been an emotional hostility towards the coal industry'.[21] This is an important comment. The development of British nuclear energy was substantially influenced by the political desire to destroy the National Union of Mineworkers, which had been led by a Marxist and had brought down Edward Heath's Conservative government.

In December 1988, the government published its Electricity Bill. The Bill included a suggestion that the government grant a subsidy to the nuclear industry so as to make it appear profitable. In July 1989, the then Secretary of State for Energy announced to the House of Commons: 'As a result of our preparations for privatization, it has become clear that the cost of reprocessing and waste treatment of spent Magnox nuclear fuel will be a great deal higher than has been charged in electricity prices and provided for in the accounts of the Central Electricity Generating Board and the South of Scotland Electricity Board ... It has been decided that both the assets and liabilities relating to the Magnox stations ... should remain under Government control. The advanced gas-cooled reactor stations will . . . [however] be privatized'.[22]

On 31 October 1989 the Financial Times business bulletin Power In Europe published a leaked Cabinet document which confirmed that the cost of nuclear energy is roughly double that of energy generated by conventional means.[23]

On 9 November 1989, the Minister of Energy announced to the House of Commons that the whole project of privatizing the nuclear industry, including the gas-cooled reactors, would be withdrawn.

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[19] Solar Energy Research Institute, The Potential for Renewable Energ;;, Golden, Colorado: National Renewable Energy Laboratory, Interlaboratory White Paper, SERIffP-260-3674, March 1990.

[20] 'Cost of Closing Reactors Crucial to Privatisation', Independent, London, 5 July 1988.

[21] House of Commons Energy Committee, The Structure, Regulation and Economic Consequences of Electricity Supply in the Private Sector, 3rd Report, London: HMSO, 1988.

[22] Hansard, London: HMSO, 24 July 1989.

[23] 'UK Electricity Privatisation: A Cabinet Document Leaks', Power in Europe, London, 31 October 1989.

He also announced a five-year moratorium on the construction of nuclear power stations. On the same day in the House of Commons the Secretary of State for Scotland explained that neither the government's own experts nor its financial advisers were able to establish the cost of decommissioning existing power stations.

Nigel Lawson, then the Chancellor of the Exchequer and a former Minister of Energy, describes the privatization process thus:

> Another important area where the received wisdom was eventually shown to be seriously flawed ... was nuclear power ... It turned out that for years the Central Electricity Generating Board, wittingly or unwittingly, had been making a deceptive case in favour of the economics of nuclear power ... the CEGB had been under-providing for, and greatly understating the likely true cost of, decommissioning a nuclear power station at the end of its life. They had been able to get away with this because no nuclear power station had so far been decommissioned . . . Had it not been for privatization, who knows how much longer the country would have been paying the price of the phoney economics of nuclear power.[24]

How did the British nucleocrats react to this?

For a few years they kept a low profile. But now they are regaining confidence. Nuclear Electric has recently appointed a research company to advise it in choosing a new name. The list of fifteen titles to be considered includes the names Safeco, Envirogen, GenCo and Britannia Electric, but nothing suggesting nuclear power.[25]

But the facts which continue to emerge demonstrate how far the nucleocracy went to produce misleading figures and to conceal the truth. In 1988 the Central Electricity Generating Board estimated the costs to a privatized nuclear operator of dealing with spent fuel and waste plus decommissioning liabilities at 2.63 billion pounds. In 1989 the figure rose to 7.63 billion pounds.[26] In 1987 British Nuclear Fuels estimated the cost of decommissioning its contaminated plants at 438 million pounds. In 1988 this figure was raised to 4.6 billion pounds.[27]

In 1989, when the British attempt to privatize nuclear energy was abandoned, the decommissioning costs were forecast to reach 15 billion pounds. The latest estimates suggest that the total un-discounted cost of decommissioning the UK's existing nuclear installations has reached 22 to 23 billion pounds.[28]

These figures provide some indication of the financial burden future generations will be forced to carry as a result of the short-sightedness and deviousness of the nucleocrats.

Are there similar cases elsewhere?

In the US the nuclear industry was forced by the courts to disclose a fair number of its secrets about safety, reliability, economics and other awkward issues. The result has been that all nuclear power plants ordered since 1973 have subsequently been cancelled and no new orders have been placed since 1978. The main causes for cancellation were safety, the growing costs of construction and maintenance (which had already reached three to five times the level originally predicted), and the existence of rules passed by forty-three states which require public utilities to meet electric services in the least costly way possible. Once the facts became known, nuclear power stations were unable to satisfy these requirements. Indeed, an authoritative analysis found that by the end of

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[24] Lawson, N., The View from No. 11: Memoirs of a Tory Radical, London: Bantam Press, 1992.

[25] 'Nuclear Electric Hopes that No Nukes will be Good News', Independent, London, 27 July 1994.

[26] National Audit Office, The Cost of Decommissioning Nuclear Facilities, London: HMSO, 27 May 1993.

[27] British Nuclear Fuels Annual Report and Accounts, 1988; House of Commons Select Committee on Energy, BNFL: reports and accounts, London: HMSO, April 1989.

[28] 'Nuclear site clean-up costs more than double to £8.2 bn', Financial Times, London, 18 June 1994.

the 1990s, at least one-third of the US nuclear plants now in operation are likely to be permanently closed and uneconomic to operate. And most US utilities agree that it is cheaper to build, fuel and operate (for the next thirty years) a combined cycle gas-fired power plant than merely to fuel and maintain a typical US nuclear power plant.[29]

Nuclear energy has no future except where energy production is centrally planned, where economically competitive options are suppressed, and where no open and informed democratic debate is possible. Wherever nuclear energy has been subjected to the test of the free market, it has not survived. The conditions for the survival of nuclear energy, therefore, are state subsidies and an absence of free debate.

France is generally considered to have succeeded in building an effective nuclear industry, which is thought to be both economic and safe. Is that the case?

No. That some people believe it to be true is merely testimony to the effectiveness of the nucleocrats' propaganda campaigns.

Nuclear power stations generate 78 per cent of France's electricity at a price generally thought to be competitive. But it is vital to understand the difference between price and cost. The price is the figure at which the industry sells electricity to consumers. The cost is the actual money spent by the industry in producing the electricity. The price can be lower than the cost because of enormous subsidies, both direct and indirect, from the state as well as cross-subsidies from other activities of Electricite de France, the public utility which supplies electricity. Of course, as in England, the cost should include the amounts needed to decommission obsolete nuclear power stations and to store radioactive waste. This is practically impossible to calculate because we don't know how to fully decommission obsolete plants, how to dispose of radioactive waste, or even how to store it safely for the long term. Even Electricite de France implicitly admits this to be the case in its reply to the French government auditing office where it states that the future cost of decommissioning 'continues to be provided for on the basis of old estimates, in the absence of more reliable figures'.[30]

Despite this disparity between price and cost, and despite the claims of the nucleocrats, electricity prices in France are not low.

The German Electricity Generating Companies Federation published the prices of electricity charged throughout Europe during 1992.[31] The study referred to residential use based on an average annual consumption of 3500 kilowatt-hours. French prices were higher than those of the Netherlands, Denmark, Ireland, Luxembourg, Germany, Greece and Great Britain. Of those countries, Denmark, Ireland, Luxembourg and Greece use no nuclear power. The Netherlands generates only 2 per cent of its electricity from nuclear power; and even the highest users, Germany and Great Britain (34 per cent and 27.2 per cent respectively) come in at less than half of France's figure of 78 per cent.[32]

The French Ministry of Industry's figures for 1993 show that despite using assumptions which are particularly favourable to nuclear energy, electricity generated by nuclear means is 50 per cent more expensive than electricity produced by combined heat and power plants using coal-fired steam turbines. If gas turbines are used, electricity generated by nuclear means remains more expensive; and it is only marginally cheaper than that generated by wind turbines placed in suitable locations.[33]

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[29] Gilinsky, V. and Bupp, I., Decision Brief: Premature Nuclear Plant Closings, Cambridge, Massachusetts: Cambridge Energy Research Associates, November 1992.

[30] Cour des Comptes, Rapport au President de fa Republique, Paris, Tome II, 1990, p. 210.

[31] Presented by the VDEW (German Electricity Generators Association) and UNIPEDE (International Union of Producers and Distributors of Electrical Energy), at a press conference at the Hannover Exhibition, 21 April 1993.

[32] Nuclear Power Stations in the World 1994, Paris: Atomic Energy Commission, 31 December 1993.

[33] Ministere de l'Industrie, des Postes et Telecommunications et du Commerce Exterieur, Les couts de reference: Production electrique d'origine thennique, Paris, 1993.

What is most significant is the way Electricite de France handles these facts. In an internal report dated June 1989 concerning commercial strategy for the years 1990 through 1992, the company describes combined heat and power and the decentralized production of electricity as 'threats'. It recommends the need to oppose combined heat and power by 'exercising pressure on the public authorities'.[34]

Let me tell you an anecdote. When this book was first published in French, it gave rise to considerable debate. As a result I was invited to discuss it at a meeting of about forty Establishment industrialists. During the meeting, not unexpectedly, I was severely attacked by a leading nucleocrat. After an exchange of ideas, the floor was taken by a major industrialist who had been one of the fathers of the French nuclear programme. He reminded us that he had been a member of the committee which had first established France's nuclear strategy and announced that he had come to the meeting to perform what he called his 'act of contrition'. With hindsight, he said, the decisions taken by the committee had been wrong on grounds both of economic viability and of safety. A great quiet descended on the meeting.

What about the safety record of the nuclear energy industry?

The history of the nuclear energy industry can be summed up as a long succession of dissimulations and lies. Of course, the best known example is Chernobyl.

In the aftermath of the accident, Alexander Lutsko, who is now Rector of the International Sakharov College of Radioecology, described the attitudes of the nucleocrats at the International Atomic Energy Agency: 'Samples of soil and foodstuffs supplied for the purpose of measuring radioactivity suddenly were placed under lock and key. After consultations, the International Atomic Energy Agency asked me not to demand the handing over of the test results because the Agency did not wish to become involved in their possible use for political ends'.[35]

Alla Yarochinskaya, a deputy of the Supreme Soviet and a member of various committees of inquiry on Chernobyl, has published a book entitled Chernobyl: The Forbidden Truth. Her conclusion: 'The lies about Chernobyl are as terrifying as the catastrophe itself'.[36]

Following the Chernobyl disaster, the Minister of the Environment of Saar province in Germany declared in the Bundestag: 'Attitudes to the safety of nuclear reactors and the provision of information in France are also a great cause for concern. On 9 May 1986, the French Embassy in Bonn issued this statement: "By reason of its remoteness from Chernobyl, French territory has not been affected by radioactive emissions" '. The Minister of the Environment went on to say, 'This was a week and a half after we had taken measurements showing concentrations two thousand times higher than normal in Saarland and in Rhineland-Palatinate. While we were warning people not to consume fresh milk and vegetables, the French authorities were completely silent. Silent, and the population was kept in the dark. The culture of secrecy in France is as hostile to man as is censorship in the Soviet Union'.[37]

Where does the truth lie?

No one knows the full extent of the truth. We can only glimpse some of the exposed parts of the iceberg. The then President of the Ukraine, Leonid Kravchuk, declared at the World Economic Forum in Davos in Switzerland that 11 million people had been affected by the Chernobyl accident.[38] Others involved have also made some revelations. Here are a few of them:

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[34] Electricite de France, 'Strategie Commerciale d'EDF, 1990-1992', unpublished internal report.

[35] In Yarochinskaya, A., Tchernobyl, Verite Interdite, Paris: Editions de l' Aube, 1993.

[36] Ibid.

[37] The text of this speech can be found in the Deutscher Bundestag's Stenographischer B erich t, 220 Sitzung, Bonn, Friday, 6 June 1986.

[38] 'Chernobyl Cost $5.5bn in Medical Aid', East European Energy Report, February 1993.

-Leonid Ichtchenko, Chief Medical Officer of the Narodichi district hospital: 'We have examined all the children in the district several times. 80 per cent of them suffer from thyroid hypertrophy'. [39]

-Alexander Satchko, Director of the Narodichi District Polyclinic: 'All 5,000 children in the district have been irradiated by iodine 131'.[40]

-The Ukrainian periodical Kiewske Wedomosti stated that in the single district of Kharkov 3,633 people were said to have been irradiated.[41]

-In September 1992, the World Health Organzation (WHO) announced that in Belarus the number of cases of thyroid cancer in children had multiplied twenty-four-fold. Dr Wilfried Kreisel, coordinator of the WHO's International Programme on the Health Effects of the Chernobyl Accident, declared, 'We are absolutely clear this increase after the accident is a result of the accident'[42] Two years later, the thyroid cancer rate among Ukrainian children has increased sixty-two-fold.[43]

-According to the Chernobyl Committee of the Russian government, of those who took part in the clean-up of the Chernobyl site, 7,000 died during the seven years following the disaster.[44]

-In Norway, a study of 35,263 pregnancies and 23,880 births shows an increase of 13.5 per cent in miscarriages during the year following the explosion.[45]

One could continue quoting for a long time.

In the light of this evidence it is scandalous that the International Atomic Energy Agency failed to organize and publish a proper study of the consequences of the accident.

The need to cover up was illustrated as recently as 24 May 1993, when the daily energy bulletin *Enerpresse* reported that Jean-Paul Lannegrace, chairman of the French Nuclear Energy Society, had stated: 'After all, there were only thirty-one deaths at Chernobyl'.[46] Mr Lannegrace is also Deputy Director of the nuclear fuel manufacturing division of Framatome, France's leading producer of equipment for the nuclear industry. The International Atomic Energy Agency, to its shame, still claims similar figures.

In August 1992, two doctors responsible for nuclear medicine at a leading hospital in Lille asserted in an interview given to the local newspaper, *Nord Eclair*, that there were no health problems among the children of Chernobyl. The interview was part of an article headlined 'Children of Chernobyl do not suffer radiation sickness'.[47]

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[39] Yarochinskaya, op. cit.

[40] Ibid.

[41] 'Une soixantaine de victimes de Tchernobyl en greve de la faim a l'hopital', Enerpresse, Paris, 28 April 1993.

[42] 'Chernobyl caused 24-fold rise in thyroid cancer', Reuters, 23 April 1993.

[43] Study by researchers from the University of Bern, reported on Greenbase by Agence France Presse, 17 September 1994.

[44] 'Russia: forgotten victims of Chemobyl taking their own lives', IPS/Moscow Times, 12 January 1993.

[45] Dumonceau, D., 'Consequences de l'explosion nucleaire de Tchernobyl sur l'evolution des grossesses en Novege', La Lettre du Gynecologue, 152, Paris, October 1991.

[46] 'Comment faire passer Ie nucleaire dans les moeurs?', Enerpresse, 24 May 1993.

[47] Belbeoch, B. and Belbeoch, R., Tchernobyl, Une Catastrophe, Paris: Editions Allia, 1993, p. 187.

It should never be forgotten that nuclear fallout produces effects of a special dimension. The deaths and serious diseases caused by a nuclear accident cannot be counted easily because they occur over a long period of time and do not carry a label specifically identifying their cause. As radioactive elements are carried by the winds and by water, their effects are geographically widespread. Contamination of the soil lasts for centuries. The principal isotope of plutonium has a half-life of 24,400 years.

And what is the state of Chernobyl today?

The Chernobyl site remains a terrible threat despite efforts to make it safe. In 1991, the number 2 reactor had to be closed because of a fire, and it has recently been discovered that the concrete sarcophagus surrounding the number 4 reactor (destroyed in the original disaster) is crumbling. It was built on wet cement. If it were to collapse, the radioactive debris released could be as much as in 1986.[48]

'Numerous safety deficiencies' exist in the operation of the two remaining nuclear reactors, according to an inspection team from the International Atomic Energy Agency.[49] These are caused not only by a shortage of money, but also by the fact that some 150 highly trained workers (about 20 per cent of the staff) have left following the breakdown of the USSR. Yet the Ukrainian authorities are unwilling to close the plant, as requested by international nuclear agencies. With Ukraine desperately short of both money and alternative sources of power, western governments are beginning to accept that they must provide support. To date they have agreed to supply some 800 million dollars, but there is significant disagreement as to how this money could best be spent. The Ukrainian government says that it cannot close Chernobyl until it has completed the construction of five new VVER-I000 nuclear reactors, on which work was halted due to a lack of funds and to political reasons.[50] It finds support for its view, needless to say, from the West's nuclear companies, all of which anticipate rich pickings should construction recommence. However, major safety questions remain regarding the design of the VVER- 1000. In 1993 the International Atomic Energy Agency found some sixteen areas in which the VVER- 1000 design did not meet normal safety standards, including fire risk, embrittlement of pressurized steel vessels and containment of radioactive emissions.[51]

If the VVER-1000 plants are not completed, how else can Ukraine meet its energy requirements?

A much wiser solution would be to pursue the potential for energy efficiency identified by a recent US Department of Energy report,[52] the figures of which are agreed to by the Ukrainian government. This reveals that the plan backed by the G7 countries (shutting down Chernobyl and opening the five VVER- 1 OOOs) is the most expensive option, and casts doubt on whether 800 million dollars would be sufficient even to close down the existing reactors at Chernobyl. By 1999, says the Energy Department, the five VVER- 1000s would produce 5000 megawatts of electricity at a cost per kilowatt-hour of some 3 to 4 US cents. By the same date, basic improvements in industrial energy efficiency would save 4250 megawatts at a cost of only 1 to 2 cents for every kilowatt-hour saved. Speeding up existing plans for wind turbines and upgrading existing hydroelectric plants in Ukraine would produce an extra 2000 megawatts for between 2 and 3 cents per kilowatt-hour. Further improvements to Ukraine's fourteen coal-fired plants, it says, could produce an extra 2000 megawatts 'at a much lower investment than would be required to build new generating capacity'. Ukraine currently needs five times more electricity for each unit of economic production than the OECD average.[53] An increase in energy efficiency, the use of renewable sources of energy and the

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[48] Hayes, R., Director General, British Nuclear Industry Forum, in a letter to The Times, London, 15 July 1994.

[49] 'Chernobyl shield crumbling', Independent, London, 21 April 1994.

[50] 'West funds reactors to replace Chernobyl', New Scientist, London, 16 July 1994.

[51] Ibid.

[52] 'US Ukraine Evaluation of Energy Options is to Replace the Chernobyl Nuclear Plant', Department of Nuclear Energy in the Department of Energy, Washington, 23 June 1994.

[53] 'Energy crisis blocks Chernobyl deal', New Scientist, London, 30 April 1994.

use of combined heat and power plants would not only help solve the Chernobyl problem but would benefit the whole Ukrainian economy, creating valuable jobs in the process. The international nucleocracy is determined this should not happen.

But there is one leading nucleocrat who is moving in the right direction. Jean Syrota, chairman of the French nuclear group Cogema, admits that 'Chernobyl-type reactors can be shut down in a technically simple way. You just need to become more efficient in the use of electricity. Energy consumption in Eastern Europe has reached alarming levels because energy in these countries is almost free. If energy were priced realistically, its use would be better controlled and we would no longer need supplies from dangerous nuclear plants... '[54]

What should we do to help Russia and the Eastern European countries?

We must facilitate, by technical and financial means, the closure of their nuclear energy systems and their replacement by increased use of renewable sources of energy, enhanced efficiency in energy use, and combined heat and power plants using gas turbines. The turbines could be versions slightly adapted from those already manufactured for military aviation, an industry which needs to be converted to civilian uses. Natural gas supplies are abundant in Russia. Such power stations would not be costly, can be built rapidly and can be installed close to towns and factories needing their output.

But to do this, we must fight the western nucleocracy. As far as the nucleocrats are concerned, the failure of the nuclear industry in eastern countries could spell salvation for the nuclear industry in the West. If western nucleocrats can convince us that problems in the East only reflect communist incompetence, they will have found their gold-mine. They will be able to re-equip the nuclear industry of the eastern countries, often at the expense of western taxpayers, and thereby revitalize their own industry. It is no accident that those western institutions which are responsible for solving energy problems in Russia and Eastern Europe are nearly all controlled by nucleocrats.

And what is the situation in Western Europe?

Western nucleocrats strive to make us believe that safety problems exist only in the east. In reality, there have been numerous instances in France and else- where. They are symptoms of the dangers inherent in the process itself, which are grave because their consequences can be so catastrophic. The most recent example in France was the fatal accident at the Cadarache reactor complex. An engineer was killed and four of his colleagues seriously injured while they tried to decommission a retired liquid sodium reactor. The blast, on 31 March 1994, brought down the concrete roof of an annex to the Rapsodie reactor, which contained 37 tonnes of sodium needing treatment.[55]

As long ago as 1990 Pierre Tanguy, Inspector-General of E1ectricite de France, wrote in his annual report: 'Today, the most worrying risk [in commercial light-water reactors used throughout the world] is that of a sudden break in one or more steam generator tubes'.[56] Steam generators are huge heat exchangers in a nuclear reactor, containing thousands of tubes through which the primary coolant circulates. A break in anyone of these tubes can cause an accident through the loss of coolant, and a break in a handful of tubes can keep the emergency cooling systems from working. It can also lead to cooling water being emptied out of the reactor containment shell via safety valves. This can leave the core of the system uncovered and thereby trigger an accident of core meltdown, followed by a massive release of radioactivity. To date, throughout the world, eleven cases of ruptures in steam generator tubes have been reported.[57] It is possible that only a limited amount of radioactivity was released, but the state of steam generators has become an urgent issue. France has decided to replace the steam generators in twenty-four reactors, but so far work has

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[54] 'Nucleaire a l'Est ... Un entretien avec Jean Syrota', La Tribune Desfosses, Paris, 25 April 1994.

[55] 'Fatal blast at "retired" reactor', New Scientist, London, 23 April 1994.

[56] Tanguy, P., Rapport de synthese: La surete nucleaire it EdF a fin 1989, Paris: Inspection Generale pour la Surete Nucleaire, 8 January 1990.

[57] Tanguy, P., Surete Nucleaire 1993: rapport de l'Inspecteur general pour la surete nucleaire, Paris: Electricite de France, 1994.

been completed only on the Dampierre-1, Bugey-5 and Gravelines-1 reactors Steam generators are also being replaced in Switzerland, Germany, Sweden and Belgium.

Another danger area is the vessel head. In September 1991 a leak was detected in the vessel head of the Bugey-3 reactor in France.[58] The cause was identified as a cracked penetration. These penetrations play a crucial role in the introduction of control rods into the reactor vessel. A break in one of them can lead to either or both of two accidents: an uncontainable loss of coolant, and significant damage to the shut-down system of the reactor which can lead to meltdown of the core.

By August 1993, nearly two years after this discovery, not even half of the potentially affected French reactors in operation had been fully checked. Of the twenty-four which had been inspected, some fifteen were found to have cracks.[59] The same failure has been identified on reactors in Sweden, Switzerland and Belgium.[60] What is more, in May 1993 circular cracks 18 mm in length and at least 4 mm deep were identified in Sweden's Ringhals-2 reactor.[61] This type of crack is particularly dangerous, because there is no leakage prior to a break and consequently the parts can rupture without warning.

There is another kind of problem. In May 1992, Electricite de France was officially informed that certain documents supplied by a contractor following work on the reactor at Dampierre-1 had been falsified. In fact two of the three welds involved were defective, and it transpired that the subcontractor had doctored the X-rays used for quality-control. Subsequently it was discovered that at least fifteen welds on three of the four reactors at Dampierre were defective.[62]

What will be the fate of existing nuclear power stations?

No large commercial nuclear power station which has been exposed to an intense neutron flux for many years, and hence is heavily contaminated, has ever been decommissioned or dismantled. Our knowledge of how to decommission such plants is limited as it has been applied to research reactors only and not to commercial reactors. In several of the examples I have given severe and unexpected metallurgical problems arose when thick sections of exotic steels and other alloys were exposed over a long period to a combination of intense radiation, heat, vibration and chemical corrosion.

Spare parts are the main source of future income for companies such as Framatome. Their commercial future looks prosperous, not as a result of the health of the industry, but because existing plants are forced to order spare parts on a much larger scale than was initially foreseen. However, promising events are taking place. A very large electricity company in Canada, Ontario Hydro, has decided to close a substantial part of its nuclear capacity rather than undertake repairs. In the United States, old reactors such as those of the Yankee Rowe, Trojan and Rancho Seco stations are being closed down; additionally, work has begun to progressively close eleven other previously commercial plants.

Here again, of course, the endemic phenomenon of rapid cost escalations emerged. At Yankee Rowe, the estimated cost of 116.6 million dollars has risen to 247.1 million dollars. At Rancho Seco, the estimated cost has risen from 126.5 million dollars to 292.9 million dollars.[63]

On another subject, tell us about recent developments in the international trade in plutonium.

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[58] Schneider, M., et aI., Vessel Head Penetration Cracking in Nuclear Reactors, Amsterdam: Greenpeace International, March 1993.

[59] French Ministry of Industry bulletin, Surete Nucleaire, Paris, October 1993.

[60] 'First circumferential penetration crack weld found at Ringhals-2', Nucleonics Week, New York, 10 June 1993

[61] Ibid.

[62] On-line search of the French Ministry of Industry's Magnuc database, 28 September 1992.

[63] Shearson Lehman Brothers, Electric Utilities Commentary, Should investors be concerned about rising nuclear decommissioning costs?, Vol. 3, No.1, proceedings of a conference held 19 November 1992.

There are about 1000 tonnes of plutonium stockpiled around the world. Of this, 140 tonnes are highly suitable for making nuclear bombs, and the rest is perfectly usable.[64] Fifty-five years ago, there was none. Plutonium is man-made. A study by the Rand Corporation for the US Defense Department concludes that within a decade there will be enough plutonium in the world to manufacture 87,000 crude but formidable nuclear weapons.[65]

The original peaceful purpose for producing plutonium was to fuel fast breeder nuclear reactors. Even nucleocrats are being forced, reluctantly, to admit that fast breeders are dangerous and uneconomic. Some are being closed, such as the prototype fast reactor at Dounreay in Scotland and the Kalkar reactor in Germany. In France, Superphenix is being converted into an experimental centre. In reality that is no more than a face-saver for the French nucleocrats who fought to keep it open.

In Britain, the state-owned company British Nuclear Fuels built a thermal oxide reprocessing plant (THORP) at Sellafield in Cumbria. The purpose of the plant is to separate out plutonium and uranium from the spent fuel discharged from nuclear power stations in order to recycle the plutonium as fuel for fast breeder reactors. But with the closure or abandonment of fast breeders the market for plutonium has been very substantially reduced. On the other hand, the market for bombs to be sold to outlaws seems to be growing.

So why proceed with THORP?

It cannot be on economic grounds. The plant does not solve the problem of how to handle spent nuclear fuel; indeed, the volume of waste actually increases during reprocessing. Dry storage would be a better option than reprocessing and Scottish Nuclear has decided in future to dry-store its spent nuclear fuel rather than send it to THORP.[66] German utilities have calculated that they would save 3.5 billion Deutschmarks (over 2 billion dollars) by ceasing to have their spent fuel reprocessed at La Hague, the French equivalent of THORP, a decision taken on both economic and environmental grounds.[67]

THORP has further major disadvantages. First, its decommissioning costs will be at least 900 million pounds,[68] and some analysts believe much higher. Second, the plant will increase radioactive releases into both the sea and the air. The Irish Sea is already the most radioactively contaminated sea in the world[69] and consequently the Irish government lobbied the British government not to open THORP. Both the Committee on Medical Aspects of Radiation in the Environment and the Department of Health were critical of the medical information provided by the government.[70] Finally, THORP will contribute to the problem of plutonium proliferation.

The British government stood firm. It lacked the guts to face the embarrassment of admitting that THORP was a 2.8 billion pound white elephant, and as a result the plant is now in operation.

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[64] Lovins, A., 'Nuclear Weapons and Power-Reactor Plutonium', Nature, 283, London, 28 February 1980.

[65] 'Wonder Fuel to Burning Question', Financial Times, London, 9 March 1994.

[66] Hickman, R., 'Report of public local inquiry into objections to the proposed spent fuel store at Torness power station', IDI/6/2. This report was completed in January 1994 and sent to the British Government, but has not been published yet.

[67] 'End to reprocessing of German fuel could save utilities over $2 billion', Nuclear Fuel, New York, 11 April 1994.

[68] 'Nuclear Plant Doubts as Cost Rises £150m', Daily Telegraph, London, 3 December 1992.

[69] House of Commons Environment Committee, Radioactive Waste, Vol. I, Session 1985-86, London: HMSO, 1986.

[70] Letter from Bryn Bridges, Chairman of the Committee on Medical Aspects of Radiation in the Environment, to Her Majesty's Inspectorate of Pollution, 27 January 1993.