NO. 4, OCTOBER 1993

Acid News

A Newsletter from the Swedish and Norwegian NGO Secretariats on Acid Rain

SULPHUR PROTOCOL

Opposing attitudes

INTERNATIONAL NEGOTIATORS, gathered in Geneva during the first week of September, failed to reach a further agreement for curbing the acid rain that falls over Europe. This was mainly due to the reluctance of some western European countries to commit themselves to the reduction of the emissions of sulphur that will have to be made.

It is now more than twenty years since acid rain first appeared on the international environmental agenda, fourteen years since the Convention on Long Range Transboundary Air Pollution was signed by all the countries of Europe and North America, and eight years since the first sulphur protocol was agreed.

Yet the emissions of acidifying air pollutants, especially sulphur dioxide, which affect human health, ecosystems, and materials all over Europe, are still much too high. Almost a third of Europe, including the British Isles, suffers from environmentally damaging depositions of acidifying sulphur compounds.

The signatories to the first sulphur protocol have undertaken to reduce their emissions of sulphur by at least 30 per cent by 1993, from the 1980 base-year levels. Of the big European emitters, only the United Kingdom, Poland, and Spain refused to sign.

Even in 1985, when the protocol was signed, it was widely recognized that a 30-per-cent reduction would only be a first step, and that much greater reductions would be necessary. It has in any case become clear that environmental deterioration will not cease until depositions have been reduced to below the so-called critical loads. The critical load is the scientifically derived and agreed data as to the maximum amount of pollution, here sulphur, the ecosystems, plants, animals, and human beings can tolerate without suffering adverse effects.

The current reduction plans (CRPs), which reflect official national energy policies and the emissions projected for the year 2000 for the various countries, are expected to bring some further reduction of the overall European emissions. Some countries, such as Austria, Germany, Finland, the Netherlands, and Sweden, have set ambitious targets, with reductions

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Acid News

A newsletter from the Swedish and Norwegian Secretariats on acid rain.

ACID NEWS is a joint publication of the two secretariats, whose aim is to provide information on the subjects of acid rain and the acidification of the environment.

Anyone interested in these problems is invited to contact the secretariats at either of the addresses below. All requests for information or material will be dealt with to the best of our ability.

In order to fullfill the purpose of Acid News, we need information from everywhere – so if you have read or heard about something that might be of general interest, please write or send a copy to:

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- The Environmental Federation (Miljöförbundet)
- The Swedish Anglers' National Association (Sportfiskarna)
- The Swedish Society for Nature Conservation (Naturskyddsföreningen)
- The Swedish Youth Association for Environmental Studies and Conservation (Fältbiologerna)
- World Wide Fund for Nature Sweden (Världsnaturfonden WWF)

Address and telephone: see above.

The Norwegian Secretariat, "The Norwegian Clean Air Campaign," is organized by five non-governmental organizations concerned with the environment:

- Nature and Youth (Natur og Ungdom)
- The Norwegian Forestry Society (Det Norske Skogselskap)
- The Norwegian Association of Anglers and Hunters (Norges Jeger- og Fiskeforbund)
- The Norwegian Society for Conservation of Nature (Norges Naturvernforbund)
- The Norwegian Mountain Touring Association (Den Norske Turistforening)

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EDITORIAL

Unusual language

IN AUGUST the debate on acidification was briefly ruffled after the Norwegian minister for the environment, Torbjørn Berntsen, had shown annoyance, in rather forthright terms, at the attitude of the British government. The situation was in itself nothing new. An unusual aspect was simply that a Cabinet minister had spoke out uninhibitedly in an internationally sensitive matter.

Speaking during an election campaign in Norway, Berntsen said: "The English environment minister (John Gummer) is the biggest shitbag I have ever come across."

When they met earlier in the year, Berntsen had tried to get Gummer to discuss the problems of acidification, reminding him that a considerable part of the acidic fallout over Norway came from emissions in the British Isles. According to Berntsen, Gummer had then been extremely rude both to Norway and to the Norwegian government.

In a letter to the editors of The Guardian and other British dailies, Berntsen later set forth in rather more polite terms what he meant, saying: "My concern was and is that acid rain, particularly from the UK, is Norway's greatest single environmental problem, causing damage to my country in the order of hundreds of millions of pounds each year."

It is in any case a fact that the United Kingdom is by far and away the greatest contributor to acid depositions over Norway. According to official statistics from EMEP, the Europe-wide monitoring system, Britain is responsible for 23 per cent of the sulphur and 29 per cent of the oxidized nitrogen compounds that fall there. Actually the British share is even greater, since some of the deposition that is classified as "of indeterminate source" in the EMEP model also emanates from the British Isles.

The damage in Norway is considerable. Altogether a quarter of the country is reckoned to be suffering seriously through acidification of soil and water, and the process is continuing. The number of lakes that have become totally devoid of fish has for instance doubled since the seventies.

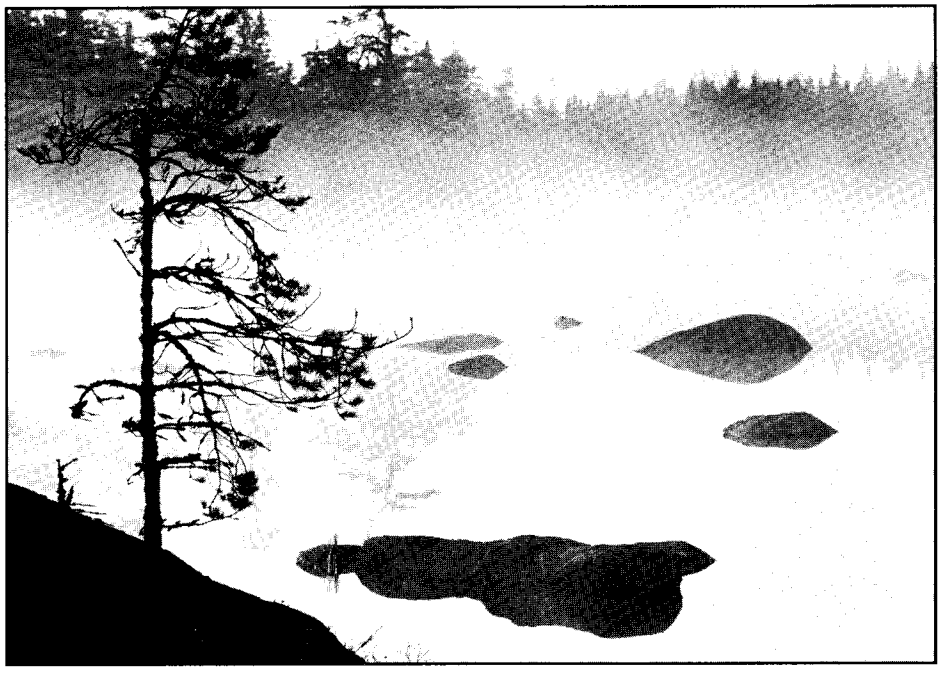
It is easy to see why, in the circumstance, the Norwegian environment minister – and, for that matter, the Norwegian public – should be enraged at the British government's show of indifference. What may seem surprising, on the other hand, is that people generally in countries that have suffered for decades from British (as well as others') emissions should have protested so little.

In the recent international negotiations for a new sulphur protocol, Britain, which should have been making a 79-per-cent reduction by 2000, would only agree to 70 per cent by 2005. A difference of 9 per cent may seem small, except that it relates to the 1980 emission level of 4.9 million tons. In fact it is a question of 440,000 tons of sulphur dioxide – an amount equal to the combined emissions of Austria, Norway, Sweden, and the Netherlands. (It may be noted that these last countries have already reduced their emissions by some 60-80 per cent, from 1980 levels.) Asking for five years more, as well as a lower reduction, makes the UK position even less tenable.

The protocol proceedings are reported in the first article of this issue. In another article (p. 5) it is shown that Britain could markedly reduce its emissions, if only there was the will. It may thus be said that Berntsen's outburst was justified by the facts. The commotion that followed doubtless had its uses, too, in reminding both the public and the decision-makers, in Britain and elsewhere, that the problems of acid rain are still with us and if anything are getting worse.

There is only one way to solve these problems, and that is by reducing the emissions of sulphur and nitrogen compounds that are the cause – and bringing that about calls for more national and international pressure on the decision-makers. If more of the affected countries were bold enough to give official expression to their displeasure, it would also bolster that pressure.

CHRISTER ÅGREN



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Continued from front page

of 80 per cent or more, while others have distinctly more modest plans. But unless something better is done, by the year 2000 more than a fifth of Europe's ecosystems will still be suffering from excess depositions of sulphur.

Now that the period of the first sulphur protocol is coming to an end, negotiations are proceeding for a second one, this time based on critical loads. Since the eventual long-term aim is to ensure that critical loads will not be exceeded, the gap between the current levels of deposition and the critical loads will have to be completely closed, in other words, by no less than one hundred per cent – an ambitious target.

The new sulphur protocol, such as has been negotiated during the past year, aims at a 60-per-cent closure, and is again but a first step in the desired direction. In environmental terms such a gap-closing is not especially ambitious – unless the aim is to achieve it within the next few years. It would still leave 7 per cent of Europe's ecosystems unprotected. In many countries, such as the Netherlands, Germany, Poland, Belgium, Norway, and what was Czechoslovakia, more than one-fifth of those systems would still be exposed to excess deposition.

Earlier in the negotiating process, a majority of the parties had agreed that in principle the western countries were to meet their targets by 2000, while the eastern ones should be allowed an extra five years, until 2005. In Geneva, most of the countries had came up with figures as to what the are prepared to do. It appears that many of them are willing to commit themselves to the sulphur reduction targets allocated to them – based on computer-model calculations of what will be needed to achieve a 60-per-cent gap closure. There are however notable exceptions, again including the United Kingdom, but also France, Denmark, Belgium, Spain, and Ireland.

It is noteworthy that some countries of Central and Eastern Europe are proposing substantial reductions in their emissions – despite the problems they are facing with economies in transition. The Czech and Slovak Republics, for instance, are aiming at reductions of 60 and 65 per cent respectively, Poland at 47 per cent and Bulgaria at 49 per cent, by 2005. With some aid from the West, these countries could doubtless achieve even higher reductions, and thus fulfill their quotas under the scheme for a 60-per-cent gap closure. Their ambitions in any case contrast sharply with the attitudes of some western countries.

Even when all the commitments are added upp, it appears that for Europe as a whole the degree of ecosystem protection will only be one per cent more than that expected as a result of the already inadequate CRPs, current reduction plans. The overall sulphur reduction would be just barely better than that resulting from the CRPs. A new protocol based in these commitments would

ON THE FOLLOWING PAGES

Factsheet insert

A plethora of information has apparently tended to confuse people as to what may be fact or fiction in regard to global warming. Through evaluation of a vast amount of scientific material, the Intergovernmental Panel on Climate Change has now been able to show what can be definitely stated as fact, and what still remains uncertain.

Sulphur emissions

Continued from page 3

therefore come to be widely regarded as a failure.

It is now broadly agreed that the new protocol should include mandatory so-called BAT standards (Best Available Technology) for major new emission sources. The proposed emission limits are largely similar to those set down in the 1988 European Community directive on large combustion plants (LCPs). According to a representative of the EC Commission, these reflect the technical level of the early 1980s. In that case their effect would mainly lie in promoting reductions in Central and Eastern Europe.

Although they are also adherents to the Convention, the United States and Canada have had a jarring influence on the latest negotiations. Referring to their own bilateral acid-rain agreement of 1991, they appear to want the coming protocol to include no new obligations whatsoever. The United States has even tried to undermine the very foundation of the protocol, by proposing to omit a fundamental point in the basic obligations of the text, namely, that the ultimate aim is to reduce depositions to below critical loads.

There has long been a general agreement that all new protocols under the Convention should reflect a scientific, effects-based approach – the critical loads approach. Five years of hard work has gone to gathering data and establishing this scientific framework on which to ground environmental protection.

As originally planned, a draft text should have been agreed at the September meeting, so that the new protocol could have been signed by ministers early in December. Now there has to be an extra round of negotiations during the first week of November, with expectations of having a protocol ready for signing in the coming spring.

Since every country has embraced the effects-based approach in principle, all must be prepared to carry out the obligations it entails for reducing emissions. It is now essential that none should back away from full implementation of a 60-per-cent gap closure on a rapid time schedule.

CHRISTER ÅGREN

BIOFUEL

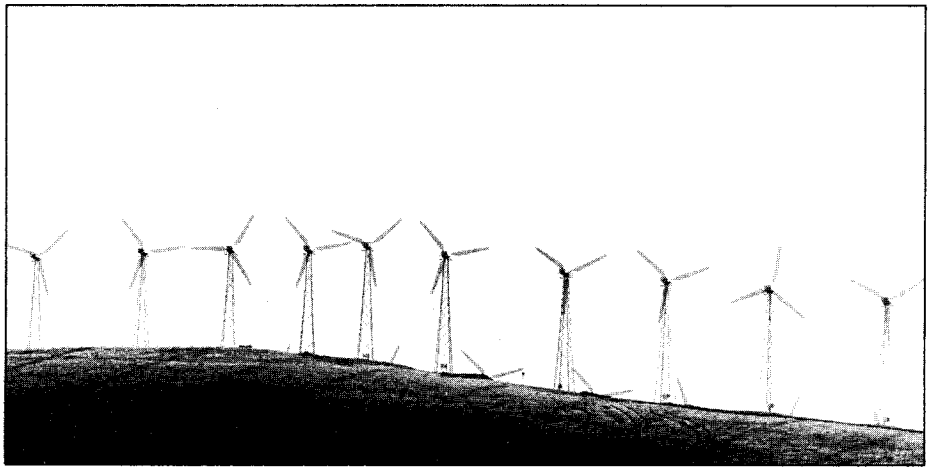
Questionable source

THERE ARE EXTENSIVE resources of peat in Sweden, but labour is expensive and local opposition to exploiting peat bogs is often vociferous. So the district-heating unit at Södertälje, just south of Stockholm, has gone over to the other side of the Baltic and signed a contract with a briquette factory near Pärnu in Estonia. The contract is for 100,000 tons of briquettes a year, which is more than the present capacity of the plant, so some will have to be supplied from another factory close to Tartu.

From an financial point of view the deal is a good one, since the peat will replace the more expensive imported coal. Moreover peat is ranked as a biofuel in Sweden, and is thus exempt from energy tax.

Environmentally, however, burning peat is an unsound activity, on the one hand posing a threat to big areas of bog with relatively intact flora and fauna, and on the other resulting in an outpour of numerous pollutants, including sulphur dioxide and various metals. Since the bogs only grow very slowly, too, peat can hardly be regarded as a renewable fuel, so burning it gives a net addition to the greenhouse effect. Moreover Sweden's forests can provide a superfluity of domestic biofuel, which can be exploited at a much lower cost to the environment than peat.

PER ELVINGSON



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WINDPOWER

Finding markets

Five thousand wind turbines are to be put up in the Ukraine during the next five years. With assistance of an American manufacturer they are to be built locally and placed on the Crimean peninsula extending out into the Black Sea.

This will be the result of a contract signed between the American firm, US Windpower, and the Ukrainian electricity company Crimenergo to manufacture the turbines on licence and install 500 MW of windpower. The project, which is already under way, is being supervised by the American company's engineers.

Rotors made in the Ukraine will also be taken by US Windpower to renovate its own turbines in California. The company is the world's largest manufacturer of such turbines, and is itself a supplier of electricity from 4200 windmills in California.

Source: **Windpower Monthly**, as quoted by Miljöaktuellt, Stockholm, May 1993.

The Danish manufacturer of wind turbines, Micon, based in Randers, has received an order for 1000 machines, worth Dkr4 billion, from the Argentine. The turbines will have a total capacity of 500 MW, which is more than Denmark's own 465 MW. Manufacture will mostly be in the Argentine, where Micon is building a factory. Financing is by institutional investors.

Micron regards the order as a breakthrough for Danish windpower technology.

Source: **Svenska Dagbladet**, Stockholm.

Hinging on coal

THE UNITED KINGDOM is a major contributor to acid deposition on sensitive soils both at home and in Scandinavia. In 1990, nearly 30 per cent of the sulphur deposition in Norway was calculated to have originated in Great Britain, which was at first slow in accepting the scientific basis for the destruction caused by acid deposition. Even after acknowledging the existence of acid rain, it has often appeared reluctant to agree to the necessary action for reducing the emissions that cause it.

The disagreements over the UK reduction program have often rested on the nature of the country's electricity supply industry (ESI), which was responsible for 72 per cent of the sulphur-dioxide emissions in 1990. In negotiations over the Large Combustion Plant Directive within the European Community, the UK was reported to have obtained more lenient reduction targets than several other member states, because of its dependence on indigenous coal for the production of electricity. It maintained that because of this dependence, its sulphur abatement strategy would have to be based on the expensive retrofitting of coal-fired power stations for flue-gas desulphurization (FGD). This was revealed to be a fallacious argument when the UK generators were freed to construct Combined Cycle Gas Turbine plant (CCGT) and to import large quantities of (relatively) low-sulphur coal.

Around this time (1989), the UK's declared 12 Gigawatt FGD program was scaled down to 8 GW (of which 6 GW are either under construction or contracted for). At the time it was clear to many that the scaling down of the FGD program would have profound consequences for the UK coal industry in the context of tightening SO_2 emission limits. It was recognized that such a situation could result in the halving of the ESI's coal burn from around 70 million tons per annum to around 35 million tons.

More recently, the British government has expressed difficulties in making abatement commitments in view of the Coal Review (now completed) that was then taking place in the UK, following announcements in October 1992 of massive and rapid pit closures.

More recently still, it has been reported that a cabinet committee has agreed to press for a reduction of only 70 per cent in sulphur emissions, despite pressure from within the EC and the negotiations for a UN sulphur protocol. This was apparently due to concern over the future of the UK coal industry.

May have used coal industry excuse once too often

However, an analysis of the UK electricity supply industry and of UK energy policy suggests that there are reasons to believe that in its negotiating stand at Geneva, the government may have used the coal industry as an excuse once too often.

Whereas in the international sphere the UK has used the coal industry to justify its intransigence over acid-rain abatement, at home it has done the reverse. It has used commitments for reducing acid emissions as a stick with which to beat the coal industry. By isolating the coal industry from any means to invest either in FGD or "clean" coal technology – long recognized within the industry as essential for its survival – it has out-flanked coal by playing the environmental card. But now that process is essentially complete, the National Union of Mineworkers (NUM) is no longer a force at all in British politics and British Coal is awaiting privatization.

What then are the implications of the decimation of British coal industry for the UK's acid rain policy? At the meeting of the UN ECE Working Group on Strategies in Geneva in February 1993, the favoured scenario for the new sulphur protocol was that for a so-called 50-per-cent gap closure. In this scenario, the situation is analyzed where countries aim to reduce their sulphur emissions to the point where the gap between deposition in 1990 and the five-percentile critical loads is halved. For the UK, the required reduction of emissions was calculated to be 89 per cent, from 1980 levels.

There was however concern that, in some parts of Norway in particular, the critical-load values were so low that natural deposition and that from non-European anthropogenic sources would exceed those values, and even if European emissions were brought down to zero, the critical loads could still not be met. Consequently it was agreed that the critical loads for eleven EMEP grid-squares should be recalculated to allow for natural and non-European deposition. The resulting scenarios were presented in April 1993, to be used at the negotiating meeting by the Working Group on Strategies in the following month.

The currently favoured computation, called Scenario A5, increases the gap closure from 50 to 60 per cent in order to retain similar levels of ecosystem protection throughout Europe. In the case of the UK, raising the critical-load values and increasing the percentage of the gap closure results in a lowering of the required reduction of SO_2 emissions from 89 to 79 per cent. As mentioned above, however, the UK government is pressing for reductions of only 70 per cent in its sulphur emissions. In other words, the UK wants to emit 43 per cent more sulphur dioxide than is currently accepted as the basis for reducing emissions down towards critical-load values.

The question arises why, when UK coal output is likely to be more than halved over the next two years, and when the general relaxing of sensitive critical loads has already greatly reduced the required UK reduction, is the government seeking to obtain a further easing of targets?

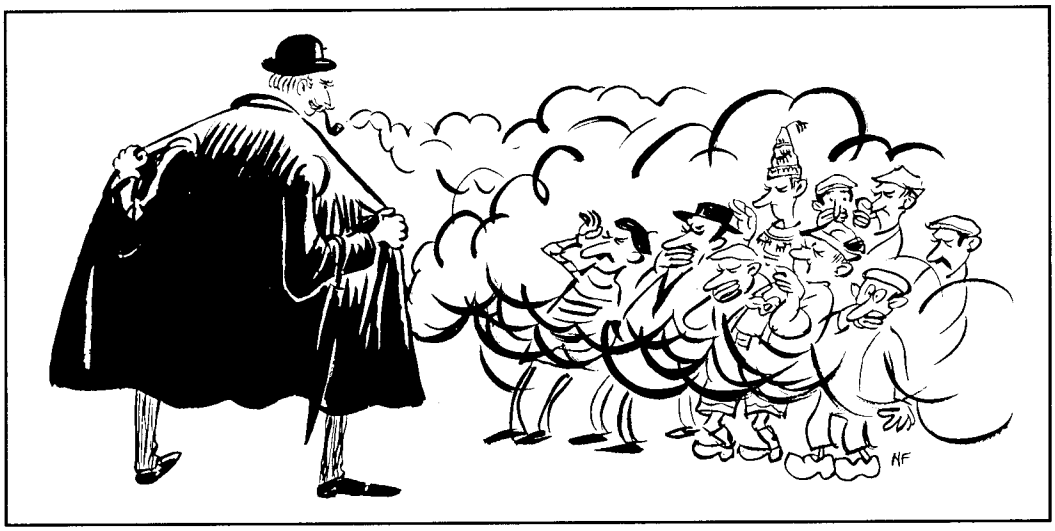
If the justification for such an approach lies with the coal industry, it is worth analyzing what the implications of such emissions will be for the British coal industry in the year

2000. In the table is shown, for a band of assumptions about the UK ESI generation mix in that year, the maximum indigenous coal the UK could burn without exceeding hypothesized emission limits. This can be viewed as imagining that the government wished to have as large a coal burn as possible in 2000. It is further assumed that the promised 8 GW of FGD capacity is installed and functioning.

Scenario 1 can be viewed as the likely range of CCGT and coal imports to be reached by 1996 (although the assumed electricity demand is put too high). The capacity of CCGT assumed in Scenario 2 is plausible, but not necessarily likely to be reached by 2000; Scenario 3 is implausible, being at the extremes both of coal imports and CCGT construction.

The most obvious thing to note is that even with the very high levels of coal imports in Scenario 3, at no time does even the 80-per-cent reduction target limit the British coal burn to below 30 million tons. There is therefore no rationale for opposing 80-per-cent reductions on the basis of protecting the coal industry.

It should be borne in mind that there is vast excess capacity in the UK ESI forecast for the middle of the decade, despite the closing down of many coal-fired plants. The table shows that despite a general overcapacity, there is a strong likelihood of a shortfall in non-sulphur emitting capacity. By 2000, if an 80-per-cent target were adopted, the UK could be between 10-20 mtce (million tons coal equivalent) short of non-sulphur capacity, despite assuming 10-13 GW of new gas turbines, 10-15 million tons of (low-sulphur) coal imports, and all nuclear power stations still running. This suggests that the concerns over the reduction targets are due to fears over the cost to the generating companies, not to the coal industry. Nearly all the coal-fired plants are owned by two companies, which would expect to be adversely affected by requirements for further reductions of SO_2 emissions. The government hopes to sell both the coal industry and its remaining 40-per-cent stake in these two generating companies in 1994, and maybe it is concern over the receipts from privatization that lies at the root of government intransigence. Ironically, the technological cost of meeting an 80-per-cent reduction target is relatively low, and a decision to revert to the abandoned 12 GW FGD program would mean that in practice the reduction could easily be met (assuming similar reductions from other sectors).



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Maybe privatization lies at root of government intransigence

In conclusion, the UK government's reluctance to commit itself to stringent emission targets for sulphur is due to a number of factors based in the history of a poorly managed ESI and its particularly ill-conceived privatization. By pressing for 70-per-cent reductions only, the UK government is seeking to persuade the other countries of Europe that they should continue to shoulder the cost of its own ineptitude. But what will that cost be?

There are two ways of looking at the cost of allowing the UK to reduce emissions only by 70 per cent. One way is to assume that the rest of Europe conforms to Scenario A5 (i.e. a 60-per-cent gap closure) that is currently under discussion and compare the implications for European ecosystems of the UK not conforming. This has been analyzed, using the RAINS computer model, in order to find out the difference in where, and by how much, critical loads will be exceeded throughout Europe, depending on whether the UK reduces its emissions by 79 or 70 per cent.

The results show that there are four EMEP squares (areas of 150 times 150 kilometres) where the exceedence increases by between 10 and 30 per cent. Two of these are in the UK, one is on the border of Belgium and France, and one is in Denmark. In another 18 squares the exceedence increases by 4-5 per cent, and these are in Germany, Norway, Sweden, the Netherlands, Denmark, the UK, and France. It is how-

Table: UK ESI fuel mix in 2000

	70% SO_2 emission reduction	80% SO_2 emission reduction
Scenario 1: 10 GW CCGT 10 mt coal imports	British coal burn: 47.4 mt Non-coal capacity shortfall: 10.1 mtce	British coal burn: 37 mt Non-coal capacity shortfall: 20.5 mtce
Scenario 2: 13 GW CCGT 15 mt coal imports	British coal burn: 44.3 mt Non-coal capacity shortfall: 0 mtce	British coal burn: 33.9 mt Non-coal capacity shortfall: 9.3 mtce
Scenario 3: 16 GW CCGT 20 mt coal imports	British coal burn: 42.2 mt Non-coal excess capacity: 12.3 mtce	British coal burn: 30.7 mt Non-coal excess capacity: 1.9 mtce

Common assumptions: Electricity demand in 2000: 127.6 mtce. Nuclear output: 29 mtce (i.e. no retirement). FGD capacity: 8 GW. Pro rata reductions from other sectors.

ever not possible to estimate the resulting damage in monetary terms.

Alternatively, one can calculate a new scenario with a 60-per-cent gap closure, but with the UK reduction limited to 70 per cent. While this will conform to the overall gap-closure requirements, it will result in altered deposition patterns as different sources are abated to compensate for the increased UK emissions. As one would expect, total costs increase (as it is less cost-optimal than Scenario A5) and those costs transfer to other countries. The resulting increase in costs amounts to DM2.1 billion per annum, and these costs are spread broadly between two types of country – those that receive deposition from the UK and those that contribute to deposition in the UK (although the distinction is obviously not clearcut). Countries in the former category, for which the abatement cost increases, are the Netherlands, Belgium, Denmark, and Norway. In the latter category, the costs increase for France and Ireland, whose emissions need to be further reduced in order to achieve the gap closure necessary for protecting British soils.

It should be borne in mind that the recent changes in the UK ESI are not represented in the national Official Energy Pathway (OEP) of the RAINS model. These energy forecasts underlie the calculations of emissions and abatement costs. In particular, the much reduced coal burn by the year 2000 reduces the UK's base SO_2 emissions by 13 per cent, and thus makes UK sulphur abatement cheaper. For Scenario A5, such an adjustment of the energy-mix forecast would lead to a reduction of DM670 million in the cost of abatement.

If the changes in the to critical-load values as well as in the national energy forecast are incorporated, as described above, the estimated cost of abatement will fall from DM3.45 billion to DM1.77 billion per annum, a reduction of nearly half.

JIM SWEET

The author is an ecological consultant specializing in energy and economics.

A report by the same author entitled "**UK sulphur emissions: 70% or 80% reductions? – The UK energy policy and the 2nd sulphur protocol**," is available from WWF UK, Panda House, Weyside Park, Godalming, Surrey, England GU07 1XR.

FORESTS

To lime or not to lime

AS PREVIOUSLY REPORTED in Acid News (2/93), the damage to Sweden's forests has become worse during the last few years, and the matter has again begun to appear on the political agenda.

Forest owners are extremely uneasy, warning that if nothing is done, Swedish forests may suffer the same fate as those in parts of Central Europe. The National Board of Forestry is urging the government to try and give an impetus to international efforts to reduce emissions of air pollutants, and to allocate funds for a large-scale liming of forest areas.

Last spring the Swedish Riksdag (parliament) appropriated 15 million kronor for liming forest land during the current budgetary period, a sum that is to be successively increased to 50 million kronor a year. Such amounts will only suffice however for a small part of the million to a million-and-a-half hectares that are considered to be at risk. Forest owners are expected to pay 20 per cent of the whole cost themselves.

Opinion differs among scientists as to the benefits of forest liming. Not all are convinced that it is advisable. At an international symposium in Sweden this summer a German, Reinhard F. Hüttl, reported that some of the experience of liming in his country had been dismaying. Although one-and-a-half billion deutschemarks had been spent on liming damaged forests during the past ten years, there had been no visible improvement. Following liming there had also been a leaching of nitrogen. Conservationists, too, worried about the effects on flora and fauna.

The only really tenable solution lies of course in a prodigious reduction of the emissions of acidifying air pollutants. The most sensitive soils are only able to neutralize depositions of one-tenth the size of those they are now being subject to. On poor soils it may also be necessary to spread wood ash to compensate for the plant nutrients that have been removed in harvesting.

To the Board of Forestry's call for intensified political activity, the Ministry of Agriculture has responded by appointing a commission to investigate.

PER ELVINGSON

Offsetting others' neglect

Maintaining life in the Swedish lakes and streams is expensive. To counteract the acidifying effects of airborne depositions, 200 million kronor are having to be spent this year on liming surface waters in southern and central Sweden. Close on 90 per cent of the fallout emanates from foreign sources – notably Germany, the United Kingdom, and Poland.

Deadly urban air

Airborne particles smaller than 2.5 micrometres, such as those from car exhausts, may be deadly even at levels that meet health standards in the United States. According to the researchers C. Arden Pope and Doug Dockery from the Harvard School of Public Health people in the most polluted of six cities they studied were 26 per cent more likely to die than those in the least-polluted city.

All six cities met US air pollution standards. Average concentrations of particles under 2.5 micrometres were between 11 and 30 micrograms per cubic metre. Researchers consider such small particles dangerous because they penetrate deep into the lungs where they can cause disease. Although a number of substances form particles, the Harvard group suspects that byproducts of fossil fuel combustion are the most dangerous.

Source: **New Scientist**, May 29, 1993.

Tax on gas guzzlers

As a measure to reduce emissions of carbon dioxide, the Germans are planning to impose a special tax on fuel-guzzling cars. According to the minister for the environment, Klaus Töpfer, as from 1994 this will apply to all cars that consume more than 0.77 litres per 10 kilometres. On the other hand those who buy cars with a better fuel economy will be able to claim a premium. The intention, says Töpfer, is to make the standard 0.5 litres per 10 km by 2005. He would also like to see the measure made applicable throughout the European Community.

Europe Environment, No. 414, July 1993.

Acidification risks studied

THE GOVERNMENT nature conservation agencies in Britain have undertaken an assessment of the threat to conservation sites from continued acidification. The method has been to use critical load exceedence maps to identify sites where the soils were acidifying.

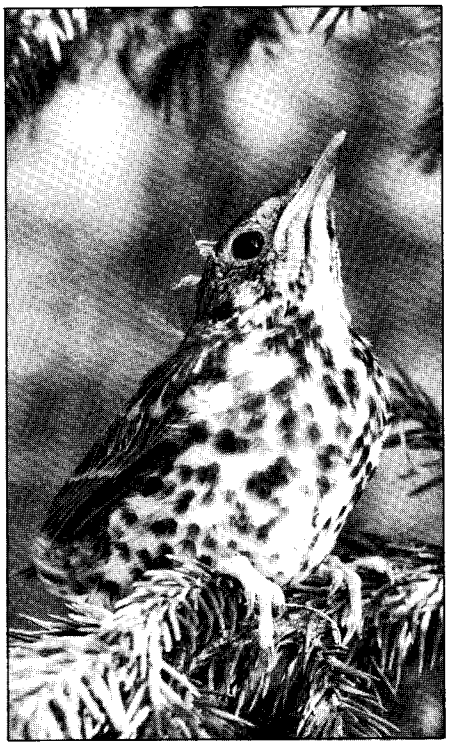
The maps, at the one-kilometre-square scale, were produced in the course of the government's own critical-load work. Of the two deposition scenarios studied, the first assumed full implementation of the EC Large Combustion Plant Directive (a 60-per-cent reduction in UK sulphur emissions from 1980 levels), while the second involved a further halving of emissions, in other words an 80 per cent reduction from 1980 levels. All sites of Special Scientific Interest (SSSIs) were identified for each one-kilometre square (SSSIs are statutorily protected areas in which are the most important wildlife areas of the country). A brief assessment was made of the nature of the site so that obviously insensitive sites, such as bat roosts, were not included in an overall assessment.

The total number of sites located on soils where the critical loads were exceeded is shown in the table. The area indicated is the actual area in each SSSI where that is the case – not the total area of the SSSIs.

Overall, for the 60 per cent scenario the 1023 sites represent 17.5 per cent of the total number of these sites in Britain, but the area where loads are exceeded is 25.8 per cent of the total. With the 80-per-cent scenario the percentages become reduced to 6.9 and 12.3 per cent respectively.

These sites cover a wide range of habitats and are spread throughout the country. Many are located in the uplands. Of considerable interest however are the many lowland heathland SSSIs in southern and eastern England that lie on soils where the critical loads are exceeded. These are areas not usually considered at risk from acidification.

Assessments were also made of impacts using exceedence maps produced at different scales. The most



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commonly seen map of the UK is one divided into 20-kilometre squares which reflect the dominant soil in each square. The area of such squares where loads are exceeded is roughly similar to the sum of the exceeded squares on a one-kilometre-square map. It may, therefore, be felt that it is a reasonable approximation. When examined for SSSIs, however, the 20-kilometre exceeded squares contain 152 sites in England under the 60 per cent scenario, as compared with 600 at the one-kilometre square level. This is because many of the exceeded soils that are not identified on the 20-kilometre-square map occur in lowland heaths, woodlands, and unimproved grasslands, which contain a very high proportion of nature-conservation sites. It seems that protected sites occur disproportionately on exceeded soils! Thus it is important to use the appropriate scale of map when assessing the particular impact that is being addressed.

It is evident from the study that current commitments are not sufficient to prevent the further acidification of a quarter of the protected areas of Britain. An 80-per-cent reduction from 1980 levels would bring about a significant improvement, but still leave many, predominantly upland, sites at risk. Significant further commitments following the current UNECE negotiations for a sulphur protocol will be needed to adequately protect these sites.

This study is only a risk assessment. It has not looked for change "on the ground." It is also unclear what soil acidification means for some of the habitats. Further research is necessary in order to clarify these issues. The study has moreover only considered sulphur. The increasing role of nitrogen as an acidifier and as a nutrient presents further risks to nature conservation.

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Ross, A. 1993. **Terrestrial SSSIs at risk from soil acidification in Scotland**. Edinburgh, Scottish Natural Heritage.

Sketch, C. & Bareham, S. 1993. **Terrestrial SSSIs at risk from soil acidification in Wales**. Bangor, Countryside Council for Wales.

	60% scenario		80% scenario	
	Number	Area (ha)	Number	Area (ha)
England	600	211,919	250	126,324
Scotland	205	148,614	69	52,443
Wales	218	109,501	86	466,609
Total	1023	470,034	405	225,376

Environmental Factsheet
No. 4, October 1993

Previous factsheets in the series:
No. 1 Forest Damage in Europe (December 1992)
No.2 Critical Loads (February 1993)
No. 3 The UN ECE Convention (April 1993)

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The Swedish Youth Association for Environmental Studies and Conservation
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Scientific knowledge

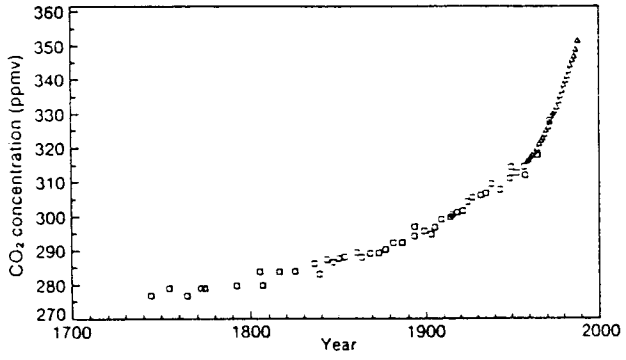
GLOBAL CLIMATE CHANGE, and its connection with man-made emissions of so-called greenhouse gases, has been a matter of increasing international concern since the mid-eighties. The plethora of information in the form of scientific reports and articles in the press has however seemingly tended to confuse the public as to what may be fact or fiction in regard to global warming. A remedy may nevertheless be found in the reports that have been published since 1990 by the Intergovernmental Panel on Climate Change. Through evaluation of a vast amount of scientific material, as well as application of personal knowledge, this international committee of scientists has been able to show what can be said to be definitely known about climate change, and what still lies in the realm of uncertainty.

The Intergovernmental Panel on Climate Change (IPCC) was established jointly in 1988 by the World Meteorological Organization and the United Nations Environmental Programme. This is a scientific and technical body with a very small secretariat but comprising 2500 scientists and experts in a worldwide network who are leaders in their fields. Its members may be nominated by national governments or intergovernmental and nongovernmental organizations.

At present there are three working groups, Working Group I assessing the available scientific information on climate change, Working Group II the scientific, technical, environmental, social, and economic information concerning its effects, as well as the options as regards the measures for adapting to it or mitigating it, while Working Group III deals with the economic and other issues that cut across that of climate change.

The first assessment report, published in 1990, comprises five sections entitled the IPCC Scientific Assessment, the IPCC Impacts Assessment, IPCC Response Strategies, the Policymakers' Summary of the IPCC Special Committee, and the IPCC Overview. The result of two years work by 170 scientists from all over the world,

Figure 1. Atmospheric increase in CO_2 during the past 250 years.



with a further two hundred involved in a peer review, this report provided a comprehensive statement of the state of scientific knowledge concerning climate change at that time, as well as the role played by mankind.

Known for certain

In a summary of the IPCC findings, the Swedish chairman, Professor Bert Bolin, notes that there is a natural greenhouse effect, which is already keeping the Earth warmer than it would be without it. But, he adds, the concentrations in the atmosphere of certain greenhouse gases are being augmented by emissions – notably of carbon dioxide, methane, and nitrous oxide – that come from human activities (See Figure 1). Such increases will bring a still further warming to the Earth's surface – a warming that will moreover be enhanced by an increase in the main greenhouse gas, water vapour, as a result of the general rise in temperature.

Calculated with confidence

Professor Bolin says it can be confidently stated that the burning of fossil fuels has been responsible for more than half of the progressive increase in the greenhouse effect in the past, and that a continuation can be expected (Figure 2).

He also notes that the atmospheric concentrations of the long-lived gases – carbon dioxide and nitrous oxide – adjust only slowly to changes in emissions. If emissions continue to increase at present rates we shall get increasing concentrations in the atmosphere for centuries to come. The longer this goes on, the greater the reduction will have to be if the concentrations are to be stabilized at a given level.

There can be no doubt that to stabilize the emission of long-lived gases that result from human activity, at today's levels, immediate reductions of more than 60 per cent will be necessary. A reduction of 15-20 per cent would be required for methane.

Projected from models

Projections using current models show that under an IPCC business-as-usual scenario, the rate of increase in global mean temperature during the next century will be between 0.2 and 0.5°C per decade (Figure 3).

Models also show that the land surfaces will warm more rapidly than the oceans, and that in winter the warming in high northern latitudes will be greater than the global mean. The regional climate changes, too, will differ from the global mean.

Under a business-as-usual scenario, during the next century the average rate of rise of the global mean sea level will be about 6 centimetres per decade (with a mean uncertainty range of 3-10 centimetres), mainly because of thermal expansion of the oceans and the melting of the land ice. A rise of about 20 centimetres is predicted for 2030, and 65 centimetres by the end of the next century (Figure 4).

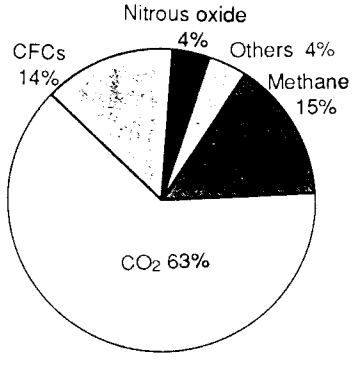
Professor Bolin does emphasize however that there are many uncertainties in the projections, particularly as regards the timing, magnitude, and regional patterns of climate change. This is due to an incomplete understanding of a) the sources and sinks of the greenhouse gases, which affect projections of future concentrations, b) clouds, which strongly influence the magnitude of climate change, c) the oceans, which influence its timing and patterns, and d) the polar ice sheets, which affect projections of rises in sea levels.

IPCC's judgment

In a summing up, the IPCC noted that during the last hundred years the global mean temperature of the surface air had increased by 0.3-0.6°C, and that the seven warmest years had occurred since 1980. Over the same period the global sea level had risen by 10-20 centimetres. In neither of these cases have the increases been regular in time, or uniform over the whole globe.

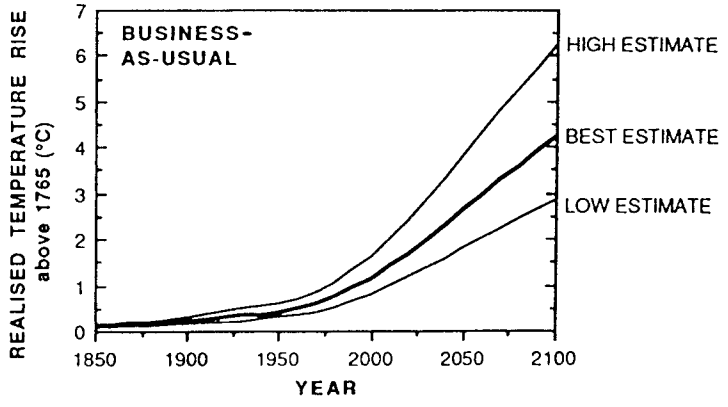
The extent of this warming up, Professor Bolin continues, while broadly consistent with the predictions of climate models, is also of the same magnitude as natural climatic variability. So the observed increase could largely be due to a natural variability – or alternatively, the natural variability, together with other human factors, might have offset a still larger greenhouse warming caused by human activities. Any certainty about this is

Figure 2. Global emissions of greenhouse gases 1990, converted to CO_2 equivalent in a 100-year perspective (IPCC 1990).



Note. The IPCC Supplementary Report (1992) states that CFCs probably give no net contribution to the greenhouse effect.

Figure 3. Simulation of the increase in global temperature from 1985-1990 due to observed increases in greenhouse gases, and predictions of the rise between 1990 and 2100 resulting from "Business-as-usual" emissions (IPCC 1990).



unlikely for at least another decade.

Vegetation affects climate and is in turn affected by a changing climate as well as by increasing concentrations in the atmosphere of carbon dioxide. Rapid changes of climate will alter the composition of ecocomplexes and their component ecosystems. Enhanced levels of carbon dioxide may increase the productivity of vegetation and its efficiency of water use. The effect of climate warming on mass biological processes, although as yet little studied, may actually increase the atmospheric concentrations of greenhouse gases.

Conclusions as to effects

Regarding the effects of climate change in its general aspects, as seen by the IPCC, Professor Bolin warns that comprehensive estimation of change at the regional level is difficult, since there is no great confidence in the regional estimates of critical climatic factors. This, he says, is particularly true for precipitation and soil moisture, where there is considerable disagreement between the various general circulation models and paleo-analogous results. There is moreover a good deal of uncertainty in regard to the relationship between climate change and biological effects, and between those effects and socio-economic consequences. It is however clear, he says, that there might be marked effects on agriculture and forestry in many parts of the world, as well as on human activities in coastal zones.

It has not yet been conclusively determined whether the global agricultural potential will, on average, increase or decrease. There may be negative effects at the regional level, which would be severe in some cases – with declines in production in those regions that are already highly vulnerable and least able to adjust to change. These include much of Brazil, Peru, the Sahel region of Africa, the Asian part of the CIS, and China.

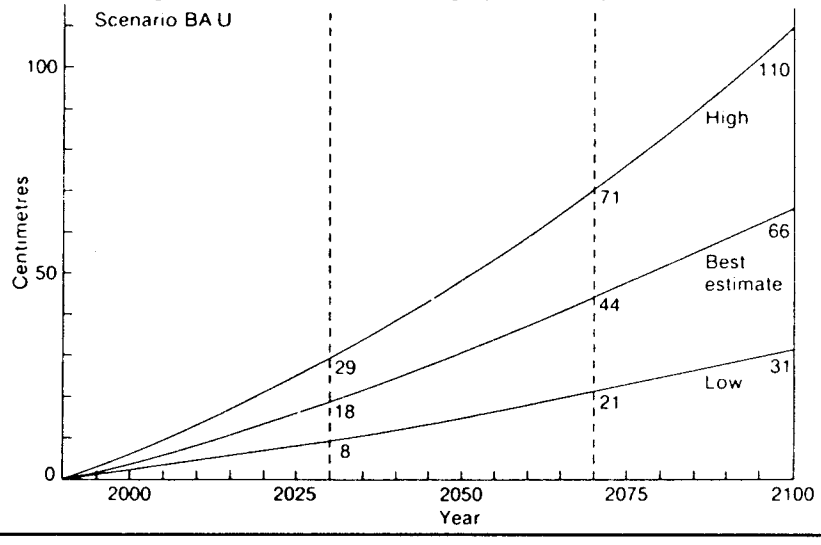
Because of a prolonged growing season in high and middle latitudes, the potential productivity might possibly increase, but it is unlikely that this would lead to any opening up of large new areas for production. The patterns of trade in farm products might be altered by a decrease in cereal growing in some of the currently high-producing areas, such as western Europe, the southern United States, parts of South America, and western Australia.

Since forests have a long period of rotation, new plantings and the present young growth will mature and decline in climates to which they are increasingly less well adapted. The actual effects will depend on the physiological adaptability of the trees and host-parasite relationship with their mycorrhizas. Large losses will occur, in the form of forest declines, from these and other factors.

The most sensitive forest areas will be those where the tree species are close to their biological limits as regards temperature and moisture. The increasing and unsustainable exploitation that may be expected will entail ever more pressure on forest investment, conservation, and sound management.

Projected changes in temperature and precipitation suggest that climatic zones, with their associated natural ecosystems, could shift several hundred kilometres towards the poles in the course of the next fifty years. Flora and fauna would lag behind these shifts. Some species might be lost because

Figure 4. Sea-level rise predicted to result from "Business-as-usual" emissions showing the best estimate and range (IPCC 1990)



of increased stress leading to a reduction in global biological diversity. Most at risk are those communities of species for which the possibilities of adaptation are most limited.

Relatively small changes of climate can cause problems with water resources in many areas – especially in arid and semi-arid regions, as well as in humid areas where demand or pollution has led to a scarcity of usable water.

The most vulnerable human settlements are those that are especially exposed to natural hazards, such as coastal or river flooding, severe drought, landslides, violent windstorms, or tropical cyclones. People in the lower-income groups of developing countries, residents of coastal lowlands and islands, and semi-arid grasslands are particularly vulnerable, as are the urban poor in squatter settlements, slums, and shanty towns, especially in megacities.

Global warming, concludes Professor Bolin, will accelerate the rise in sea level, modify ocean circulation, and change the marine ecosystems, with considerable socio-economic consequences. All this will come on top of the present trend towards rising sea levels.

Review

An update of the 1990 report, addressing its key conclusions in the light of fresh data and analyses, followed in 1992. Background papers for this were provided by 118 scientists from twenty-two countries, while 380 others from sixty-three countries and eighteen from the United Nations or nongovernmental organizations participated in the peer review both of the background material and of this supplement.

The supplement was agreed in January 1992 at a plenary meeting of Working Group I, which was attended by 130 delegates from forty-seven countries. It can therefore be considered as an authoritative statement by the international scientific community.

While essentially reaffirming the conclusions of the 1990 assessment, the Supplementary Report also presented some significant new findings. It notes for instance that in middle and high latitudes the depletion of ozone in the lower stratosphere results in a decrease in radiative forcing that is believed to be comparable to the globally averaged contribution of chlorofluorocarbons (CFCs) to such forcing over the last decade or so.

It also says that during the past several decades the cooling effect of aerosols deriving from sulphur emissions may have offset a significant part of the greenhouse warming in the northern hemisphere. Although this phenomenon was recognized in the 1990 report, there has since been some progress in quantifying its effect.

While the rates of increase in the atmospheric concentrations of many greenhouse gases have continued to grow, or have remained steady, those of methane and some halogen compounds have slowed. There are also data indicating that the global emissions of methane from rice paddies may amount to less than previously estimated.

Following up

The IPCC is to publish, by mid-1994, reports on Radiative Forcing of Climate and on Guidelines for National Inventories of Net Greenhouse Gas Emissions. A second full Scientific Assessment of Climate Change will come in 1995.

Among the matters that will receive especial attention in this second assessment are: The effects of sulphates from power plants, as well as of other anthropogenic aerosols. The problem of calculating global warming potentials (GWPs) arising from uncertainty as to how long carbon-dioxide emissions remain in the atmosphere. Methods for improving predictions of climate change at the regional level. Water resources, desertification, and drought. The effects of climate change, such as rise in sea level, and the options for response, particularly with regard to energy, human activities, and economics. Methodologies for studying the effects and making inventories of – listing and quantifying – greenhouse-gas emissions and sinks.

Note. In its scientific definition, aerosol is an airborne particle or collection of particles.

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Greenpeace 1990: **Global Warming. The Greenpeace Report.** Jeremy Leggget (Ed.). 554 pp. Oxford University Press.

Further information can be obtained from:

The IPCC Secretariat
c/o The World Meteorological Organization
Case Postale 2300
CH-1211 Geneva 2
Switzerland

A better option

IF AN AVERAGE coal-burning power plant were replaced by a new plant using natural gas, the greenhouse emissions would be reduced to a third. Replacing the worst power stations, burning the worst coal, would result in an even more spectacular improvement.

The proposed EC energy/CO_2 tax has the twin aims of conserving energy and bringing about a shift towards less carbon-intensive fuels. Whereas nobody is however explicitly against energy conservation, many people, from parts of Greenpeace to OPEC, have their doubts about the benefit of shifting from one fossil fuel to another.

In principle, photovoltaics, solar thermal, wind, and wave power, etc., offer the only sustainable solution. But for keeping CO_2 emissions to their 1990 level by the year 2000, photovoltaics and wave power are irrelevant, and even with a maximum expansion of energy from wind and other sources, renewables could not account for more than some tens per cent of the market for new power during the next decade.

For meeting new demand, and replacing ageing fossil and nuclear power stations, gas on the other hand provides a large-scale immediate option. The main remaining alternative is not renewables, or nuclear, or oil, but coal.

It is thus worthwhile considering the differences between coal and natural gas, especially as regards emissions of greenhouse gases.

Carbon content. The energy from burning hydrocarbons comes from a mixture of carbon and hydrogen. The carbon fraction produces CO_2, the hydrogen part only water vapour. In methane, the dominating constituent of natural gas, the hydrogen/carbon weight ratio is 1:3, as against 1:20 or so for coal. When an energy unit of coal is combusted, 1.8 times as much CO_2 is emitted as from an energy unit of natural gas.

Conversion efficiency. The CO_2 emissions (as well as others) are also directly dependent on the efficiency of the power plant. An average coal-fired station has an efficiency of about 35 per cent, which means that 65 per cent of the coal is wasted, although it still produces CO_2. With the best available coal technology the efficiency is about 44 per cent, but this is not quite commercially viable. The standard coal power station that is being ordered today has an efficiency of 40 per cent. The efficiency of the worst coal-fired stations in the EC is 22 per cent (according to confidential information from the Commission DG XII). Even worse examples could be found in ex-communist and third-world countries.

Alternative is not renewables, or nuclear, or oil, but coal.

The best available commercial technology for natural gas is a combination of gas turbine and steam turbine with a gas-to-electricity efficiency of 58 per cent. (ABB autumn 1993). General Electric is now heading for 60-per-cent efficiency. This development is more or less a spinoff from airplane-engine technology, and even better efficiencies are to be expected, for example in the BRITE materials technology program at DG XII. The principal objective for BRITE is however not to save energy but to achieve safer operation and longer life for the turbines, which will also cut costs.

A new power plant for natural gas uses the fuel 1.4 times more efficiently than a new coal plant.

Replacing old coal-burning plant with a gas-fired plant improves the efficiency by a factor 1.6-2.5.

The efficiency factor (1.4-2.5) can be multiplied by the carbon content factor (1.8), which so far gives a CO_2 emission advantage for natural gas of 2.5-4.5. But this is not the whole story.

Front-end efficiency losses. It takes less energy to drill for gas than to mine coal. It takes less energy to pump gas through the pipeline than to propel coal trains and ships. It takes less energy to dry and desulphurize natural gas than to wash and pulverize the coal. A conservative guess is that front end *average* losses for coal are 1.1 times worse than for gas.

The energy for bringing up the coal is, according to another confidential Commission source, ten times higher in Germany than from Australian opencast mining. The difference is then obviously greater than a factor 1.1.

Back-end efficiency losses. Electricity is to some extent consumed as space heating, and in some industrial processes. If this power comes from a coal-burning plant, some 70 per cent of the energy is lost between pit and electricity output. Of the remainder, 10 per cent is lost in the high-tension grid and another 10 per cent, on average, in transformers and the distribution network. Even if the space heating is 100 per cent efficient, the system efficiency is more like 15-25 per cent!

Direct gas heating is an alternative to electricity, coal is usually not. The conversion efficiency from natural gas to heat is at least 80 per cent.

Replacing an average power station burning coal from an average mine with a modern natural-gas plant will decrease CO_2 emissions by a factor 1.8x1.6x1.1=3.17. If electric heat from that coal power plant is replaced with natural-gas heating the CO_2 will be reduced by a factor 5, at the very least. The figures for the worst coal-fired plants using coal with the worst front-end energy efficiency may be twice as high.

Sixty to ninety per cent of the CO_2 emissions from coal could thus be avoided by switching to gas.

Although carbon dioxide is the most important greenhouse gas, it is not the only one.

Methane. The second most important of the man-made gases is methane. It is emitted both from coal mining and the production of natural gas (through venting and leakages). In the United Kingdom in 1989, 992,000 tons were emitted from coal mining, 345,000 tons from

Recent publications

Air pollution & tree health in the United Kingdom (1993)
A report by the United Kingdom Terrestrial Effects Review Group, prepared at the request of the Department of Environment. It assesses the pollution climate and the relative importance of atmospheric pollution for trees.

£20.00. 88 pp. Can be ordered from HMSO Publications Centre, P.O. Box 276, London, England SW8 5DT.

The Nordic environment – present state, trends and threats (1993)
An attempt to give an overall picture of the state of the environment in the Scandinavian countries. Text, illustrations, charts, and maps combine to show both the present situation and what the future may hold.

160 kronor. 212 pp. Obtainable from Swedish Environmental Protection Agency, Information department, S-171 85 Solna, Sweden.

Emission of air pollutants in the region of the Central European Initiative –1988 (1993)
A report presenting an inventory of the emissions of sulphur dioxide, nitrogen oxides, particulate matter, and carbon dioxide for the countries engaged in the Central European Initiative, i.e. Austria, Croatia, the Czech and Slovak Republics, Hungary, Italy, Poland, and Slovenia. The inventory describes emissions in the year 1988.

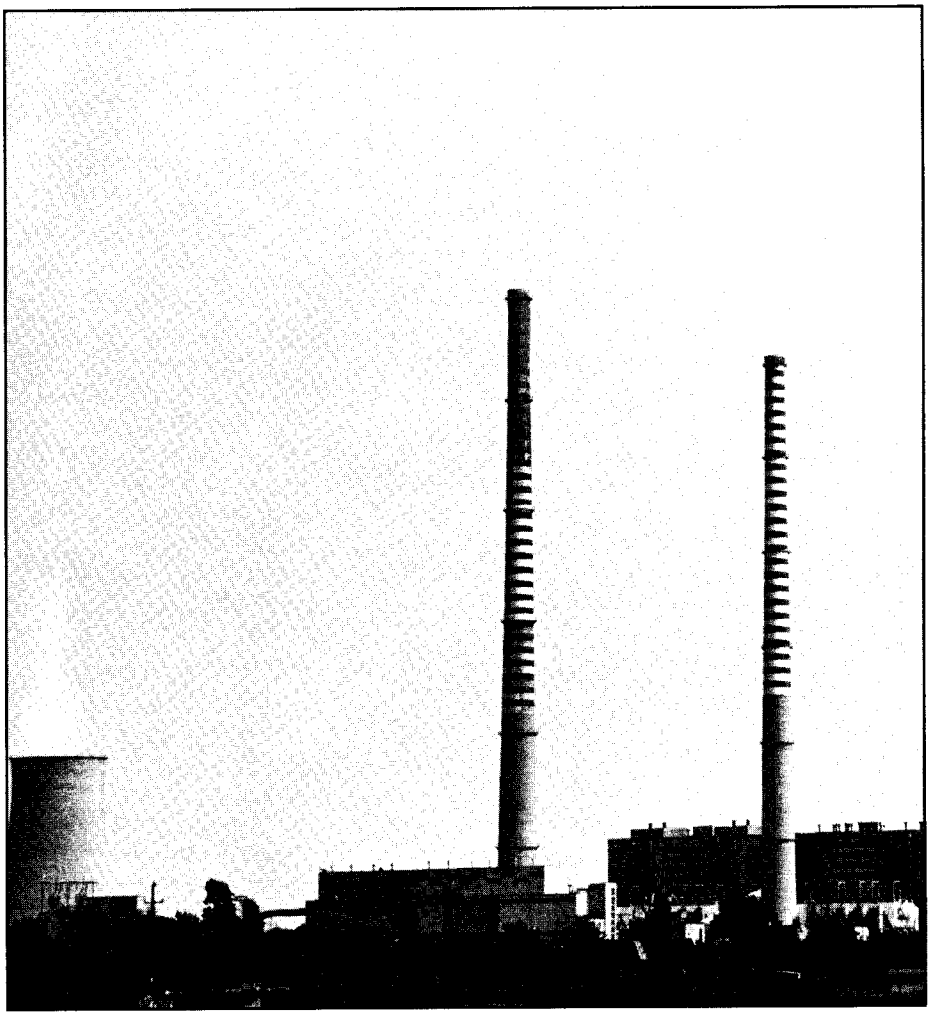
92 pp. Available from IIASA, A-2361 Laxenburg, Austria.

Air pollution in Upper Silesia (1993)
By Piotr S. Poborski. A report aiming to present an objective view of air quality in Upper Silesia, with emphasis on the effects on human health. Also includes proposals for measures to deal with the situation.

54 pp. Published by the Information Centre for Air Protection, Polish Ecological Club, Pl. Grunwaldski 8-10, Pl-40-950 Katowice, Poland.

Exhaust gas emissions from sea transportation (1993)
A survey of the emissions of air pollutants from shipping in Swedish waters, made by consultants Mariterm AB. Identifies the factors influencing emission levels and the available methods for cleaning exhaust fumes.

226 pp. Published by the Swedish Transport Research board, Birger Jarls torg 5, S-111 28 Stockholm, Sweden.



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gas leakage, and 219,000 tons from oil and gas venting. Of the venting, at least two-thirds should be attributed to oil rather than gas.

The total production of coal was 59 Mtoe, and gas 37 Mtoe, so per energy unit, the methane emissions from gas were less than those from coal.

In a *dynamic* perspective the difference weighs over even more towards gas.

Much of the leakage occurs when natural gas is pumped into old city gas systems. This is however unlikely to increase – it should actually decrease as old pipes and valves are routinely replaced. Venting is also decreasing. On the other hand there is not much to be done about methane emissions from coal mines as long as they stay in operation. To avoid risk of explosion, the gas has to be vented, but when a mine is closed down, it should be possible to collect some of the methane and feed it into the gas grid. In Britain for instance the natural-gas grid could also swallow some of the 716,000 tons of methane emitted from landfills all over the country.

The conclusion that coal is a greater emitter of methane than natural gas seems to apply in most of the world, including Germany and the United States.

The big question mark applies to imports from the Russian Commonwealth. How much does the CIS system actually leak? And will it leak more, or less, as exports and indigenous uses increase? Loose figures abound, but there is little solid knowledge. If horror figures of 50 per cent losses are substantiated, it should be very cost effective to mend the leaks, as it would mean 100 per cent more sales in hard cash for the Russians. Considering what is at stake, economically and ecologically, the costs of making a reasonably exact assessment should not be overwhelming. Such an assessment should be a prerequisite for any new import contracts, or new pipelines. For the foreseeable future, administrative instruments are obviously preferable to a methane tax.

Other greenhouse gases. Even the most advanced coal combustors emit considerably more NOx than gas-burning power stations. Nitrogen

oxides are precursors of tropospheric ozone, which is also a prominent greenhouse gas.

Some of the NOx emitted will finally be converted back to nitrogen gas by anaerobic bacteria, but this process is far from perfect. It also yields N_2O, nitrous oxide, a potent and persistent greenhouse gas which is also emitted directly from coal-burning power stations, either as a result of the combustion or from denitrification processes. To convert the nitrogen emissions to CO_2 equivalents is extremely difficult, but it is clear that in this respect coal is much worse than natural gas, even when burnt in newer plants.

The chlorine content of coal is partially emitted as chloro-alkane, an extremely potent and persistent greenhouse gas, although neither the emissions nor the greenhouse properties are as yet well quantified. Natural gas contains no chlorine.

Acid rain, eutrophication, and local pollution: Old coal power stations emit large amounts of sulphur dioxide, volatile organic compounds, hydrogen chloride, heavy metals, and particulate matter, new plants much less, but natural-gas plants very little or none at all. The emissions of NOx (causing eutrophication and acid rain) are lower or very much lower from natural gas. The costs of retrofitting the world's coal power plants with desulphurization and de-NOxing equipment are so huge that just for that reason new gas-fired plants are already a viable alternative, notably in Britain and the United States. Although gas is more expensive than coal, the plant capital costs amount only to about half.

The CO_2/energy tax would hasten the move to gas. The beauty of such a move is that it would hit the worst mines and worst coal power stations first, and thus achieve much more and cheaper CO_2 reduction than indicated by the macroeconomic calculations.

There is also a strong case for a rapid phase-out of coal subsidies, as urged by the European Commission.

On the other hand there seems little justification for financial support for the so-called Clean Coal Technology, for example in the THERMIE program. In a greenhouse perspective, there is no clean coal.

The phase-out of European coal will entail considerable social costs. But it should be kept in mind that the largest part of those social costs has already been paid. In Belgium and Holland there are no pits left, and in all the EC member states there are now no more than 150,000 underground miners. To slow down the phase-out will not help the depressed regions. Those regions need *new* jobs to survive.

Such new jobs could be provided by re-directing coal subsidies to renewables, conservation, and environmental cleanup, all of which are relatively labour-intensive.

It may be argued that a dash for gas, reinforced by a CO_2 tax will not only kill coal, but also block the use of renewables. On the other hand, a rapid expansion of gas should lead to higher prices, and so make renewables more competitive. A safeguard to protect the market for renewables might also take the form of a mandatory commitment for the power industry, along the lines of the UK Non-Fossil Fuel Commitment. The gas industry would probably be ready to pay this small price to win acceptance for gas.

In the last instance the great advantage of gas is that the supply, though huge, is clearly finite. At the present rate of consumption the estimated reserves will last some 58 years. With a rapid expansion they would last only for about one generation. Gas is, inevitably, a transitory solution on the way either to renewables or back to coal. Unless the phasing-in of renewables can be done in 20-30 years, it will not be possible at all.

Coal, on the other hand is so plentiful and so cheap to dig up that if it should be found acceptable, there will be no reason to start thinking about what is to replace it for more than a hundred years. The CO_2 content of the natural gas reserves amounts to some 600 gigatons, but if all the coal were to be combusted, the amount would be some 4000 gigatons, "clean" coal or not, with roughly an equal amount of other greenhouse gases. If even a substantial part of this were released, the resulting climatic disruption might be so severe that there would be no need for further energy policy considerations.

FREDRIK LUNDBERG

Further publications

International environmental negotiations — process, issues and contexts (1993)

Has the world learnt anything from decades of environmental negotiating? What are the factors behind the positions that have been taken? Analyses are given by diplomats, negotiators, experts, observer NGOs, and others that are involved.

282 pp. Published by the Swedish Council for Planning and Coordination of Research (FRN), Box 6710, S-113 85 Stockholm, Sweden.

Getting the prices right — a European scheme for making transport pay its true costs (1993)

By Per Kågeson. A proposal from the European Federation for Transport and Environment for ways to make the transport sector bear its full social costs, including the environmental ones.

Ecu 15.00. 210 pp. Available from T&E Secretariat, Rue de la Victorie 26, B-1060 Brussels, Belgium.

Economic instruments in European environmental policy (1993)

By Per Kågeson, published by the European Environmental Bureau. A survey of the use of economic policy levers in various European countries. Also discusses the possible options for an extended use of such instruments in the European Community. Gives a thorough account of the way the various instruments operate.

120 kronor. 140 pp. Can be ordered from Naturskyddsföreningens förlag, Box 4625, S-116 91 Stockholm, Sweden.

The costs of cutting carbon emissions: Results from global models (1993)

A report analyzing six different models for calculating the cost of reducing emissions of carbon dioxide.

US$19.00. 160 pp. Can be ordered from OECD, 2 rue André Pascal, F-75775 Paris Cedex 16, France.

Strategies to prevent climate changes (1992)

Describes the general problem of greenhouse gases, the emissions of them in Sweden, trends in the energy and transport sectors, and the effects of various measures for bringing the emissions down.

188 pp. Report 4186 (Summary 32 pp. Report 4187). Obtainable from Swedish Environmental Protection Agency, Information department, S-171 85 Solna, Sweden.

Better from smaller units

A SUPER-DISTRICT for market economy, was the way the president of the Federal Monopolies Commission characterized the takeover of energy supply in the former DDR by the western German power giants RWE, Bayernwerke, and Preussen Elektra. The preparations for the takeover had been swathed in the strictest secrecy. The background to this deal-of-the-century was that despite all talk of a "free market economy," energy supply in Germany was already dominated by monopolies. A few concerns, linked with dozens of subsidiaries, had divided the market among themselves.

The energy supply law, a legislative fossil dating from 1935, continues to provide legitimacy for existing monopolies, the law's primary aim being to ensure a sufficient, cheap, and reliable supply of electricity. The law on restriction of competition, which is intended to prevent monopolistic agreements, allows generous exceptions for the energy industry. Thus the energy suppliers (*Energiversorgungsunternehmen,* EVUs) are united through so-called demarcation agreements, defining the territory of each.

Eastern Germany has similarly been divided up, RWE having taken over the Chemnitz-Leipzig-Cottbus network, while Preussen Elektra appropriated Rostock, Neubrandenburg, Magdeburg, Potsdam, and Frankfurt/Oder, and Bayernwerke took Suhl, Gera, and Erfurt.

The regulation of the energy industry has caused, and is still causing, the electricity lobby to sink billions of deutschemarks in the dinosaurian technology of giant power plants, thus creating overdimensioned reserves of power that no one really needs. In such circumstances it can hardly be a matter of surprise that the power suppliers should be pushing into the heating sector and boasting that heat-from-power provides a "cleaner" alternative. The fact that in the process well over half of the energy input is uselessly dissipated has been carefully suppressed. The efficiency of the power stations is no more than 26 per cent when burning brown coal, and 37 per cent with hard coal.

The Grüne Liga, an umbrella organization for ecological groups in the former DDR, is now proposing a new law for energy production, which would take into account the needs of the environment. Its argument is that the most desirable technique no longer comprises huge plants – from which power is transported with great losses over enormous distances on super-high-voltage lines – but small, decentralized generating units that also supply heat. The emissions of pollutants can thereby be halved, with a doubling of the ratio of energy output to fuel input.

Municipalities could earn money primarily by energy saving

With combined generation, independent municipal stations could supply both power and heat, and – as in the case of natural gas – transport both to customers through their own distribution networks. This also means money for the municipal coffers – which the EVUs vehemently dispute, trying to frighten local politicians with warnings of a great accumulation of debt. If that is really the case, counters the Grüne Liga, it seems curious that the EVUs should be so eager to become participants in the municipal schemes.

According to the law of local self-government, municipalities are responsible for the organization of the power supply. They have the right both to establish their own power stations and take over the operation of existing ones. Lately there has been a growing demand for the conversion of energy supply undertakings (EVUs) into suppliers of energy services (EDUs, *Energi-Dienst-leitungsunternehmen).* As an ecologically and socially orientated undertaking, an EDU would be able to provide consumers not only with energy carriers, such as coal, electricity, and gas, but also with heating, lighting, and refrigeration services.

The aim of EDUs should be to satisfy such needs in as economically and ecologically compatible a manner as possible, rather than to sell a lot of electricity. This can be accomplished through better-insulated dwellings, the use of more efficient household appliances, as well as other ways of saving energy, instead of building additional power stations. Subsidies or low-interest loans for such measures would often cost an EDU less than investment in a new power station. In other words, an EDU could earn money primarily by energy saving.

An example of this new kind of energy policy can be seen in a pilot project that is being conducted by the municipal company at Rottweil. Apartment-house tenants will for instance be given subsidies if they substitute gas cooking stoves for their present electric ones, or buy new, energy-efficient electrical appliances. In this case the heating plants for single-family homes are owned and operated by the municipality, and consumers have to pay only for the heat they actually use – with the assurance, too, that is has been generated in the most ecologically compatible manner that is now possible.

Source: Pressrelease from Grüne Liga, Projektgruppe, Energieberatung, Schönhauser Allee 185, O-1058 Berlin, Germany.

Taking it back

Despite undertakings to reduce the country's emissions of carbon dioxide, Germany is now permitting the construction of new coal-fired power plants in the former DDR. Now that contracts have been signed securing the supply of brown coal, the work on two 800 MW blocks at Lippendorf, near Leipzig, can go ahead. These will burn 9-10 million tons of lignite per year from nearby opencast mines. The intention is also to build new 800 MW blocks at Boxberg (one or two) and Schwarze Pumpe (two). These are to come on line by 1997, the Lippendorf blocks not until 1999-2000.

Source: **Power in Europe**, March 26, 1993.

Environmental aid faltering

IN 1990 the Commission of the European Communities decided to start a Black Triangle Programme to support measures for environmental protection in this greatly polluted area, with its high concentration of industry and extensive mining of coal. The aim was to coordinate assistance from the G-24 (OECD) group and implement projects that could be quickly realized.

Several million ecus had already been allocated by 1991, but by the end of 1992 the coordination office for the Northern Bohemian region, for instance, had still not become properly established, and environmental planning and feasibility studies for the area had not even been started. There has been some talk of projects such as "conversion from coal to gas" in Poland, but nothing has come of it.

In 1991 the Commission had announced that problems associated with acute threats to health in the Black Triangle should be addressed urgently, and given absolute top priority. This too, however, seems to have been mere empty words.

It is therefore suggested that environmentalist NGOs should ask the EC for urgent action by writing to:

H. De Conynck, Coordinator
Black Triangle Regional Programme,
Commission of the European Communities, DX XI – Environment, Nuclear Safety and Civil Protection
200 rue de la Loi
B-1049 Brussels, Belgium
Tel: +32-2-2969146. Fax: 2993570.

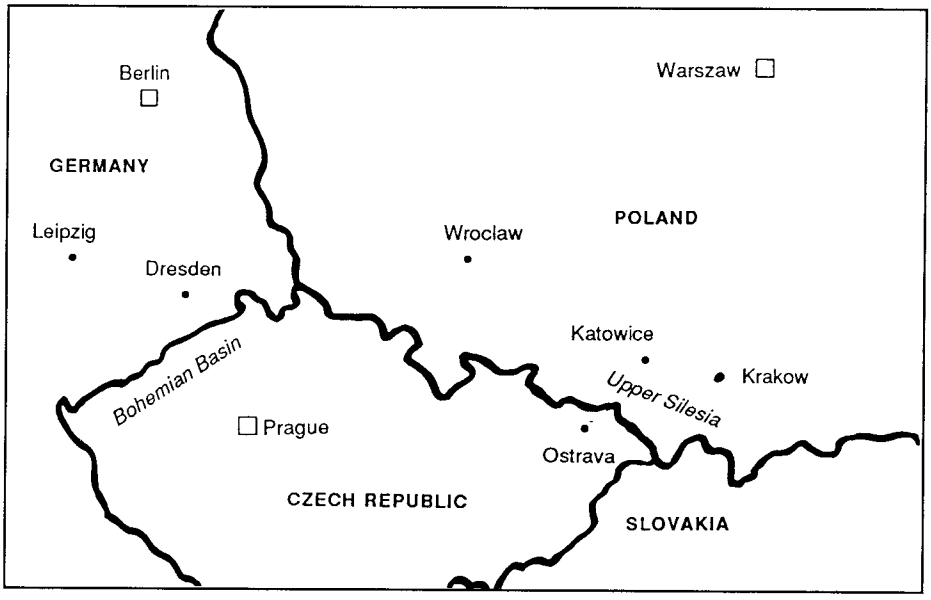
Environmentalist groups in the Black Triangle region are in any case preparing an NGO conference in Most, Northern Bohemia (Eko-Most, October 19-23) to evaluate the environmental assistance programs from the West. Information can be obtained from:

Ekoforum/Greenhouse Litvinov
Rooseweltova 296
43600 Litvinov, Czech Republic

REINHOLD PAPE

The Black Triangle

The development of mechanisms for environmental improvement in this heavily polluted part of Europe proceeds only slowly. Plans exist, but international banks have been reluctant to commit themselves. Another aspect of the problem is the struggle between coal and environmental interests.



UPPER SILESIA

Not much change

AS PRESIDENT of the Polish Ecological Club in Upper Silesia, Wojciech Beblo had organized protests against the actions of the local authorities even while the Communists were still in power at the end of the eighties. He is now himself director of the government department of the environment in Upper Silesia. But after more than two years in that post he has to admit that the official attitude to environmental protection still shows no appreciable change. Industry is not expected to do anything but grow, no consideration is being given to the saving of resources, and industrial leaders simply ignore such matters.

According to Wojciech Beblo, air pollution is the main problem, and the energy sector is still the main polluter. In 1990 the Polish government published a list of 80 enterprises whose plants should have been closed down unless measures were taken to clean up. Mr Beblo says that by the summer of 1993 only three had actually been closed down, and while restructuring was at least being planned in a few cases, the emissions from 77 plants were still continuing as before.

Outside assistance is slow in coming. Neither the World Bank nor the European Bank for Reconstruction and Development has yet started any specific environmental project for the region around Katowice, Wojciech Beblo's home town. The EBRD is instead financing a new motorway, which is supposed to traverse Upper Silesia.

Mr Beblo does however note improvement in at least one respect: The emissions of dust have declined substantially during the last few years, 40 per cent of the decrease being attributable to the economic recession and 60 per cent to environmental measures.

REINHOLD PAPE

Debt-for-environment swaps

AT A MEETING IN APRIL 1991 of the so-called Paris Club (G-24, comprising the OECD countries), it was agreed that further reductions of Poland's debt – up to 10 per cent of the initial amount, or 20 per cent of the remaining half – could be made through a number of voluntary bilateral agreements with the country's creditors.

At the same time the Polish government made way for an EcoFund to manage the selection, development, and financing of projects undertaken within the framework of debt-for-environment swaps.

If all Poland's creditors were to respond to the Paris Club's proposal, it would mean that the fund could have at its disposal more than $3 billion for disbursement over a period of eighteen years. It was estimated that the fund's budget would never exceed 15 per cent of the total domestic expenditure on environmental projects. Four main problem areas were named as international priorities for projects to be supported by the EcoFund.

☐ Abatement of long-range transboundary air pollution.

☐ Increased control over contamination and eutrophication of the Baltic Sea.

☐ Abatement of the emissions of carbon dioxide (and other greenhouse gases), mainly through energy-efficient technologies.

☐ Preservation of biological diversity through sound development assistance affecting ecological systems of international importance.

Bilateral agreements have already been negotiated with a number of the country's creditors. It has been confirmed that the EcoFund shall dispose of 10 per cent ($367 million) of Poland's indebtedness to the United States. The French government has agreed to swap 10 per cent, too, although it has yet to be decided whether the full amount shall be channelled through the fund. At the time of the Lucerne conference of ministers in April, on the European environment, Switzerland also announced its intention of adhering to the 10-per-cent swap proposal.

In Sweden environmentalist groups have called on the government to go the same way as soon as possible, and it is hoped that during the next round of renegotiation of Polish debts, at the meeting of the Paris Club in 1994, more countries will take up proposals for debt-for-environment swaps.

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See also: **Debt-For-Environment Swaps: The Institutional Dimension**. By Tomasz Sylicz. Beijer Discussion Paper Series, No. 18. Beijer International Institute of Ecological Economics, Box 50005, S-104 05 Stockholm, Sweden.

Direct inquiries can be addressed to: Maciej Nowicki, Director, EcoFund, Ul. Wawelska 52, Warszaw, Poland.

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Simple means for quick effect

A SWEDISH ENERGY CONSULTANT, with long international experience in the power sector, has, in cooperation with the Swedish NGO Secretariat on Acid Rain and environmentalist NGOs in Poland and the Czech Republic, put forward proposals for attacking air pollution in the Black Triangle region through short-term, relatively inexpensive measures, with the payoff time and cost-benefit among the prime considerations.

The most important thing, he says, is to get energy-saving started, giving initial priority to the simplest measures. The time for introducing advanced capital-intensive technology will come later, when the economy is improving.

One simple proposal would be to retrain boiler stokers and get them to change their attitude towards reducing the waste of energy. Pilot projects have shown it to be possible to reduce fuel consumption in small heating boilers by 30 per cent simply by teaching the stokers how to handle and maintain their boilers properly.

The need to conserve energy would be impressed on consumers, and savings made more easily possible in district-heating distribution systems, if western makers of space-heating and pipe installations were to set up local manufacturing facilities for radiator valves and temperature regulators.

Other suggestions in the study* include:

☐ Lime injection in medium-sized boilers, which could reduce the emissions of sulphur 30-40 per cent.

☐ Coal-washing plants to get rid both of ballast (up to 30 per cent) and pyrite sulphur.

☐ The expansion of combined heat-and-power generation for instance in Chorzow, Upper Silesia, and Ledvice, Northern Bohemia.

REINHOLD PAPE

* The full report by Stefan Björklund appears in No.2 of the Air Pollution and Climate Series, published by the Swedish NGO Secretariat on Acid Rain, entitled **The Black Triangle – A General Reader**. Available on request.

Victims of coal mining in Northern Bohemia

1952 Jezeří
1955 Pláň
1955 Michanice
1957 Ervěnice
1957 Růžodol
1958 Kocourkov
1959 Dřevotluky
1960 Lipětín
1960 Podhradice
1960 Velebudice
1960 Staré Verneřice
1962 Prunéřov
1964 Březánky-Adéla
1965 Břešťany
1965 Jizerka
1965 Kamenice
1965 Libouš
1965 Milžany
1965 Čachovice
1965 Bystřice
1965 Skyřice
1965 Úžín
1966 Radovesice
1966 Nové Sedlo
1966 Královské město
Most
1967 Hetov
1967 Tušimice
1968 Lískovice
1968 Roudné
1969 Chotovenka
1969 Přezetice
1969 Slatinice
1969 Pařidla
1969 Varvažov
1970 Skřinice
1970 Dřínek
1970 Vrchnice
1970 Prahly
1970 Lužice
1972 Kundratice
1972 Podhoří
1973 Jenišův Újezd
1974 Dřínov
1974 Kralupy u
Chomoutova
1974 Kyjice
1974 Kamenná Voda
1974 Liptice
1974 Ondřejov
1974 Podhůří
1974 Tucholupy
1974 Újezd
1974 Vysočany
1974 Zálužany
1974 Tuchomyšl
1974 Záluží
1974 Židovice
1975 Skránce
1975 Třícholupy
1976 Lochočice
1976 Otovice
1977 Bejlany
1977 Konobrže
1977 Kopisty
1977 Pohledy
1978 Vršany
1978 Holešice
1978 Osada Duřec
1979 Vychlice
1979 Stará Bělá
1980 Dolní Litvínov
1980 Hořany
1980 Hrdlovky
1980 Brány
1980 Brančíky
1981 Naší
1981 Račice
1982 Krbice
1982 Albrechtice
1982 Dvorců
1983 Ahníkov
1983 Dolní Jiřetín
1983 Zásada
1987 Zichlice
1989 Hrlovice
1993 LIBKOVICE?

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CZECH REPUBLIC

Plight of Libkovice

COAL IS THE ABSOLUTE RULER in Northern Bohemia. Some hundred villages and the historic town of Most had already been obliterated, 200,000 people had lost their homes, when the turn came to Libkovice, a village of 309 houses and 1200 inhabitants that had recently celebrated its 800th anniversary.

Beneath the village is a high-quality deposit of brown coal. Geologically, however, the site is complicated, and it is uncertain whether mining can be extended under the village. It had in any case come to a stop about a kilometre away on account of an accident.

Although little is left of the former village, there are too many unknown factors to justify completing its destruction. At best it could take three years for mining to get as far as Libkovice, and even so, that would not necessarily mean the end. There are many examples of mining having gone on underneath villages, but in this case it has seemed easiest to bulldoze it all away.

In Northern Bohemia 112 villages have been levelled because communist doctrine held it to be impossible to build a workers' paradise without brown coal. But now Libkovice is threatened with extinction because the new Czech democracy has not yet learned to protect its citizens from what they view as a well-established industrial mafia.

Libkovice is one of the first villages in Northern Bohemia to start resisting this kind of development. The local mayor is convinced that if it can be stopped, people will return and rebuild their former homes. Many have declared that they would like to do so, and have shown an interest in reclaiming their abandoned property.

JAN PINOS

Send pleas to save Libkovice to:
Prime Minister Vaclav Klaus
Urad Vlady, Nabrezi Edvarda, Benese 4,
11000 Praha, Czech Republic.

Seminars on energy policy

THE INFORMATION CENTER for Air Protection (ICAP) of the Polish Ecological Club in Upper Silesia recently held two seminars on environmental policy, one to discuss integrated planning for energy management in the region, the other to deal with the Natural Heritage in Polluted Areas, and consider the effects of pollution on the few remaining natural areas in this heavily industrialized part of the country, and find ways of restoring the wastelands left by mining and other activities.

Among the general conclusions of the seminar on energy management, which was attended by city mayors and other high municipal officials, as well as representatives of NGOs, were the following:

☐ The existing energy systems are low in efficiency and generally obsolete. Since the main sources of energy are hard coal and lignite, the present production is extremely harmful to the environment.

☐ Producers are interested only in supplying energy to customers, without any regard to its efficient end-use.

☐ Energy-saving projects are not treated on an equal footing with others merely for increasing energy production. Saving activities are not regarded as a means of increasing energy resources.

☐ Projects for increasing efficiency in energy use are considerably cheaper than building new generating plants.

☐ There is no public awareness of the need for changing the system of energy management.

☐ The existing legal system also favours energy producers.

☐ Energy producers are moreover supported by a strong fuel-sector lobby.

☐ In the present state of recession, there is a considerable overproduction of energy in Poland, and particularly of electricity.

☐ There is no possibility of evaluating the environmental effects of economic decisions on a macro scale (concerning, say, fuel prices and environmental charges).

☐ On account of a producers' monopoly, energy prices are not subject to the laws of a market economy.

REINHOLD PAPE

Full reports of both seminars can be obtained from ICAP, Polish Ecological Club, Pl. Grunwaldzki 8-10, PL-40-950 Katowice, Poland.

Debating improvements

IN COMPARISON with the general rate of progress towards international treaties, ratification of the UN Climate Convention is proceeding fairly rapidly. By August 1993 the Convention had been adopted by the parliaments of thirty-one countries, and it is expected that the necessary quota of fifty will soon be attained, thus enabling the Convention to come into force at the beginning of next year.

The EC countries, which were actively supporting the Convention at Rio, have still not ratified, owing to a disagreement among themselves regarding an energy/CO_2 tax that would help make a stabilization of CO_2 emissions possible by the year 2000. Improvements to the Convention will however be discussed at the Conference of the Parties (COP), the first official meeting of the Convention, which is expected to take place in Germany in March 1995.

In the meantime the International Negotiation Committee on Climate Change, which prepared the Convention, will be meeting three times to make ready for the Conference of the Parties. Many issues that were left open at Rio will still have to be negotiated at these INC meetings. These include the interpretation of commitments that are part of the Convention, methodologies for calculating emissions and sinks of greenhouse gases, and the financial mechanism for assisting the so-called Southern countries.

An important issue that needs clarifying is the concept of "joint implementation." Written into the Convention on Norwegian initiative, this is intended as a transferable compliance with the requirements of the Climate Convention, whereby an action limiting emissions of greenhouse gases is carried out in one country to offset the control obligations of another that is either unable or unwilling to comply.

Such offsets may be of two types: either an actual reduction of emissions achieved, say, through deployment of energy-efficiency technologies or demand-side management, or the "capture" or sequestration of emissions through the enhancement of natural biotic sinks, typically by afforestation projects. If achieved as a jointly implemented project, the offset gain can be credited in whole or in part to the sponsoring country or entity.

As an example, the Norwegian government and the World Bank signed an agreement on December 16, 1992, that will allow Norway to "purchase" carbon credits from Mexico and Poland. Norway will add $4.5 million to grants for the Poland coal-to-gas boiler conversion project and the total-energy housing projects, as well as a Mexican project for high-efficiency lighting.

The World Bank will "estimate the physical value of the carbon offset generated by the provision of Norwegian co-financing and which can be attributed to Norway and claimed as a part of its contribution to the global effort of limiting GHG emissions under the Climate Convention." The agreement specifies that Norway will be provided with a carbon-offset certificate for one or both of the projects. After appraisal, a workshop will be organized to review the experience of joint implementation arrangements, as well as the design of accreditable and tradable carbon-offset instruments.

Non-governmental organizations reacted angrily to the deal, charging that it undermines the Climate Convention by pre-empting decisions by the COP. The NGOs want first to see improvements in the Convention. Greenpeace for instance proposes that joint implementation should wait until the OECD countries have agreed on a 20-per-cent reduction of CO_2 emissions. Twenty-two environmental NGOs in Scandinavia called on their governments to take the initiative, on the first anniversary of the Convention last June, by proposing that a protocol for a specified reduction of CO_2 (20 per cent by each OECD country by 2005) be adopted at the first COP meeting.

REINHOLD PAPE

Further information as to NGO attitudes on joint implementation can be obtained from:

Climate Network Europe
44, rue du Taciturne
B-1040 Brussels, Belgium
Tel: +32-2-231 01 80
Fax: +32-2-230 517

Climate Network Africa
c/o Kenya Consumers Organization
P.O. Box 21136
Nairobi, Kenya
Tel. & fax: +254-2-214 898

Get ready!

ENVIRONMENTALIST organizations are asked to start preparing activities for the Global Climate Alliance Action Day, December 10, 1993, focusing on the effects of global warming on the Southern countries and highlighting for instance the links between deforestation and land ownership as well as human-rights issues.

For more information please contact:
Service Centre for Development Cooperation, Fredrikinkatu 63 A8
SF-00100 Helsinki, Finland.
Tel: +358-0-6944233.
Fax: +358-0-6941786.

Negawatts pay

A $7.5 million compact-flourescent-lamp factory saves as much electricity as a $1 billion power plant can make. While consuming 140 times less capital, the factory also avoids fuel cost and pollution of the power plant. A $10 million "superglass" factory making windows that block heat but pass light can produce more comfort than the air conditioners run by $2 billion worth of generating stations. Over 30 years, a single glass factory's output would save a $12.25 billion of investment in power plants.

Source: Rocky Mountain Institute Newsletter, Spring 1993.