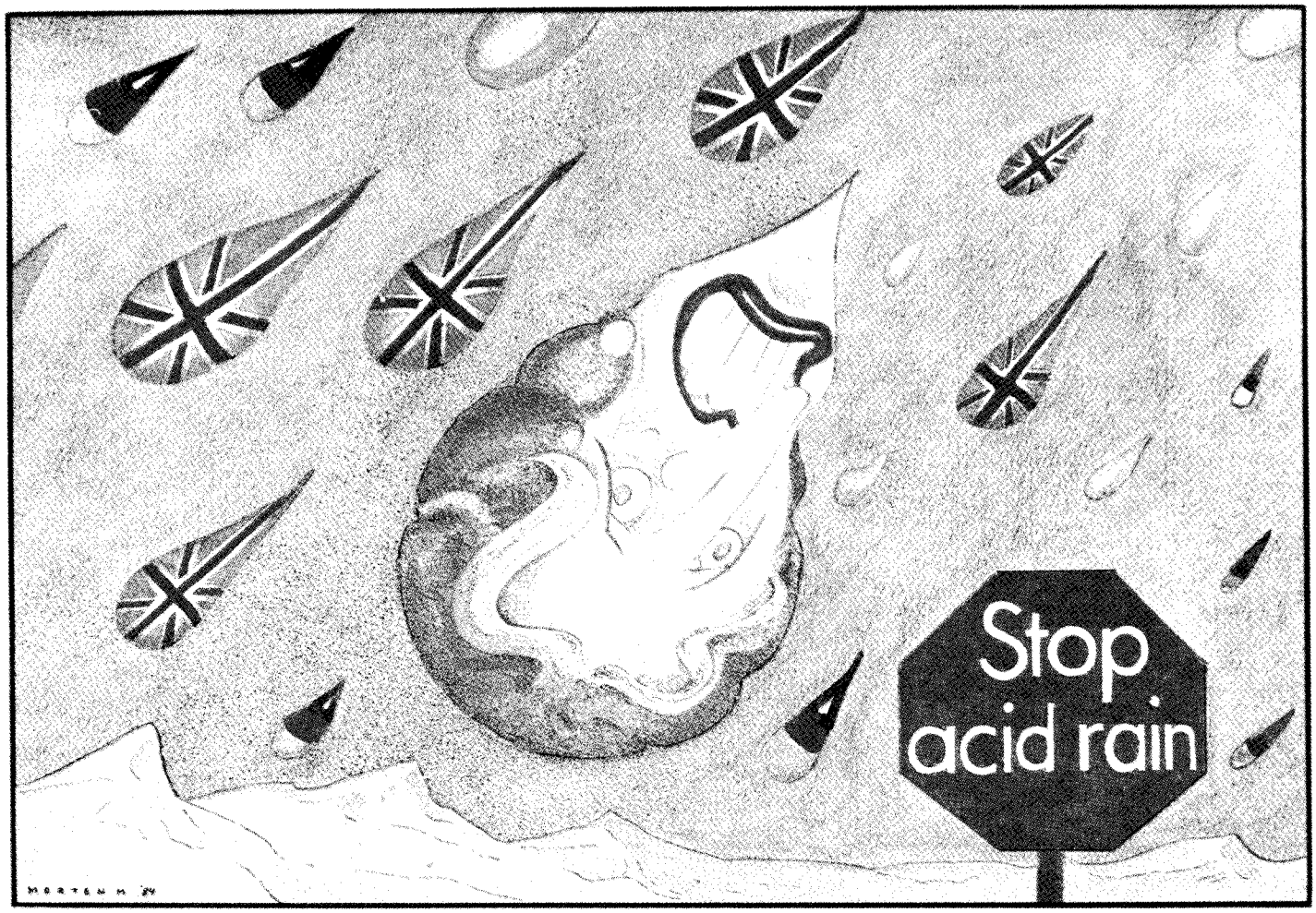
NO.3, SEPTEMBER 1990

Acid News

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



SWAP REPORT

The inevitable outcome

HARDLY likely to cause surprise was one of the conclusions of the Surface Water Acidification Programme, a research project that has been going on for over five years and at last presented its findings in London last March. This was that the acidification of lakes and streams, and the subsequent fishkill, is due to emissions of acidifying air pollutants.

Known by its acronym as SWAP, the British-Scandinavian joint project came in for criticism right away when announced by the Royal Society in the autumn of 1983. For one thing it was aimed at clarifying something that Scandinavian scientists maintained had already been proved during the seventies: namely, the acidifying effect of air pollutants on surface water. For another, it was to be financed by the Central Electricity Generating Board and the National Coal Board in England – together responsible for most of the British emissions of sulphur, and so for a great part of the acid precipitation over the most sensitive areas of southern Scandinavia.

It appeared to many that the main purpose of the exercise was to buy time in order to be able to delay the capital investments that would be required for cleaning up. The initial proposal for a research program had in fact come from Sir Walter Marshall, who was then CEGB chairman.

The project was nevertheless set going, and a management group was formed with representatives from the Royal Society and the corresponding scientific institutions in Norway and Sweden, with £5 million at its disposal. The agreed objectives were to find out what factors determine the fishery status of the

Continued on page 3

The Swedish NGO Secretariat on Acid Rain
Box 245
S-401 24 Göteborg, Sweden
Phone: +46-31-15 39 55

The Norwegian Clean Air Campaign
Postbox 94
N-1364 Hvalstad, Norway
Phone: +47-2-78 38 60

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:

The Swedish NGO Secretariat on Acid Rain
Box 245
S-401 24 Göteborg, Sweden
Telephone: 031-15 39 55
Telefax: 031-15 09 33
Editor: Christer Ågren
Published by: The Swedish Society for the Conservation of Nature
Printed by: Williamssons Offset, Solna
ISSN 0281-5087

THE SECRETARIATS

The Swedish NGO Secretariat on Acid Rain is supported by the following environmental organizations:

- The Environmental Federation (Miljöförbundet)
- The Swedish Anglers' National Association (Sportfiskarna)
- The Swedish Society for the Conservation of Nature (Naturskyddsföreningen)
- The Swedish Youth Association for Environmental Studies and Conservation (Fältbiologerna)

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 Fiskeförbund)
- The Norwegian Society for Conservation of Nature (Norges Naturvernforbund)
- The Norwegian Mountain Touring Association (Den Norske Turistforening)

The Norwegian Clean Air Campaign
Postbox 94
N-1364 Hvalstad, Norway
Telephone: 02-78 38 60
Telefax: 02-90 15 87

EDITORIAL

Leadership needed

THE USE of the critical loads approach in the international work for bringing about a reduction of the emissions of transboundary air pollutants is making headway, albeit at a slow pace.

At the last meeting of the UN ECE Working Group on Abatement Strategies, in July, the possibility was discussed of employing the critical loads approach in developing a new protocol for sulphur. In line with the existing sulphur protocol, which was signed in Helsinki in May 1985 and came into force two years later, twenty-one of the thirty-five signatories to the ECE Convention on Long Range Transboundary Air Pollution pledged a reduction of their sulphur emissions by at least 30 per cent from 1980 to 1993.

If it is to properly replace the old sulphur protocol, the new one should come into force in 1993. Since it apparently takes some countries about two years to get through the ratifying process, a new sulphur protocol would have to be agreed upon at the latest by the autumn of 1991, in other words within one year. It may be noted that the NOx protocol, which was signed in Sofia, Bulgaria, on November 1, 1988, has so far been ratified by only ten of the twenty-seven signatories to that protocol. It needs to be ratified by six more before it can come into force.

That it should take two years, or even longer, for a country to ratify an international agreement, and inform the ECE that it has done so, can only be taken as a sign of an alarming lack of engagement in the international work for protecting the environment.

That it is possible to use the critical loads approach in policy making has been shown in the case of the Netherlands (Acid News 4/89, p 12). In that country's Acidification Abatement Plan of 1989 it is said that in order to hold back acidification, the deposition limit will have to be 400 acid equivalents per hectare per annum. Since it will require more than a 95-per-cent reduction of acidifying air pollutants both in the Netherlands and the surrounding countries to achieve this, target loads have been set at three levels as stages on the way down to the critical loads. Achievement of the target load for the second stage, 2400 acideq/ha, was set for the year 2000 at the latest. This would involve a reduction of the Dutch emissions of sulphur dioxide by 80 per cent, nitrogen oxides by 50 per cent, and ammonia by 70 per cent, all in relation to 1980. But in June this year it was decided to accelerate the process, so as to try and bring about the reductions by 1997-98.

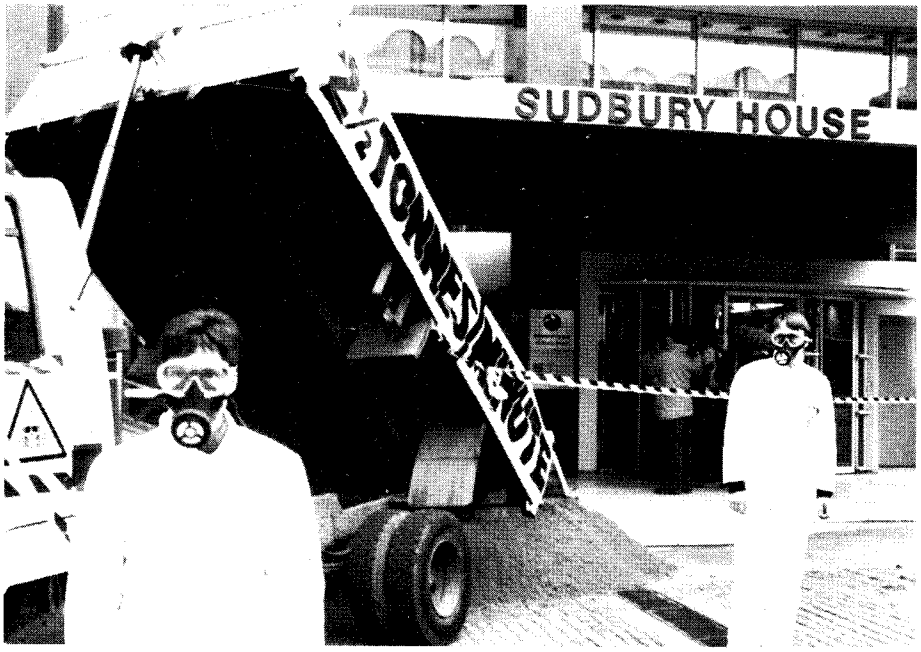
For almost two years another ECE Working Group, on VOCs, has been trying to arrive at a draft protocol for reducing emissions of volatile organic compounds (hydrocarbons). A draft was expected to be ready for the meeting of the Executive Body of the ECE Convention next November, but so far no agreement has been reached either on the desired levels for reduction or the principles on which they are to be achieved. This means that in all probability another year will pass before a draft will be forthcoming.

There are several reasons why the emissions of hydrocarbons need to be reduced, extending from their direct effects on human health to their contribution to the formation of photochemical oxidants, especially ozone. The Dutch Acidification Abatement Plan calls for a reduction of 60 per cent by the year 2000, with an eventual aim of an 80-per-cent reduction. These figures give an indication of what should be aimed at internationally.

Since the development of international agreements on the reduction of emissions all too often tends to be hobbled by greatly exaggerated and even misplaced caution, it is vitally important for individual countries to take the role of leaders. By taking the lead they can demonstrate the possibilities and so contribute to bringing the aims of international agreements up to levels where they will be properly effective.

Christer Ågren

ECE = United Nations Economic Commission for Europe



© CHRISTER ÅGREN

Greenpeace demonstrating outside CEGB headquarter in London against the emissions of sulphur from British coal-fired power plants.

Continued from page 1

lakes, how these are influenced by various characteristics of catchments, and finally how water chemistry and fishery status would be changed by given levels of reduction of man-made sulphur deposition.

After five years' research, involving two hundred scientists split into thirty groups, the three nations concerned were able to confirm that the Scandinavian scientists had been right all along. Anthropogenic air pollutants were the basic cause of acidification, which in turn determined the survival or otherwise of fish in the affected areas.

Studies of the sediment from lakes in the three countries showed that acidification had already started with the spread of industry during the nineteenth century. This was accompanied by an increase in the incidence of soot particles and heavy metals in the sediment, a result of the combustion of coal and later oil. Also revealed were signs of recovery in some lakes after 1980, following a reduction of sulphur emissions in western Europe. The reductions of sulphate seem however to be largely offset by increases in nitrates, especially in Norwegian lakes.

Naturally the sensitivity of an area to acidification will depend on its inherent ability to resist it. This ability is largely determined by the type of bedrock and soil, and the thickness of the soil cover. Most sensitive are areas with slowly weathering bedrock such as granite and gneiss, and a thin soil cover, such as are common in Scandinavia as well as in Scotland and Wales. In forested regions acidification may be accelerated by the trees acting as a filter, capturing and concentrating the depositions of air pollutants.

Fishkill in acidified waters is caused both by the acidity itself and the aluminium that is leached out of the soil through acidification and washed out into the lakes and streams. Fish are especially sensitive to short, highly acidic flushes, with high concentrations of aluminium, that follow heavy rainfall and melting snow and may also come after a dry period.

Aluminium in inorganic form is adsorbed on the surface of gills, causing disturbance of the fishes' sodium balance and leading to loss of body sodium and eventually to circulation failure. Acidity and high concentrations of aluminium can also have adverse effects on aquatic invertebrates such as crustacea and mayfly, important links in the food chain.

The rate at which lakes and streams can recover when depositions of acidifying substances are reduced will depend primarily on the structure and chemical composition of the rocks and soil. Where the soil is thin, with small amounts of accumulated sulphur, it may take place quite rapidly, but where there is a thick soil cover, and the accumulated stores of sulphur are large, it may take several years or even decades before the sulphur has been leached out.

Substantial and rapid reduction of the emissions of acidifying air pollutants is however essential for quick recovery. According to SWAP calculations, not even a 60-per-cent reduction of sulphur emissions will suffice to ensure recovery in the most acidified areas.

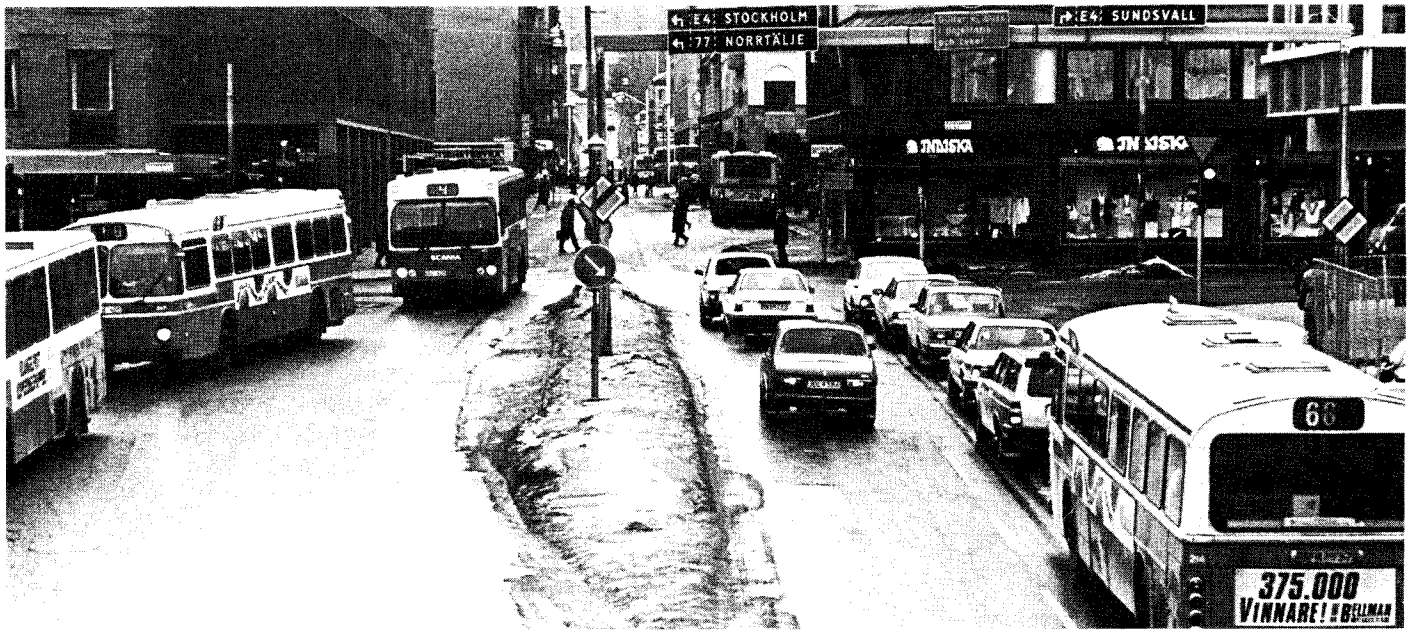
While SWAP fails to give any indication as to how great a reduction will be necessary for saving the most sensitive areas, other research had already provided an answer several years ago. The critical load of sulphur for such areas is less then three kilograms per hectare per year (or 0.3 grams per square metre per year). In the forested parts of southern Sweden, for instance, the yearly deposition is now running at 30 kg/ha. In other words, depositions, and so emissions, will have to be reduced by 90 per cent in order to bring them down to acceptable levels. The quicker the reductions are made, the less will be the damage that has to be corrected, and so the quicker the recovery.

Christer Ågren

On the following pages

Reducing nitrogen emissions	**4**	**East Germany facing realities**	**11**
EC transport policies	**6**	**Poles protest environment**	**14**
Air pollution and wildlife	**8**	**Their country's needs outlined**	**15**
Swedish forest liming	**9**	**Plan for Kola peninsula**	**16**
Downscaling desulphurization	**10**	**Czechoslovakian energy revamp**	**16**

Possibilities and costs



© ANDRE MASLENNIKOV

IF ALL European countries were to apply the best technology for power plants, industrial combustion units, and motor vehicles, the emissions of nitrogen oxides could be reduced by at least 60 per cent – according to the calculations of the International Institute for Applied System Analysis (IIASA), as set forth in a recent report.*

The institute estimates European emissions of nitrogen oxides to have been rather more than 27 million tons in 1980. This compares with the previous figure of just over 20 million tons put forward by the UN Economic Commission for Europe (ECE). The Bulgarian, Romanian, Turkish, and Yugoslavian emissions come out about twice as high in the IIASA estimate as in the ECE's, and those of the Soviet Union three times. The divergences can be explained by the fact that the IIASA estimates are based on the statistics for energy use in the various sectors, whereas the ECE figures stem from official national reports concerning emissions.

The IIASA report considers in turn various technical methods for reducing the emissions of nitrogen oxides from different sources, giving the percentage of reductions that can be attained, and stating the cost in each case. Only methods that are already commercially viable are taken into account. The conclusion as regards power plants and industrial combustors is that flue-gas denitrification (selective catalytic reduction, SCR), in combination with modifications in the firing process, can reduce emissions by 90 per cent. The cost in such case is put at DM 2-4 per kilogram of nitrogen oxides thus eliminated.

Three-way catalytic converters on petrol-driven cars can yield an 80-per-cent reduction at a cost of DM 4-10/kg NOx. Here no account is taken of the fact that catalyzers also lessen the emissions of other substances. If the reduction of hydrocarbons and carbon monoxide were included as well, and all three types of pollutant given an equal value, the cost would fall to DM 0.5-1.3/kg NOx. Bringing the diesel engines of heavy vehicles into line with the US-1991 standards would result in a 40-per-cent reduction and cost DM 4-15 per kilogram of nitrogen oxides.

The costs vary considerably from one country to another, especially as regards emissions from mobile sources. This is mainly due to differences in the cost of fuel as well as in the annual consumption of fuel per vehicle. Another reason for the variations may be found in the differing structures of the national energy systems.

In the IIASA report the combined effects of the various factors are brought out by ranging the available control options, country by country, according to the marginal cost for NOx reduction, and by linking their individual potentials for emission reductions. A cost diagram for each country, of which a sample is shown in Figure 1, appears in an appendix. These diagrams show both the marginal cost and the total cost of reduction. The estimates are all based on each country's official forecast of energy use in the year 2000.

Even if all the countries were to fulfill the promises given on the one hand in the ECE's NOx protocol and

Table 1. Assumed Best Available Technologies in different cases.

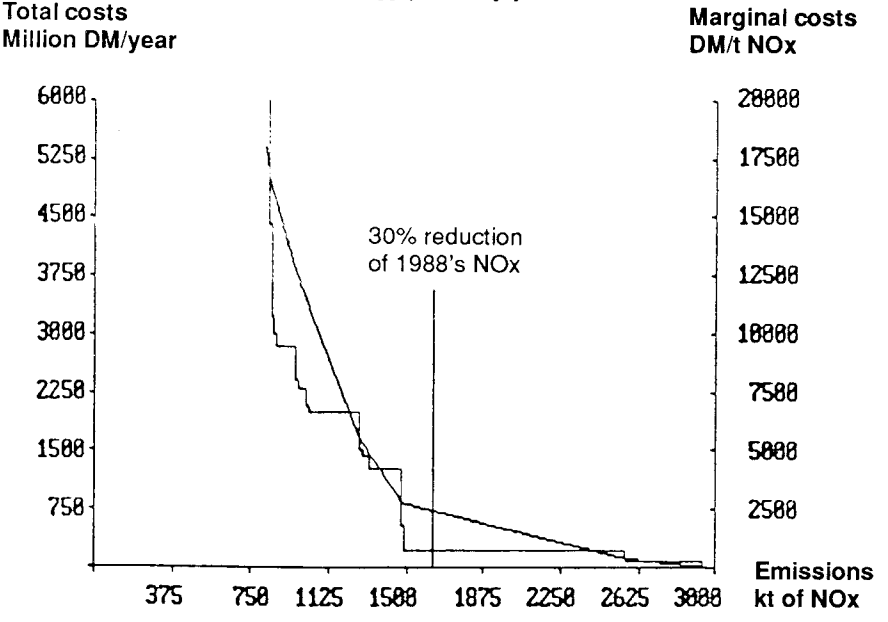
Sector	Best available technology	Removal efficiency
Power plants	Combustion modification + SCR	90%
Industry	Combustion modification + SCR processes	90%
Refineries	Combustion modification + SCR processes	90%
Heavy duty trucks	US Standard 1991	40%
Petrol-driven cars	Three-way catalyst	80%
Industrial process emissions	Different methods	80%

on the other hand in the 30 Per Cent Declaration of twelve countries (AN 1/89, pp 8-9), emissions would only be lessened by 5 per cent. The reduction that might have been expected is kept back by the fact that emissions from countries such as Turkey, Greece, and Yugoslavia are expected to increase as a result of economic growth.

Table 2. NOx emissions (in kt NO_2/year) both in 1980, and after the maximum technically feasible reductions have been brought about as shown in Table 1. Based on projected energy use in the year 2000.

Country	1980	Maximum feasible reductions	% Reduction
Albania	28	16	43
Austria	239	103	57
Belgium	439	181	59
Bulgaria	357	198	45
CSSR	796	214	73
Denmark	250	85	66
Finland	234	121	49
France	1944	674	66
FRG	2891	953	67
GDR	850	252	70
Greece	239	132	45
Hungary	305	110	46
Ireland	89	37	58
Italy	1458	678	55
Luxembourg	31	16	49
Netherlands	577	229	60
Norway	169	87	49
Poland	1597	551	65
Portugal	149	88	40
Romania	661	335	50
Spain	950	538	44
Sweden	333	142	58
Switzerland	186	61	67
Turkey	356	514	+44
UK	2324	838	64
USSR	9454	3678	61
Yugoslavia	394	184	53
Total	27317	11027	60

Figure 1. National cost function for NOx for the United Kingdom Official energy pathway year 2000.



But if all countries were to apply the best technology, as set forth in Table 1, emissions could be reduced by 60 per cent (Table 2). The cost of attaining such reduction solely by technical methods is calculated to amount to DM 66 billion per annum for Europe as a whole. Per head of population this would correspond to DM 90 per annum.

Changes in the energy and transport systems in particular could result in cheaper and more far-reaching reductions. Improved energy efficiency, a greater use of renewable sources for energy, substitution of fuels, speed limits, and switching from road and air to railway and other modes of public transport are among the means for achieving reduced emissions.

In 1987 the IIASA issued a similar report concerning the possibilities and costs of reducing emissions of sulphur dioxide. Through the use of the Institute's computer model RAINS, comparisons and evaluation can be made of the cost effectiveness of the various proposd measures for abatement. The model can also be run "backwards" by first setting deposition limits for sulphur and nitrogen compounds for the various regions, and then letting the computer show how the desired goals can be attained in the most cost-effective manner. In such case the deposition limits can well be the same as the so-called target loads, based on scientific estimates of critical loads.

It is of great importance that computer models shall be extended so as to include wider strategies for emission abatement, such as the structural changes in energy and transport systems mentioned above. It is also important that the technical possibilities should be continuously updated, so as to keep pace with the developments that will make the methods both cheaper and more effective.

Both of these steps will be important if the analyses are not to be misleading. It is thought that they will, if properly carried out, lead to results showing that a considerably greater reduction of emissions can be achieved, and what more, at a lower cost.

Christer Ågren

*Markus Amann: *Potential and costs for control of NOx emissions in Europe.* IIASA, A-2361 Laxenburg, Austria.

Bad for the environment

THE European Commission's Task Force on the Environment and the Internal Market has stated quite bluntly that it considers transport to be the most important single source of environmental damage after 1992. The liberalization of road haulage, the introduction of cabotage (freedom for a carrier to operate in the domestic market of another country) and the removal of frontier barriers will reduce the costs of transport by truck by up to 25 per cent and increase truck kilometers by up to 100 per cent.

The whole 1992 process depends on opening up of transport markets to the stimulus of international competition. It is essential that the new generation of streamlined, innovative, relocated, and highly productive manufacturing enterprises be served by a distribution system that is at least as efficient, and ideally much better, than the present one. The rhetoric that surrounds 1992 cannot disguise the environmental blank cheque that Ministers have signed. The Commission does not know how much extra damage will be caused but cannot resist the 1992 tide by asking awkward questions. It has no basic strategy for removing environmental problems caused by traffic, particularly in cities and in densely populated areas, but is prepared to inject a massive stimulus for more road vehicles into the European economy.

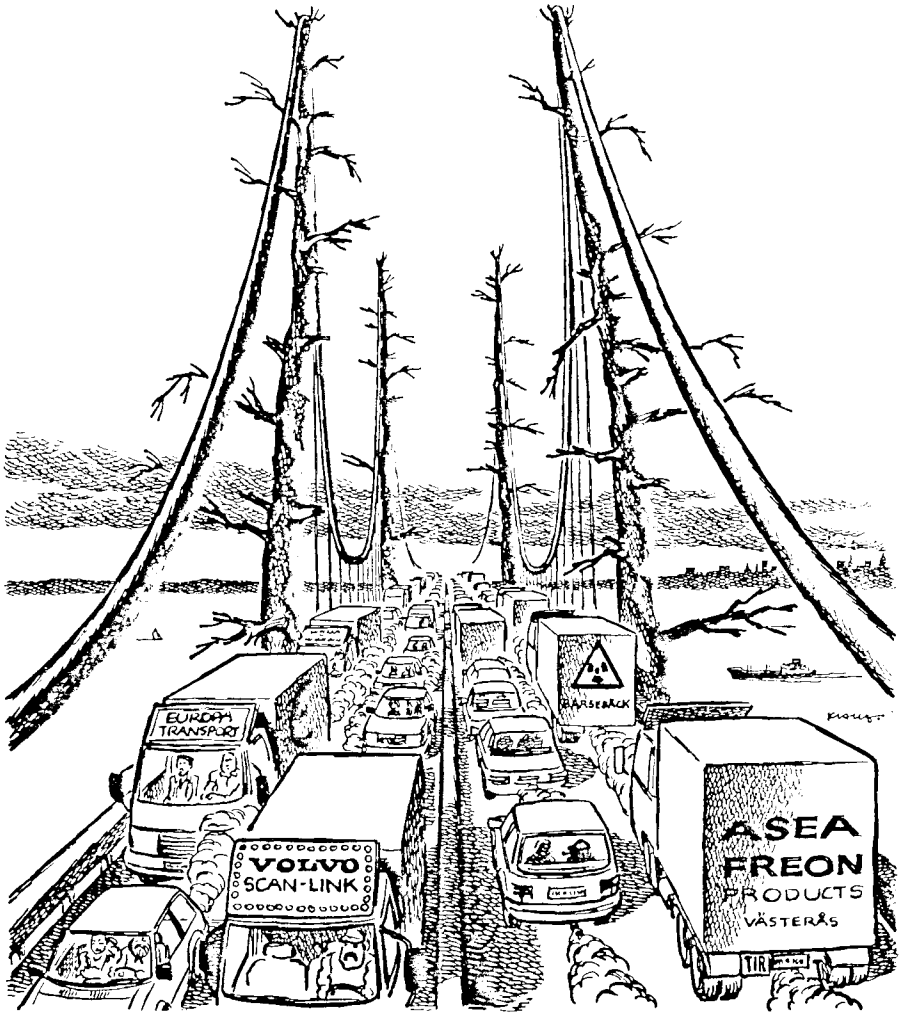
Ignorance of the problems caused by trucks cannot be an excuse. A glance at the table shows that sending a ton of freight one kilometre by road imposes a huge and expensive burden on society. The UPI Umwelt und Prognose Institute in Heidelberg has caluculated that the truck pays about one-eighth of the costs it imposes on society through noise, exhaust emissions, vibration, accidents, and demands on road space. Sending freight by rail is not only environmentally friendly; it is cheaper in the widest sense of total cost.

The Single European Market, with its promise of economic growth and wider consumer choice, has the effect of delivering harmful emissions to a wider population at higher concentrations.

Forecasting the extent of the damage to be caused by the 1992 process is fraught with difficulties. The 1989 forecasts of traffic growth in Britain (which take into account the Single Market and the Channel tunnel) predict an increase in heavy goods vehicle traffic (HGV) of 17 to 31 per cent to the year 2000 and 67-141 per sent by the year 2025, compared with 1988 (in ton-kilometres). The German Federal Environment Office in Berlin (UBA) is predicting a 42 per cent increase in kilometres travelled by trucks in the period between 1985 and 2000. The main concern of the UBA is the effect of completing the internal market, and it predicts that the effect will be an increase in NOx emissions of 61.1 per cent on current emission regulations (14.4 gNOx/kWh), declining to a 24.2 per cent increase at the much more stringent level of 7.0 g/kWh.

Most forecasts of increased vehicular activity and increased ton-kilometres do not take into account the full extent of economic growth expected from 1992, and the spatial changes in the location and organization of manufacturing activity, which will concentrate production at fewer sites and lengthen supply routes both for suppliers and for consumers. The economic benefits of lower-cost production at higher volumes will not have to take account of transferring the burden to transport infrastructure and to environmental damage and negative health effects.

The growth in ton-kilometres of freight carried by truck in Germany may be as high as 100 per cent by the year 2000. This forecast is based on the relationship between growth



© KLAUS ALBRECTSEN

in GDP and freight moved by road and an estimate of the spatial effects of 1992. It assumes that nothing will be done to counter the problem, such as shifting freight from road to rail or increasing the taxes for trucks to reflect the real cost burden. Such an increase will produce measurable health effects and significant increases in air pollutions, noise, vibration, and accidents assiociated with trucks.

The opening of the Channel tunnel in the same year that the Single Market begins to bite (1993) presents Britain with an opportunity to reduce the significance of the truck, particularly for long-haul, international journeys. The degree to which this opportunity will be realized depends on a large number of factors outside of the tunnel, and expectations of a huge environmental gain from the tunnel are almost certainly misplaced. The total cross-channel freight market is expected to rise to 88.3 million tons by 1993 and to 193 million tons by 2013. Eurotunnel expects to capture about 18 per cent of this market. This still leaves a lot for the RoRo ferry and road carriers pounding their way to Channel ports. Complications over EC regulations governing rest periods for drivers could even restore some lost market share to ferry operators, especially if they come out fighting on price.

On the rail side the sad story of Britain's poor infrastructure, particularly in the southeast, and the systems's lack of enough clearence for European freight cars (the Berne gauge) does not inspire confidence that the tunnel will bring about a railway revival.

Road will be a vigorous competitor, and will have four freight shuttles per hour (in the peak) through the tunnel, each capable of carrying twenty-four 18-metre HGVs with a gross weight of 44 tons each. Through international freight trains will also run (two per hour at peak times) giving direct connections between UK and continental destinations.

The total package of tunnel plus all the add-on bits does not represent a serious challange to the market share of road carriers operating as they have done before the tunnel. Moreover the cost reductions in road haulage arising from liberalization and the heightened competitive environment brought about by cabotage will give road transport a significant cost advantage over rail transport. It is also commonplace for road investment schemes to go ahead with large amounts of public funds and for opposition to fail. It is instructive to compare the relative costs and benefits of a motorway and a railway and then to compare the UK government's £12 billion bonanza for roads with rail proposals for London and the southeast.

The European Commission will not grasp the poisoned chalice of effective regulation of road haulage (policing) and full cost recovery (i e making the sector pay for all the damage caused). The result is a cost reducing frenzy and an enormous additional environmental and health burden. This is why the Germans have imposed a unilateral charge on all goods vehicles using their roads. This is directly contrary to the spirit and the law of 1992 but must be understood in terms of deep worries about the damaging environmental effects of 1992 and the damage it will cause to railways.

European economic development and transport policy still operates in a 19th century time warp, unable to appreciate that it is possible to have a clean environment, better health and to move goods about in an efficient manner. What is lacking is the will to bring it about and the vision to ask the right questions.

John Whitelegg

Author of *Transport Policy in the EEC* (Routledge, 1988).

A comparison of road and rail transport in terms of pollution, land take, and accidents.

Grams per ton-km	Road	Rail
CO_2	220	50
NO_x	3.60	0.22
NO_x 1993	3.18	0.16
CO	1.58	0.07
C_xH_y	0.81	0.05
Particles	0.27	0.03
SO_2	0.23	0.33
SO_2 1993	0.17	0.12
Accidents Injured persons/billion ton-kms	248	10
Land take Sq metres per ton-km per year	0.007	0.0025

Source: UPI Umwelt- und Prognose Institut Heidelberg, Report No. 14, **Gesellschaftliche Kosten des Strassengüterverkehrs.**

Publications

Clearing The Air: A Global Agenda (1990)
Worldwatch Paper 94 by Hilary F. French. The report describes how air pollution is inflicting a growing toll on health and the world environment, what is being done and what could to be done to reduce emissions of air pollutants. It concludes that tough international agreements on reductions are necessary, and stresses the need for transfer of technology from Western Europe, the USA and Japan to Eastern Europe and the Third World. 54 pp. Price US$ 4.00. Obtainable from Worldwatch Institute, 1776 Massachusets Ave., N.W., Washington, D.C. 20036, USA.

Environmental Policy and 1992 (1989)
A Institute for European Environmental Policy report by Nigel Haigh and David Baldock, analyzing the possible environmental impact of the completion of the internal market in the European Economic Community, from a British perspective. 54 pp. Obtainable from IEEP, 3 Endsleigh Street, London England WC1H 0DD.

The Rains Model of Acidification – Science and Strategies in Europe (1990)
Editors J. Alcamo, R. Shaw and L. Hordijk. The book provides a very good overview of the European acidification problem, based on the use of the IIASA RAINS computer model. This model is used by several countries as well as in international negotiations about pollution reduction, for both scientific documentation and policy analysis. It provides useful information on most of the aspects of the acidification problem, including effects, emissions, transboundary transport, international policy, abatement technologies and their potentials, cost-efficient emission reduction strategies, etc. 402 pp. Price US$ 35 (paperback). Available from the publisher: Kluwer Academic, P.O. Box 322, NL-3300 AH Dordrecht, Netherlands.

The Netherlands Acidification Abatement Plan (1989)
Report describing the Dutch acidification abatement programme, based on the critical loads approach. 140 pp. Obtainable from the publisher: The Dutch Environment Ministry, Box 20591, NL-2500 EZ The Hague, Netherlands.

Control Strategy for Emissions of Volatile Organic Compounds (1989)
A presentation of the Dutch program to reduce VOCs emissions by 60 per cent between 1981 and 2000. 150 pp. Available from the same address as above.

Effects of air pollution

THE environmental effects of air pollution tend generally to be considered in economic terms. Extensive studies have been made, for instance, of the effects on forests and crops. But air pollution also affects the wild flora and fauna, and many species are now on the brink of extinction. Although many of them are small and seemingly insignificant, they nevertheless constitute valuable genetic capital, which it would be unwise to lose.

On the basis of a review of the literature concerning damage to wildlife in Europe generally, including Scandinavia, two Swedish scientists have now attempted to draw conclusions as to the situation in Sweden in particular.

Extensive changes have been observed, for example, in the mosses and lichens growing on trees in southern Sweden. Of the twenty species of oceanic lichens in that area, seven have died out during the last forty years, and a further nine are seriously threatened. Since the beginning of the century three nitrogen-fixing species of the genus *Lobaria* have also markedly declined. Not only the *Lobaria* but the oceanic species, too, have practically ceased to reproduce in this part of the country. In view of the general state of pollution, it would seem that the enormous acid precipitation constitutes a greater threat to lichens and mosses than the relatively low concentrations in the atmosphere of sulphur dioxide.

Pollution of the air also affects vascular plants and fungi. Over a great part of Europe there now is a general trend for acidophilic species to increase, as well as those favoured by nitrogen. Contrariwise there is a diminishment of species that need considerable base saturation of the soil, and also species that are adapted to naturally nitrogen-poor ecosystems. Many of the soils in southern Sweden have become two to ten times more acidic during the last fifteen to thirty-five years, with a lower degree of base saturation in consequence. At the same time there is an atmospheric deposition of nitrogen of 20-30 kg/hectar year, and many ecosystems are showing sign of nitrogen saturation. Thus the great question today, according to the makers of the study, is not if but when the changes will occur, and how great they will be.

According to a previous Swedish estimate, acid rain is a decided threat to some hundred vascular plants, and there is an additional threat from the fallouts of nitrogen. Of all threatened vascular plants species in Europe (Red Data List), two-thirds are said to be able to compete only on nitrogen-poor soils.

Since only fragmentary information is available as to the effects of air pollution on terrestrial fauna, the authors consider it impracticable to try and outline the present situation in Sweden.

Among birds some of the fish-eating species are thought to be especially exposed. Ospreys for instance are known to be less successful in reproducing in those parts of the country where the lakes are widely acidified. The red-throated diver is another of these species that have diminished in acidified areas, probably on account of reduced availability of food. There is however also a threat to them in the deposition of nitrogen, which is one of the reasons for bogs becoming choked with vegetation. These divers nest mostly by the bogland pools, and need open stretches of water for alighting and taking off.

Another threat to birdlife that has previously been reported (Acid News 1/90) is the thinning of eggshells. Yet another effect of air pollution is that there will be fewer spiders on spruce trees that have lost needles. This affects several inhabitants of conifer forests, such as the goldcrest, whose survival in winter is entirely dependent on the availability of spiders.

Terrestrial molluscs are adversely affected by the reduced amounts of calcium in acidified soils. Distinct declines both of species and individuals have been found as a result of repeated counts made in southern Sweden during the last 20-40 years. Declines have always been greatest in localities with a low pH value in the soil.

Many of the groups of organisms that would seem likely to be affected by air pollution at an early stage, such as terrestrial animals as well as insects, have been relatively little studied. This means that extensive changes may have already taken place in the terrestrial fauna – changes which in future may cause repercussions throughout the ecosystem.

As also appears from this study, the greatest threat to flora and fauna in Sweden has long been, and still is, changed land uses, including the practice of farming and forestry on an ever larger scale.

Attempts to protect threatened species and ecosystems have mostly been through the setting up of nature reserves. The trouble is that air pollution does not halt at the edge of the reserve, and so threatens to nullify the whole effort.

Per Elvingson

Torstensson, P. and Liljelund, L-E. 1989: *Flora- och faunaförändringar i terrestra miljöer orsakade av luftföroreningar och försurning*. Rapport 3604. Naturvårdsverket, S-171 85 Solna, Sweden.

Even frogs

Both field and laboratory trials have shown that acidified waters can increase frogspawn mortality and affect the growth and development of tadpoles. A new British study by researchers at Trent Polytechnic in Nottingham indicates that frogspawn from the Common Frog is susceptible to much lower levels of toxic aluminium occuring in acidified waters than was previously known. The more acid the water, the higher the amount of toxic aluminium and the more lethal it becomes to fish and frogspawn. Decreased survival could be seen already at five micromoles per litre. At 15 micromoles per litre – a level commonly found in acidified waters – survival of frogs' eggs was reduced by two thirds, and surviving eggs developed into tadpoles with decreased body length.

Widescale liming

THE pH value of the soil on some 650,000 hectares of forested land in South Sweden is now under 4.4, which is thought to be the critical level at which the release of potentially toxic metals to the soil water will start. On a further 700,000 hectares in that part of the country the pH values ranges between 4.4 and 4.7, and unless there is a dramatic reduction of the deposition of acidifying airborne pollutants, the acidification of these soils too will go below the critical level within a couple of decades.

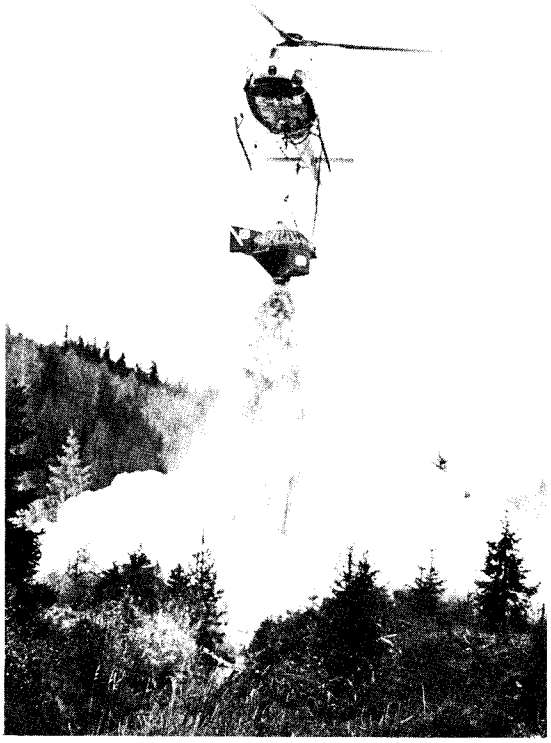
It has appeared from previous investigations that during the last three or four decades the acidification of forest soils in southern Sweden has proceeded at a rate of 1-2 pH units. In other words, they have become 10 to 100 times more acidic. The main cause is the deposition of sulphur, which there amounts to between 20 and 30 kilograms per hectare per year. The most sensitive soils will not stand more than three kilograms – which is only a tenth of what they now get.

One effect of acidification is the greatly increased leaching of plant nutrients from the soil. In some areas more than half of the available magnesium, potassium, and calcium has become lost in this way.

Consequently the National Board of Forestry has now presented a plan for starting a widescale liming of forest soils. The research into the effects of such liming that has been going on in Sweden since the early eighties will now be succeeded by large-scale trials with the method. Between 1989 and 1992 some 3,500 hectares will be treated with applications of three tons of dolomitic limestone (calcium magnesium carbonate) per hectare. This is expected to have a lasting effect of 30 to 50 years.

The aim will be to test and develop methods for spreading the limestone, and to arrive at routines for forest liming that are suited to particular stands as well as meeting conservation requirements. The total cost will be 24 million kronor. There will also be parallel trials of the effects of applying wood ash, and of various combinations of lime and nutrients (so-called vitalizing fertilization), on forest soils.

Although assessements of the costs vary, experience in West Germany, where such liming has been practised for several years, would suggest a figure of about 2000 kronor per hectare. Liming the whole affected area in South Sweden, amounting almost to 1.5 million hectares, would thus cost close on 3 billion kronor. Larger applications than those at present envisaged, or liming in combination with fertilizing to counteract the loss of nutrients, would naturally increase the cost still further.



© ANDRE MASLENNIKOV

It goes without saying that forest owners in Sweden are fully aware that the only solution in the long term will lie in a rapid reduction of the emissions of acidifying air pollutants, so as to bring them down to the levels that nature can stand. Since however more than 80 per cent of the depositions come from abroad, and international wrangling over abatement measures is making the process long drawn-out, it is concluded that large-scale liming is inevitable and should be set going as soon as possible.

Litle is yet known of the possible adverse effects of liming forest soils. The effect on flora may depend on the way the limestone is spread, in the form of powder or pellets. Lichens, mosses, and fungi are among the kinds of plant that are especially sensitive, and any negative effects on them may in turn have consequences for instance for micro-organisms and insects. Effects on fungi can be translated to trees, since there is a symbiotoic association through mycorrhiza between several types of fungi and the trees' roots.

Large applications of limestone may also cause nutrient imbalance, nitrogen leakage, and shock effects on fauna as well as on flora. Some types of soil and forest, such as bare ground and wetland woods, ought not to be limed at all.

Forest owners in southern Sweden may thus be faced with an awkward choice. On the one hand they might accept continued acidification, with all its known consequences of liberated metals in the soil, leaching away of nutrients, changes in flora and fauna, and so on. On the other hand they have a seemingly favourable prospect as a result of liming and fertilizing, which yet entail certain risks and the possibility of unpleasant surprises.

Whatever the forest itself may be thought to imagine about the matter, owners, officials, and experts have in any case made up their mind. Growth is to be assured and billions are to be kept rolling. And some of those billions are to be used for large-scale liming. A question that remains however is who is to pay. Is it to be the forest owners themselves, or the state, that is, the tax payers? Or might we possibly hope, in time to come, for proportional contributions from countries that are dumping their pollution over us?

Christer Ågren

UK program fails to meet EC directive

It has now appeared from an inquiry held by the House of Commons Select Committee on Energy on April 25 that the UK program for desulphurization is to be reduced by one-third.

This comes after the Minister for Environment David Trippier had confirmed to Parliament only as recently as last December that at least 12,000 MW of electricity capacity would be retrofitted for flue-gas desulphurization. About a month later however a rumour began to circulate that as part of the privatization of the Central Electricity Generating Board, the desulphurization program would be modified so as to make the new companies more attractive to investors. See also article in Acid News 2/90, page 1.

At the inquiry representatives of the new generating companies, National Power and PowerGen, in any case stated that they each planned to retrofit no more than 4,000 MW with FGD, and the Department of the Environment and the Department of Energy wrote in a joint memorandum: "The Government does not intend to specify the manner in which the targets are to be achieved, but the Department of Energy has reached an understanding with National Power and PowerGen that each will undertake 4 GW of FGD retrofits."

National Power has already started a retrofit of 4,000 MW at Drax, which is expected to be completed at earliest in 1996 (see AN 4/89, p13). PowerGen has still not started anything, but will probably put retrofits at Ratcliffe and Ferrybridge, in each case for 2,000 MW. It plans to have FGD operating at least at one of these plants by 1998.

The targets referred to in the departments' memorandum to the inquiry are those in the EC Large Combustion Plants Directive of 1988, according to which the United Kingdom should reduce the sulphur-dioxide emissions from existing large combustors by 20, 40, and 60 per cent by 1993, 1998, and 2003 respectively (from 1980 levels). For the electricity supply industry, however, the Department of the Environment has set a lower target, with an 11 per cent reduction for 1993, on the assumption that the industrial and refinery sectors will achieve reductions respectively of 66 and 55 per cent.

For various reasons that assumption has however been challenged, among others by Greenpeace UK in its report *Response to the DoE Consultation Paper on the Implementation of the LCP Directive.*

In memoranda presented at the inquiry, National Power and PowerGen also gave assessments of the capital and operating costs of retrofitting FGD. Here it was stated that the installation of FGD at a typical coal-fired power station would give rise to capital costs of around £300-400 million and an annual cost of about £20-30 million at current price level. This would include costs associated with the loss of efficiency and output arising from desulphurization. Expressed as unit cost, the total costs of fitting FGD were estimated to be about 0.5 pence/kWh.

There is now a further report* from Greenpeace UK, analysing the energy sector's future emissions of sulphur dioxide in the light of various assumptions, concerning for instance the use of gas (in combined-cycle gas turbines, CCGT), imported low-sulphur coal, and the demand for energy. Its findings can be summarized as follows:

Current commitments by the electricity supply industry to retrofit up to 8,000 MW of existing coal plant with FGD and construct up to 10,000 MW of new gas-turbine capacity will, given current estimates of energy demand, substantially fail to meet the targets specified by the Large Combustion Plants Directive (LCPD).

An additional measure of importing low-sulphur fuels (notably coal) would also fail to meet the final target of the Directive, even if low-sulphur were to be burnt exclusively by all UK power stations.

If a modest reduction in energy demand occurred in the period 1992-2003, the Directive would be met by 14,000 MW of FGD retrofit (or equivalent capacity of existing coal plant refurbished with advanced coal-firing technologies) together with new gas-turbine capacity, but without the need to import low-sulphur coal.

Efforts to reduce demand should be taken immediately, bearing in mind the dual benefits of reducing emissions of sulphur dioxide (SO_2) and carbon dioxide (CO_2).

Trends in the prices and availability of gas and low-sulphur coals in world markets suggest that they may only remain cheaper options compared to FGD and advanced coal technologies for a relatively short period of time.

This suggests in turn that the needs of the environment, in terms of reducing acidic gas emissions from power stations in the UK, are not best served by allowing the generating companies free rein to choose how they meet the targets of the Directive.

Regenerable systems of FGD, such as the Wellman-Lord process, should be deployed in favour of the once-through processes currently favoured by the generators. The abandonment of the regenerable option by the generators is considered inexplicable, especially when most of the evidence has found regenerable systems to be more environmentally benign.

In its negotiations over the Large Combustion Plants Directive the UK Government secured lenient targets based on false premises. If the generating companies continue to be allowed to meet the Directive through the use of low-sulphur coal, in preference to fitting FGD, then it should become a matter for the European Commission as to whether the UK should now be obliged to meet the higher targets set for other major European polluters.

Christer Ågren

**Memorandum on the energy market implications of flue gas desulphurization and alternative means of reducing sulphur emissions.* Available from Greenpeace UK, 30-31 Islington Green, London N1 8XE, UK.

Facing up to realities

NOW the truth is coming out about the environmental situation in the German Democratic Republic. A first official report, based on data from 1988, was presented last January by the former East German Environmental Minister Diederich to the Central Roundtable. This was a body, consisting of members of the reformed Communist party with representatives from all the main opposition groups in the GDR that had been set up after the collapse of the former Communist government in November 1989. It had been acting as an agent for government policy prior to the elections on March 28 this year.

As described in the report, the situation in the GDR turned out to be even worse than the environmentalists had expected. It appeared that in 1988 environmental investments in the GDR had only accounted for 0.4 per cent of the gross national product, as compared for instance with 1.1 per cent in the Federal Republic.

Environmental problems were aggravated, according to the report, by wrong decisions, especially for the localization and structure of industry. By causing a continuation of obsolescent processes of production, and an ineffective development and application of environmental technology, such decisions intensified the pollution, especially in the areas of brown-coal mining and electricty-production around Cottbus, Dresden, Halle, and Leipzig.

Whereas East German emissions of sulphur dioxide had beeen estimated by the Economic Commission for Europe to have been 4.9 million tons in 1987 (the GDR official report to the ECE for 1986 had 5 million tons), the new report reveals that actually they were more than 5.3 million tons in 1985 and nearly 5.6 million tons in 1987. Even after the GDR had signed the ECE protocol in 1985 for a 30-per-cent reduction, these emissions had increased by more than 200,000 tons. (For more about air pollution in the GDR, see the extract from the report on page 12.)

Already in February a large symposium on energy had been arranged by *Neues Forum* in East Berlin, calling for an intensive energy-saving program. After the USA and Canada, East Germany is the world's largest per-capita user of energy, and according to Neues Forum, a saving of 70 per cent could be made in the use of primary energy. Three-quarters of the East German power stations are moreover now so old that they are ready for closing down.

The proposals for a nuclear power program were heavily criticized at the symposium. Actually only 3 per cent of East German power is generated in nuclear plants. Nevertheless, and although divided on the issue, the Working Group for Ecological reconstruction set up by the Roundtable has also thought fit to enter the debate.

Before any decision is made for extending nuclear power, it says, estimates of all the costs, including the ensuing costs and risks in comparison with other methods of power generation, should be made available for public debate.

It notes that those members of the group representing among others the *Grüne Liga* and the Green party were against any extension of nuclear power. Reserving the right to take a stand until after official publication of the program for energy conservation were representatives of political parties such as the Christian Democratic.

The following conditions for a new energy program were put forward:

- Reduction of energy use by at least 30 per cent through the following measures:
- Temporary abolition of state subsidies for electricity and gas. The economy to be subjected to the real costs of energy. Individuals and business firms to receive financial compensation and so be rewarded for contributing to energy saving.
- Development and application of techniques for energy saving (making insulation compulsory, expanding the industries making insulation material, applying energy-saving technology for refrigeration, air conditioning, and lighting, heat recovery, combined heat-and-power production, low-energy housing).
- Gradual reduction of the export of energy-intensive and environmentally harmful products (heavy machinery, cement, nitrogen fertilizer, meat, livestock).

© CHRISTER ÅGREN

Appearance of East Greman car parks will soon change, if expectations that people will buy at least 600,000 new cars from West Germany are realized.

GDR environmental report

The following is extracted from the first official report on the state of the environment since the changeover in East-Germany.

CLEAN-AIR measures in the GDR have previously been concentrated almost entirely on the provision of dust filters. Nevertheless depositions, especially in the area around Leipzig, still exceed the permissible levels. The ineffectiveness of the measures for controlling dust makes it quite clear that investment went largely to replacement of worn-out equipment. Actually only 30 per cent of the need for dust-controlling equipment was met.

From 1986 onwards there were increasing allocations for flue-gas desulphurization. The effect has been minimal, since efficient plant has, for the most part, either not been available at all or insufficiently so. Moreover, after 1984 none of the measures that had been passed for flue-gas desulphurization were included in the national economic plan.

As much as 70 per cent of GDR energy is based on brown-coal, while 12 per cent of the primary energy consumption is covered by oil and 10 per cent by natural gas. With 233 GJ per capita, the GDR has the next highest domestic consumption of energy after Canada and the United States.

The extensive use of brown coal has distinctly adverse effects on the environment. These effects concern human health, the griming of towns, villages and workplaces, the exploitation of land and water resources, and the destruction of entire countrysides.

Since 1980 the emissions of sulphur dioxide and dust have shown the following pattern.

	Sulphur dioxide		Dust	
	000 tons	t/km^2	000 tons	t/km^2
1980	4636	40	2456	23
1985	5340	49	2335	22
1986	5358	50	2323	21
1987	5560	51	2335	22
1988	5209	48	2198	20

The GDR leads Europe in emission of sulphur dioxide per unit of area. In industry, coal and energy production accounts for 5[illegible]ent of the sulphur dioxide and 41 per cent of the dus[illegible]ons..

[illegible]e Protocol of the Convention on Long Range Tr[illegible]ary Pollution of July 9, 1985, the nations undertoc[illegible]e their annual emissions off SO2, or their transbou[illegible]xes, by 30 per cent from 1980 levels.

[illegible]his requirement decisions were taken in the GDR to r[illegible]4.4 billion available for hastening the installatior[illegible] equipment. Faulty arrangements in regard to mat[illegible]pplies and financing, as well as inadequate technical [illegible]opment, meant that the effect was nil. Consequently the GDR has still not ratified the protocol.

The development of methods for flue-gas desulphurization at plants burning brown coal was started in the GDR in the mid-seventies and accelerated after 1984 at several pilot plants. The aim has been to develop methods to the stage where they could be applied and to manufacture the appropriate equiment.

The main hindrance to a reduction of emissions proved to be the obstinate adhesion to an energy program based on a steady increase in the mining and conversion of brown coal without any change in the design of power plants to units that would meet ecological requirements.

For this reason the Coalition Government in April 1990 promulgated a new energy program which takes ecological requirements into account and is intended to lead to a reduction of brown-coal mining.

With a view to protection of the environment it lays down the following conditions:

- Achievement of greater efficiency in the use of energy and its production from all sources, stimulated by new prices and tariffs.
- Fitting all new combined heat-and-power plants with equipment for flue-gas desulphurization, as well as designing them for improved energy conversion.
- Rebuilding and modernizing large power stations for greater efficiency and equipping them for flue-gas desulphurization.
- Retrofitting existing heating and combined plants for FGD in areas where there is heavy demand in order to reduce emissions of transboundary pollutants from small and medium-sized installations as well.

In fulfillment of this program the application of fluidized bed combustion will be of great importance as being an internationally accepted method for improved energy conversion and reduction of the emissions of sulphur dioxide and nitrogen oxides. In addition the Coalition Government has sanctioned the import of equipment for the Buna industrial plant, proposed licensing agreements and in connection with joint pilot projects with the Federal Republic included the installation of corresponding equipment at Magdeburg and Staaken.

An annual emission of 2.2 million tons of dust amounts to an equivalent of 0.14 tons per capita and 20 tons per unit of area. Of this total, 902,000 tons, or 41 per cent, are emitted by the coal/energy sector, and 12 per cent by chemical industries.

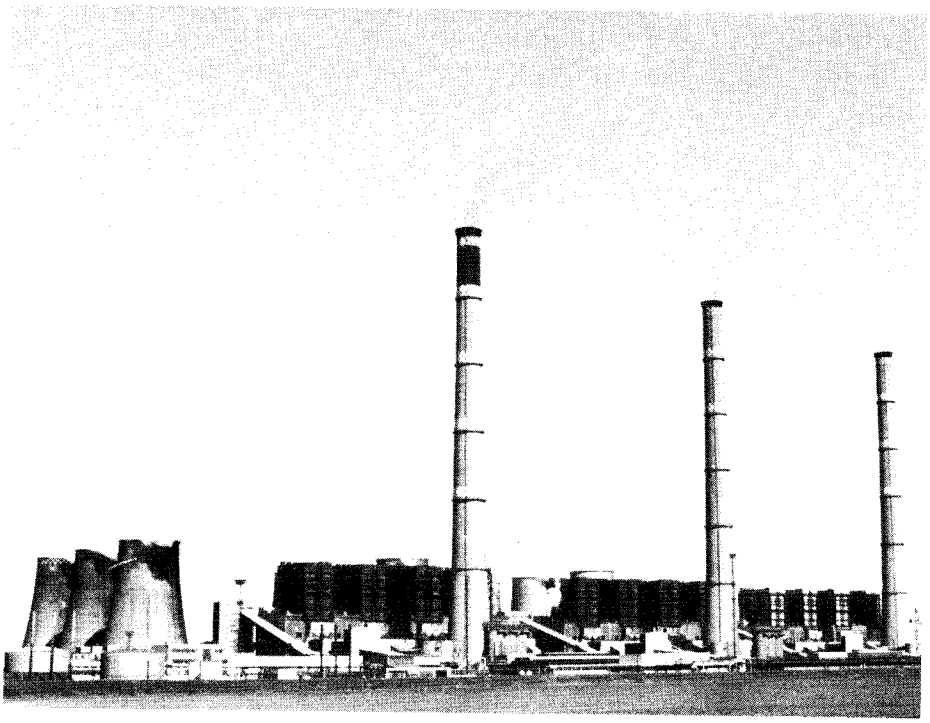
In Berlin, the emission level amounts at highest to 74 tons per sq kilometre, in Cottbus to 58 tons, Halle 54 tons, and Leipzig 48 tons. In Schwerin and Neubrandenburg on the other hand it is no more than 4 tons and in Rostock and Potsdam 5 tons.

Around 10 per cent of the industrial plants are operating either without any dust-control whatsoever or with dilapidated and inefficient equipment.

The cost of replacing worn-out equipment for dust control has been estimated by the consultants, VEB Entstaubungsanlagen und Industrieanlagenbau INEX, to be M 5 billion. Dependent on a future energy program and the modernization of existing power plants is an investment need for 1990 of M 5 million. So far however only about 49 per cent of that sum is available.

The Coalition Government had ordered an investigation of the possibilities of increasing the coverage for investment needs, including imports, together with the formulaion of proposals for inclusion in a national economic plan for 1990. It will moreover be absolutely essential to decide on a reconstruction of the engineering firms that may be involved, such as the SDAG Wismut and others with hitherto specialized production.

From *Information zur Entwicklung der Umweltbedingungen in der DDR und weitere Massnahmen. Basisjahr 1988.*



© CHRISTER ÅGREN

- Gradual substitution of other energy sources in place of brown coal, and a stop to the export of brown coal.
- Steady encouragement and greatest possible use of renewable energy sources (wind, waterpower, old dams, watermills, solar collectors for heating water and space in buildings, heat accumulators, biogas).
- Intensive research into alternative resources of energy, while also taking advantage of the possibilities for international cooperation in scientific matters.

The Roundtable group has also presented a list of 400 undertakings that ought, for environmental reasons, to be closed down. This would mean a loss of 65,000 jobs.

Hope is now turning to help from the West. As early as September 1987 a protocol on environmental cooperation had been signed by the two German states. Since then thirty rounds of technical negotiations have taken place, and six pilot projects chosen as objects for West German financial assistance. The number of such projects had risen by June to at least thirty-four, financed with DM 1 billion from the Federal Republic.

Among the aided projects is one for the exchange of environmental data, while others include the purchase of equipment for environmental monitoring, and the retrofitting of four smaller coal-fired power plants for flue-gas desulphurization. At the time of the Leipzig Fair a preliminary agreement was signed between the East German Braunkohle-Kombinat and the Rheinisch-Westfälische Elektricitätswerke for the supply of desulphurization equipment for the coal-fired power station at Thierbach, Saxony. At present the annual emissions of sulphur dioxide from that plant amount to nearly 200,000 tons. This will also be a pilot project.

The cost of economic and environmental reconstruction in East Germany is estimated to be at the very least DM 500 billion. But as the West German Minister for the Environment has said: "Even more important than the financing of any project will be to increase GDR capacity for planning and execution, because that is where there are bottlenecks."

In the meantime, while the process of unification is gaining momentum, an important step has been taken (April 28) by the ministers for the environment of the two states. July 2 will mark not only the establishment of a monetary, economic, and social union, but also an environmental one. After that date all new installations in East Germany will have to be built to West German standards, and for existing plants there will be bridging solutions.

There nevertheless remains a considerable danger that these measures may only serve as an excuse for passivity. Some well-known West German scientists, organized in a working group for ecological economic policy, have warned "In the view of the notable economic difficulties associated with rapid assimilation of the GDR with the Federal economic and monetary system, there is an acute danger of the protection of the environment once again being relegated to a matter of secondary importance. The development of a market economy will be dependent on western capital, and there is already a lobby voicing the opinion that the inclination to invest should not be disturbed by social and ecological demands. There are plenty of other countries that are attractive to investment.

"In practice the GDR might have a chance of attracting private investment on any large scale within the framework of a liberal market economy by trying to turn its comparative disadvantage to advantage by presenting itself as an area of cheap labour and cheap nature. There would then be a danger of the GDR becoming, in a double sense, the extended workbench of the Federal Republic – a place where labour-intensive, technologically undemanding, and environmentally dubious production could proliferate."

Controlling economic restructuring in the GDR will require a strong environmental movement. After Communist rule had collapsed environmental groups all over the country quickly started work to inform the public, which they had tried to do for a long time. In February the *Grüne Liga* had been founded by several hundred enthusiasts as an umbrella organization for environmental groups in the GDR. West German environmental groups, too, are now setting out to establish themselves in the GDR, where they are trying to find partners.

In view of the immense cost of restructuring the GDR economy, other European countries should not leave the matter of providing aid entirely to the West Germans. They should still consider the possibilities of cooperative efforts to save the environment, perhaps on a local level, and especially in areas of ecological disaster such as the Halle-Cottbus region.

Reinhold Pape

Indignation aroused

LAST autumn the Polish Ecological Club set up a special office in Katowice for dealing with the problems of air pollution. Providing information, environmental education, organizing seminars, and guiding foreign visitors now occupies two full-time officers. During the last few months more than 350 of those using the services of the new office have come from abroad, among them being journalists and members of film teams.

Known as ICAP (Information Center for Air Protection), the Katowice office now serves a network of local environmental groups spread all over Polish Upper Silesia, and eventually it will act as an information centre for the whole of Poland. Environmental activities in this part of the country have of late greatly increased. Under the Communist regime popular movements here were closely watched, making it extremely difficult to carry on public agitation. Now, however, this has all changed, and the environmentalist organizations are working in close cooperation with the Solidarity movement.

Campaigning by the Polish Ecological Club, together with allied activities, has now roused the people of Upper Silesia to protest openly at the environmental situation in this, the most polluted area in the whole country.

In this region, covering 6650 sq kilometres, are some ten towns with a combined population of 4 million. Here 80 per cent of Poland's coal is mined, and from here comes 30 per cent of the country's industrial output. Hardly any modernization of the industry has taken place, and there have been no measures for environmental protection. Half of the material extracted in coal mining is waste, which is dumped in the countryside between the towns. The waste itself is contaminated with heavy metals, and being mixed with all other industrial and household waste is extremly toxic and is often in direct contact with the groundwater.

Health is badly affected, life expectancy in these parts being up to six years lower than the average in Poland. Children especially suffer from lead taken in with their food, and the leukaemia rate in children is twice as high as in the rest of the country. It is notable, too, that among the eighty most dangerous industries in Poland, represented in a "black list" published by the government last January, were twenty-three around Katowice.

The activities of the environmental movement in Upper Silesia culminated during Earth Day on April 22, when nearly every town and village saw some kind of action. Pupils and teachers from many of the schools demonstrated in the streets, bearing placards with slogans such as "Let us live". Other activities included street theatre performances, singing environmental songs, tree planting, photo exhibitions, cleaning up in the parks and areas of natural interest. Clearly people wanted not only to protest, but to do something practical as well.

The Bishop of Katowice issued a special prayer for the environment, to be read in all the churches. In several places public lectures were given under the general theme of "How to save Upper Silesia" and people could call a special number for answers to environmental questions.

In the centre of Katowice enthusiasts were selling "Clean air" in bottles, as well as going about in gasmasks and demonstrating in bicycle cavalcades.

A five-hour public debate on the environment, in which several ministers took part, was broadcast from Upper Silesia on television, using an open-air studio with microphones placed out in the streets to get people's reactions. Also during the day the ministers for environment and industry took part in a seminar on the region's environmental crisis.

Several thousand people, headed by the Bishop , engaged in a demonstration at the Nova Huta steelworks and the Lasiska power plant, primarily to protest at the excessive emissions of dust particles from the power station. The dust contaminates, among other things, the drinking water in the local reservoirs. Workers from nearby factories also submitted a petition, with 12,000 signatures, to the minister for the environment, reading a part as follows,

"We, the inhabitants of the town of Wodislaw Slaski and the Rybnik Coal Region, petition the Polish Par-

© ZYGMUNT WIECZREK

Poles demonstrating against air pollution in Upper Silesia on Earth Day this year.

liament to restore our basic right to health and to living conditions worthy of human beings. Our buildings lack the most elementary facilities for a decent life. Our children suffer from rachitis, allergies, and diseases of the respiratory system."

To the President of the Republic of Poland, to the Presidents of the Seym and Senate:

"We, the inhabitants of the towns of Lasiska Gorne, Orzesze, and Mikolow, live in the polluted area called "the triangle of death". We live among the forests of chimneys of the power plant and the steelworks. It is a place of ecological disaster... From an analysis of satellite pictures it has appeared that life must be unsustainable here, where we are forced to live. If the Polish Government should have taken no action to improve the situation before the end of 1990, we must conclude that this is an intentional act on the part of the government, and the Ministry of Environmental Protection and the Ministry of Industry in particular, to continue endangering our life and helth."

From Katarzyna Klich and Alexandra Chodasewicz, working for ICAP, came the comment: "We trust it will be clear from all this that the people of Upper Silesia really are out for an improvement of their environment."

Much of the pollution in Upper Silesia emanates from Czechoslovakia and East Germany, and emissions from the area are a serious threat to the historical town of Cracow, eighty kilometres away, which has been designated by UNESCO a World Heritage. The pollution problems of the whole of the so-called "black triangle,"in the border region where Poland, East Germany, and Czechoslovakia meet, will really need world attention. The Polish Ecological Club is however already making preparations for two workshops in the autumn, to gather together environmentalists and scientists from all three countries for discussion of a plan of action. This will prepare the ground for a major conference in March 1991, attended by politicians, scientists and environmentalists.

Reinhold Pape

Information Centre for Air Protection, Address: 40-960 Katowice, A.Czerwonej Street 2/200, Poland.

ENVIONMENT MINISTER

Poland's coming needs

WHILE the various conferences were taking place in Bergen, Norway, last april, the Polish Minister for the Environment, Bronislav Kaminski, had a meeting with environmentalists and the press to discuss Poland's problems. The necessary structural changes in the country's political and economic system would, he said, take fifteen to twenty years, and probably the whole body of legislation would have to be changed.

He revealed that intense negotiations were just now taking place with the World Bank for a large loan to improve the environmental protection administration and monitoring of the environment, and for reconstruction of the energy sector. As a first step towards this, energy prices had been increased last January by 600 per cent.

Brown-coal prices are being fixed according to the sulphur content, and a hundred or so plants and industrial undertakings are scheduled for closure on account of pollution. Despite mounting pressure from the trade unions, the minister said he was not prepared to compromise in this respect.

Eight bills are being prepared for the current parliamentary session, covering such matters as general environmental policy, environmental taxes, and forestry. Opposition could, Mr Kaminski said, be expected from the Upper-Silesian lobby, which is unwilling to accept the polluter pays principle. He maintained however that economic instruments would gain the day.

It has been agreed with the World Bank that EC environmental standards shall apply for all new plants, and that old polluters must adapt within the next seven years. But the minister added that it would be impossible for Poland to achieve these aims on its own. International cooperation and aid would be needed.

As regards nuclear power, Mr Kaminski noted that Poland was surrounded by some forty plants of the Chernobyl type. It was to be decided at the end of this year whether the construction of Poland's first nuclear power station at Zarnovietz (1000MW) should be continued, but the minister indicated that he personally was against it.Energy equivalent to the output of a 1000 MW plant could be saved right away by coal washing and by rationalization of the energy supply, and the sulphur content of the brown coal can be reduced by 40-50 per cent, he said. Poland on the other hand would be unable to fulfill the conditions of the ECE 30-per-cent protocol for sulphur. All Mr Kaminski could promise was that the country would reduce its SO_2 emissions by 10-12 per cent during the next five years.

Polish environmentalists questioned the minister closely in regard to the Zarnovietz power station and the "black list" of 100 dangerous plants. His reply was that 1 MW of energy generated by nuclear power in Poland would be ten times more expensive than the equivalent produced with desulphurized coal. Concerning the black list he had asked for social support, and there he had to appeal to the public in Poland.

A great deal of resistance to closures is now coming from around Cracow and Katowice in particular, and Mr Kaminski's conclusion that Poland will now need strong NGOs is confirmed by the news that is now coming out. Within the Solidarity movement economic questions are tending more and more to be given top priority. While this is understandable in view of the country's deep economic crisis, it also shows that a lot of information and education will be necessary before the public and politicians in Poland see the environment as a matter of the highest priority – and realize that it will require a large investment on the part of the nation.

Reinhold Pape

KOLA PENINSULA

Proposals for aid in cleaning up

ENORMOUS emissions of sulphur from smelters on the Kola peninsula in North Russia are threatening to devastate forests and damage water and reindeer pasturage in Norway and Finland. As a start towards dealing with this problem, earlier this year the USSR and Finland signed an agreement for a 50-per-cent reduction of emissions in the border region before 1995. Before 1992 there is to be a definition of critical loads, and a program for a reduction of emissions down to the critical level is to be produced before the end of 1993.

Saving the vulnerable ecosystems of the region will require faster and greater reductions than the Soviet economy can manage. The rate of advance of the "sulphur desert" around the smelters will only be slowed down by the proposed measures, not stopped. In view of this, during the summer the possibilities of aid to the Soviet industry have been examined jointly by Norway and Finland.

The Norwegian government is prepared to provide 300 million (Norwegian) kroner, while the Nordic Investment Bank and Scandinavian institutions for financing exports can together make available up to 1.4 billion kroner. The aim is to bring about a reduction of the emissions of sulphur from the two plants of the Petsjenga combine by 95 per cent. This will entail rebuilding the smelters, using process and flue-gas-cleaning technology supplied by the Finnish Outokumpo concern and the Norwegian Elkem. A condition for the financing is namely, that the orders shall go to Finnish and Norwegian firms.

Saving ecosystems is more than Soviet economy can manage

Petsjanga is one of several combines within the Soviet nickel industry. The administrative headquarters are at Nirilsk in Sibir. The problems on Kola really started when the local mines were nearing exhaustion, and ore had to be taken from Nirilsk, where the sulphur content is ten times higher.

On the Norwegian side of the frontier a local action operating under the banner of "Stop the death pall from Soviet" won wide support, and was at the back of several demonstrations. For the time being however, in order to avoid disturbing the climate for negotiations, the leaders have decided to withold further action. There is also a struggle going on in Norwegian government circles as to where the money is to come from. The department of the environment fears that as a result of a big investment in the Soviet Union, it will be deprived of any real increase in funds for domestic measures during the coming years.

Dag-Arne Hoystad

CZECHOSLOVAKIA

Revamping the energy sector

THE energy sector in Czechoslovakia is in for reconstruction. While it is generally agreed that the use of brown coal must be scaled down, the solution proposed under the Communist regime had envisaged a vast program of nuclear power. In the face of the dilemma, environmentalists are seeking alternatives, with attention focused for the moment on three main issues.

ALUMINIUM. The wisdom is questioned of trying to produce aluminium in a country that lacks both the raw material and the necessary electric energy. When Czechoslovakia has become integrated in a world market and has to meet competition, there will be little prospect of profitable operation when faced with cheap hydropower in Norway, gas on the Gulf, and South American waterpower. Plans for aluminium smelting in Czechoslovakia should therefore be abandoned, and the manufacture of semifinished products from imported aluminium substituted instead.

HYDROPOWER. During the interwar period, numerous small hydroelectric plants were built to supply rural areas and local industry. Many of these have had to give way to large central units and fallen into a state of disrepair. With the aid of Norwegian expertise they can be made fit for operation again.

ENERGY CONSERVATION. The choice lies between trying to satisfy a steadily increasing demand, or doing everything possible to hold back demand through the more efficient use of energy. Two research projects that are now nearing completion in Scandinavia may well serve as a model for a study of possible alternatives for Czechoslovakia. The Scandinavian studies have examined the connection between energy production and acidification in order to see what can be done in order to achieve desired environmental aims. They also examine the possibility of attaining the goal of the "low-energy scenario" in the Brundtland report, namely a 50-per-cent reduction of energy use in the industrialized countries. It appears that present energy services can be maintained with such a reduction, but to achieve a 90-percent reduction of SO_2 emissions and stabilization of the CO_2 in the atmosphere, the rich countries will have to be willing to limit their luxury consumption.

Dag-Arne Hoystad

Further information can be obtained from The Norwegian Clean Air Campaign, P.O.Box 94, N-1364 Hvalstad, Norway