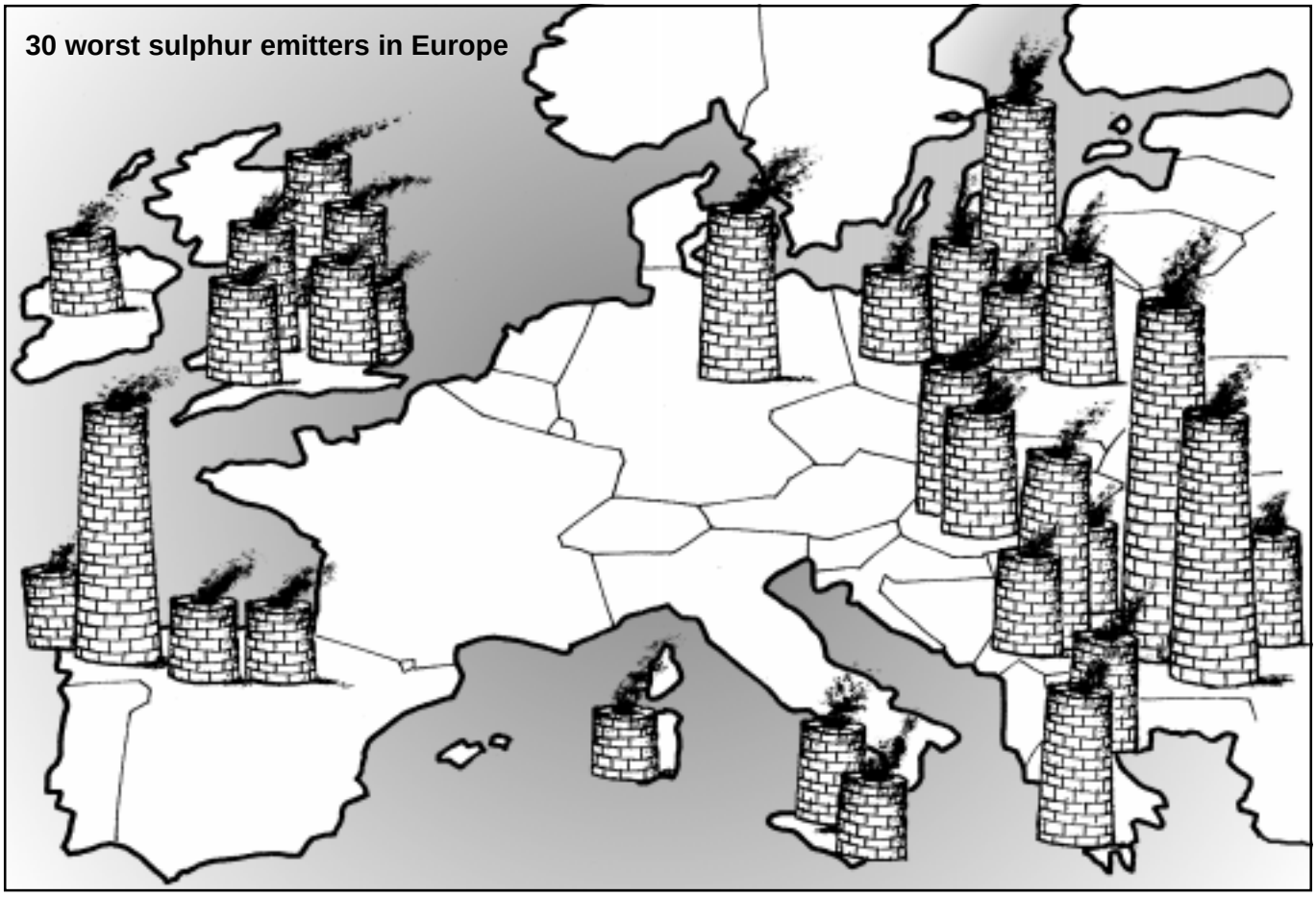
NO. 4, DECEMBER 2000

Acid News



LARGE COMBUSTION PLANTS

Too little required of them

THE EUROPEAN POWER plants that are fired with fossil fuels let out enormous amounts of air pollutants. It is mostly sulphur dioxide that they emit, but also nitrogen oxides, particles, and heavy metals, all making trouble for health and the natural environment. They all emit, too, large amounts of greenhouse gases, notably carbon dioxide.

The revision of a directive dating from 1988, setting emission limit values for some of these pollutants from the largest plants (meaning those with a capacity of more than 50 megawatt) is now being considered in the European Union.

In its draft for a new directive, put forward in 1998, the Commission proposed a tightening of the limit values for new plants, which would mean those built after 2003. The new limits would be approximately twice as strict as the old ones, in other words, the values would be just about halved in comparison with those that have so far applied for plants built since 1987. The question is just *how much* tougher they really will be.

As much as four years ago (1996) we published a report[1] showing that there were a number of plants in operation in Europe that were not only easily meeting the current requirements for new installations (that is, the values for post-1987 plants), but also the new ones that might result from revision of the 1988 directive. The plants that were looked at in the report were of various ages (built between 1961 and 1994), of greatly varying size (100 to 5700 MW_{th}) and fired with a variety of fuels (hard coal, lignite, oil, gas, and biofuels).

An updating of the list of the "best" plants fired with fossil fuels was made in connection with a recent survey of the largest sources of sulphur emissions in Europe (see AN 3/00). In this survey[2] the plants were ranked according to their combined emissions of SO_2 and NOx in relation to their output of useful energy (electricity and/or heat). Although this kind of assessment is somewhat unusual, it is better from the point

Continued on page 3

Acid News

is a newsletter from the Swedish NGO Secretariat on Acid Rain, whose primary 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 secretariat. All requests for information or material will be dealt with to the best of our ability. Acid News is distributed free of charge.

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 7005, S-402 31 Göteborg, Sweden

Tel: +46-31-711 45 15. Fax: 711 46 20

E-mail: info@acidrain.org

Internet: www.acidrain.org

Editor: Christer Ågren

Published by: The Swedish Society for Nature Conservation

Printed by Williamssons Offset, Solna, on paper not bleached with chlorine.

ISSN 0281-5087

THE SECRETARIAT

The Secretariat has a board comprising one representative from each of the following organizations: Friends of the Earth Sweden, the Swedish Anglers' National Association, the Swedish Society for Nature Conservation, the Swedish Youth Association for Environmental Studies and Conservation, and the World Wide Fund for Nature Sweden.

The essential aim of the secretariat is to promote awareness of the problems associated with air pollution, and thus, in part as a result of public pressure, to bring about the needed reductions in the emissions of air pollutants. The aim is to have those emissions eventually brought down to levels – the so-called critical loads – that the environment can tolerate without suffering damage.

In furtherance of these aims, the secretariat operates by

• Keeping under observation political trends and scientific developments.

• Acting as an information centre, primarily for European environmentalist organizations, but also for the media, authorities, and researchers.

• Producing information material.

• Supporting environmentalist bodies in other countries in their work towards common ends.

• Acting as coordinator of the international activities, including lobbying, of European environmentalist organizations, as for instance in connection with the meetings of the Convention on Long Range Transboundary Air Pollution and policy initiatives in the European Union.

• Acting as an observer at the proceedings involving international agreements for reducing the emissions of greenhouse gases.

EDITORIAL

They should not give way

IT IS AT LEAST beginning to dawn on leading policy makers that restricting the emissions from existing coal-fired power plants would have the double advantage of curbing not only sulphur and nitrogen oxides but also the greenhouse gas carbon dioxide.

The Moneypoint plant in Ireland is a case in point. This is a relatively modern installation with a capacity of 915 MW_e, which was started up in the mid-80s. Nevertheless it lacks effective cleaning of the flue gases either from sulphur or nitrogen oxides. Seen in a European perspective, Moneypoint is no great "baddie," coming only twenty-third among the worst emitters of sulphur in Europe. But by the latest count this plant is responsible for almost two-fifths of all Ireland's emissions of sulphur, about a fifth of the nitrogen oxides, and a sixth of the carbon dioxide.

In a press release dated November 2, the Irish environment minister, Noel Dempsey, presented his country's strategy for dealing with climate change, saying: "In recognition of the reality that closure or conversion of Moneypoint would make the largest single contribution to reducing greenhouse gas emissions, the government has declared its intention to ensure that measures addressing the energy supply sector will be supportive of the ceasing of coal firing at Moneypoint by 2008."

Some of the shortfall in the electricity supply caused by the closing down of Moneypoint could probably be compensated by energy saving and a more efficient use of energy, and some by electricity from new, renewable sources, such as windpower. But even if the whole shortfall were to be made up by the electricity from new, modern gas-fired plants, that measure alone would cut down the country's emissions of sulphur dioxide and nitrogen oxides by almost 40 and 20 per cent, and those of carbon dioxide by about 10 per cent.

Which such enormous gains in prospect, one wonders why the Irish are choosing to wait until 2008 before stopping coal firing at Moneypoint.

But old, polluting coal-fired plants give rise to other problems too. In Germany the ministry of economics, in company with the country's generators, is puzzling how the electricity from Germany's relatively "clean" plants (at least as regards their emissions of sulphur and nitrogen oxides) are to compete on more or less equal terms with the electricity from much dirtier plants in other countries – a problem that is getting steadily more acute as the European electricity market becomes liberalized and more international.

The ministry is considering legislation as one means of preventing imports of "dirty" electricity from countries with a more lenient attitude as regards environment and safety. Among the other possibilities that are being weighed are voluntary agreements and/or ecolabelling of electricity.

But there is another solution, which would be more effective. In view of the revision of the EU directive from 1988, regulating the emissions of sulphur, nitrogen oxides, and dust from large combustion plants, which is now taking place, environmentalist organizations are supporting the proposal of the EU Parliament to make binding emission limit values applicable to *all* existing plants.

That would not only drastically cut down the emissions of a number of air pollutants, but also those of the greenhouse gas carbon dioxide – because many of the oldest and least efficient power plants would be shut down instead of being fitted for flue-gas cleaning. No matter what would be used to replace them – whether it would be more efficient use or new sources of energy, or new plants burning fossil fuels – the emissions of carbon dioxide would markedly fall off. Minimum emission standards would moreover make for much fairer competition in the market for electricity.

Unfortunately the vehement opposition of some of the coal-producing EU countries has induced the Council of Ministers to persist in allowing a number of exceptions and escape clauses. It will therefore be of decisive importance, when the directive now comes up for a second reading, for Parliament to stick to the demands it made at the first reading.

CHRISTER ÅGREN

Continued from front page

of view of effects on the environment in that it rewards plants that use energy most effectively.

The best plants usually come in this order according to fuel type: those fired with natural gas (1), oil (2), and coal (3). Emission control techniques, such as flue-gas desulphurization or denitrification, may however change the order of ranking, which will also be affected if plants produce electricity only or heat as well. In combined heat-and-power plants the output of useful energy is typically 100 to 200 per cent higher, with a subsequent reduction of emissions per output.

At least five or six of the coal-fired plants on the list have such low combined emissions of SO_2 and NOx as to be comparable with gas-fired ones. (If the emissions of the greenhouse gas carbon dioxide are also taken into consideration, coal-fired plants will however be worse than gas-fired from the point of view of the environment.) All these coal-fired plants are producing both heat and power, and are equipped for desulphurization and denitrification of the flue gases. By and large all the best coal-fired plants among the 200 are located in Germany, Austria, the Netherlands and Sweden – in other words, those countries with the strictest laws concerning measures to control emissions in Europe.

In the EU directive, as well as in many countries' legislation, emissions are expressed as milligrams of pollutant per cubic metre of air (mg/m^3) in the flue gases, and Barrett also gives a list of the best plants with emissions denoted in this unit. In this list plant performances are also compared when estimated a) according to the limit values in the 1988 directive, and b) the values that the Commission proposes should apply for new plants from 2003.

It should be noted that the emission figures for the best plants have been calculated from the available official statistics. Since such plants quite frequently burn fuel of varying quality – differing for instance in sulphur and energy content – and sometimes even use different kinds of fuel, and will be run at different loads from one year to another, performance may vary considerably over the years.

Be that as it may be, however, these

Continued on next page

Performance of some of the best coal-fired plants in respect of emissions of air pollutants.

		Sulphur dioxide (SO_2)		Nitrogen oxides (NO_2)	
Plant name	Country	mg/m^3	% of 2003 ELV	mg/m^3	% of 2003 ELV
Västerås	Sweden	42	21%	104	52%
Riedersbach	Austria	57	28%	112	56%
Kiel	Germany	76	38%	143	71%
Duernrohr	Austria	100	50%	134	67%
Gelderland	Netherlands	137	69%	130	65%
Knepper	Germany	129	64%	121	60%

Source: The worst and the best. Atmospheric emissions from large point sources in Europe. By Mark Barrett, 2000.

On the following pages

Continued from page 3
new figures show that there are already a very large number of plants, probably more than a hundred burning fossil fuel, that easily meet the emission limits proposed by the Commission for post-2003 installations. There can therefore be no doubt as to the possibility of achieving emission levels, by the use of conventional technology, that are considerably lower than those proposed in the new EU SO_2 and NOx standards for such plants.

It is also a matter of interest that the requirements for stationary plants are still being formulated in such a way as to be "technology conserving." The emission limits that will apply for new plants for the next 10-15 years are being set so they can safely be met by using the same kind of commercially available techniques as will be in general use when the legislation is drafted.

The requirements for road vehicles have on the other hand come to act as "technology forcing," being set at levels that are considered possible of achievement within a few years. They are moreover being successively tightened up at much shorter intervals than those for stationary equipment.

At the time of the first reading of the directive in the European Parliament in the spring of 1999 attempts were made to better the requirements at least for emissions of SO_2. This idea found no place however in the common position adopted by the Council this last June.

The study of large point sources shows, too, that by far the greatest part of the emissions of SO_2 – about 90 per cent – comes from old plants (built before 1987). If the reductions that will be needed in the next ten years for fulfillment of the EU aims for acidification and air quality are to be achieved, something must obviously be done about the emissions from these plants. But there is nothing about this in the Commission's proposal.

The need to deal with existing plants has also been revealed in a study made by IIASA at the request of the Commission. In 2010, 85 per cent of the emissions of SO_2 from large combustion plants in the EU will, according to IIASA estimates, come from plants built before 1987, as well as 66 per cent of the NOx emissions. In coming to this conclusion, the IIASA assumed that the emission limit values proposed by the Commission for all new plants would be applicable from the year 2000.

This was why the European Parliament proposed that limit values for SO_2 and NOx should be made to apply to all existing plants – meaning all built before the year 2000. See AN 2/99, p.7. It was proposed to allow a period of transition until 2005, when the requirements would begin to apply. In its common position the Council did indeed make a small move in the same direction (AN 3/00, p.8), but with the inclusion of fewer plants and a start of application from 2008. It would also allow member countries great flexibility in carrying out the directive, and retain several exceptions, as for instance for plants burning indigenous lignite.

Requirements still being formulated so as to be "technology conserving"

This winter, probably sometime between January and March, a second reading of the draft directive is expected to take place in the Parliament. It will then go to the Council for a final decision. Any disagreement between the two bodies will have to be settled through conciliation in accordance with the so-called co-decision procedure.

CHRISTER ÅGREN

[1] **Doing more than required. Plants that are showing the way**. By A-K Hjalmarsson. APC Report No. 6, 1996.

[2] **The worst and the best. Atmospheric emissions from large point sources in Europe**. By Mark Barrett. APC Report No. 15, 2000.

Both reports are obtainable free of charge from the publisher, the Swedish NGO Secretariat on Acid Rain. Also available in pdf format at www.acidrain.org/publications.htm.

The 100 largest sulphur emitters

Some corrections need to be made in the table on page 5 of the last issue.

Two British power stations, Rugeley and Drakelow, were listed twice. The lower figures are the correct ones in each case: Rugeley 29,000 tons (72nd), Drakelow 19,000 tons (99th).

Maritsa in Bulgaria, placed at the top of the list, should be reported as two plants: Maritsa III, 220,000 tons per year, becomes second, and Maritsa I, 96,000 tons, is then fourteenth.

Maritsa North, properly Maritsa II, moves up to first place, with an annual emission of 291,000 tons.

Maritsa, Bulgaria.

The corrections have been made both in the web version of Acid News and in Mark Barrett's report.

It should be noted that the information dates from 1997-98, and that there have since been other changes. The two coal-fired stations at Thierbach, placed 6th in the table, and Lippendorf (35th) in Germany have for instance been shut down.

Mark Barrett will be glad to receive corrections or additions to the data or text in the report, as well as suggestions as to how it might be improved. Address: MarkBarrett@sencouk.co.uk.

Lower the sulphur in bunker oil

In a report to the EU Commission, consultants make this proposal for cleaner shipping

Three vessels used by the Swedish forest-products company Södra run on low-sulphur oil and are equipped for catalytic cleaning of the exhaust gases. There are no technical reasons for not cutting down the emissions of air pollutants from shipping.

ACCORDING TO estimates in a study[1] made for the EU Commission, the emissions of nitrogen oxides and sulphur dioxide from shipping in European waters now amount, respectively, to 2.3 and 1.9 million tons a year. If nothing is done to check them, by 2010 they will be equivalent to more than a third of the emissions of NOx then expected in the EU and 40-50 per cent of the SO_2.

In order to be able to compare ships with large combustion plants on land, the consultants who made the study reckoned the power consumption of the shipping in all European waters to be approximately equivalent to that of 390 50-megawatt units running continuously every day of the year. In the terms of the directive (88/609/EC), large combustion plants are those with at least 50 MW thermal output.

The consultants therefore propose that the EU should pass legislation setting the limit for sulphur in bunker oils at 1 per cent for ships plying in EU territorial waters. At present there is no legislation on such oils. The sulphur content of other types of oil is regulated in directive 99/32/EC, setting a maximum of 1 per cent for heavy fuel oils used in emission sources on land, and 0.2 per cent for gas oils, including any used on ships.

It has been agreed within the UN International Maritime Organization that there should be a global cap of 4.5 per cent on sulphur in bunker oils. It is not likely however that this will have much effect, since the general average sulphur content has long been under 3 per cent. The IMO has moreover designated the Baltic and North Seas as low-sulphur-fuel zones, where the maximum limit would be 1.5 per cent. It is however highly uncertain when this will become effective, since IMO rules have first to be ratified by as many countries as represent half of the world's shipping.

With a 1-per-cent limit, emissions would come down by 35-40 per cent

With a 1-per-cent limit for the bunker oils used in EU territorial waters, the overall emissions of sulphur from shipping would come down by 700,000 tons, or 35-40 per cent. The consultants have put the cost of carrying out such a measure at US$1000 per ton of SO_2 so eliminated, which would mean approximately US$700 million a year. They note however that their estimate is greatly dependent on assumptions as to future oil prices and that there are other studies showing the cost to be only half as high.

The consultants also note that the emissions of nitrogen oxides from shipping could be reduced by as much as 50 per cent through the use of financial incentives such as differentiated harbour dues. They estimate the cost in that case to lie between US$800 and 1200 per ton of NOx thus eliminated. By using more far-reaching methods, the emissions could be reduced by two-thirds, but then the cost would also be higher.

As regards incentive schemes for controlling the emissions both of SO_2 and NOx, a nationally operated but port-administered system of levies is considered preferable to a scheme of harbour dues, and that such a levy system should be based on emissions rather than on gross tonnage.

Unfortunately it does not appear from the final report just how the new figures for the overall emissions from shipping have been arrived at – despite their being much lower than the corresponding EMEP figures based on calculations made by Lloyd's Register (see p.20). Moreover the latter do not take into account the emissions from naval and fishing vessels or small craft, nor those from ships lying in port or at anchor awaiting a berth or further orders.

CHRISTER ÅGREN

[1] **Study on the economic, legal, environmental and practical implications of a European Union system to reduce ship emissions of SO_2 and NOx**. Final report for the European Commission (August 2000). By M.E. Davies, et al., BMT Murray Fenton Edon Liddiard Vince Ltd, UK. Available in pdf format at http://europa.eu.int/comm/environment/enveco/studies2.htm#27.

Results coming in better air quality

Emissions expected to drop despite increase in road traffic, but more is needed to achieve aims

IT IS EVIDENT from the Commission's final report on the Auto-Oil II project that the measures already decided upon for reducing the emissions from road traffic will bring marked improvement in air quality during the next few decades. The proportion of pollutants coming from road vehicles is also expected to diminish. Nevertheless in 2010 great numbers of people will still be living in cities where the concentrations lie well above the desirable limits.

The first Auto-Oil program was a cooperative project in which the vehicle manufacturers and the oil industry were engaged, together with the EU Commission, between 1992 and 1996. Out of it came a number of proposals for directives, including three on emission standards for vehicles (private cars, light commercial and heavy duty vehicles) and another on quality requirements for motor fuels (petrol and diesel oil). These set down values that were intended to start applying in 2000 and 2005, although in the latter case they were only to be indicative.

The Commission wanted to have more research done before the indicative standards were finally adopted. It therefore started a wide-ranging program, Auto-Oil II, which was to differ from the first in that it should also look into possible non-technical measures for arriving at cost-effective solutions, and allow all those with an interest in the matter to participate from the beginning. The first program had been heavily criticized for its lack of openness.

But things did not turn out quite as the Commission had expected. The EU Parliament managed to ensure that the standards for 2005, instead of being merely indicative, should be definite. This rather upset the Auto-Oil II project. A final report was however issued this last summer, followed by a communication from the Commission in October.

In it the Commission notes that the directives emerging from Auto-Oil I will result in a considerable reduction of emissions. It estimates that despite the expected increase in the volume of road traffic, the emissions of several air pollutants will have dropped by 70-80 per cent or more by 2010, from their 1995 levels, and thereafter fall off still further (see chart below). Without these directives the emissions from road traffic would be 50-100 per cent higher in 2010, and then go on increasing in step with increasing road traffic.

The emissions of carbon dioxide are nevertheless estimated to increase by 10-15 per cent from 1995 to 2005, and then level off, since by that time the increase in road traffic is expected to have been offset by more fuel-efficient vehicles.

Further improvement will be needed in respect of pollutants that are damaging to health. Small particles in particular (PM_{10}) will loom large. In 2010 between 50 and 75 per cent of the total urban population will still be living in cities that fail to meet accepted air-quality standards for particles (today it is closer to 90 per cent). In general there will be a great improvement as regards other pollutants, except for nitrogen oxides which will still exceed the standards here and there.

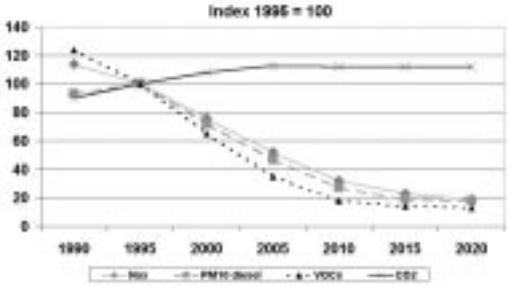
As a source of pollution, road traffic will decline in importance, according to the Commission, which points to the fact that there will be a need in future to direct attention to other sources as well – adding that the air-quality standards for particles, for instance, would not be met even if emissions from road traffic were entirely eliminated.

One thing that came out of the Auto-Oil II project was that two and three-wheel vehicles were "a key remaining area" where stricter emission limits would significantly improve air quality. The Commission recently presented a proposal for a directive setting stricter limits for such vehicles (see AN 3/00). A proposal for the technical updating of standards for all types of light and heavy vehicles is expected next year. Additions will also be made to the directive on fuel quality, which may be extended as a result of a review process initiated by the Commission (see article on opposite page).

In addition to the measures at EU level, the Commission urges individual action by the member countries, which it says should include promotion of alternative fuels for fleets of vehicles driving mainly in city centres (i.e. buses), the use of fiscal instruments, schemes to accelerate scrapping of old vehicles, and local, non-technical measures such as parking charges and road pricing.

Fiscal instruments and local non-technical measures are thought to have a significant potential. General increases in fuel duty or differentiated duties on fuel are predicted to have a "large net societal benefit" if revenues are used to reduce the "more distorting" kinds of taxes. Local non-technical measures could moreover provide "highly cost-effective" solutions.

PER ELVINGSON



Emissions from road traffic in EU 1990-2020. Those of nitrogen oxides (NOx), volatile organic compounds (VOCs) and particles (PM_{10}) from diesel-engined vehicles are estimated to have dropped by about 80 per cent between 1995 and 2020. A similar trend is discernible for emissions of benzene and carbon monoxide, while those of carbon dioxide (CO_2) are expected to increase.

To find out more: The Commission has a website for the Auto-Oil program, from which a number of documents can be downloaded, including the above-mentioned communication, entitled *A Review of the Auto-Oil II Programme* (COM(2000)626), as well as the main report on the project and a number of sub-reports from working groups. See http://europa.eu.int/comm/environment/autooil/index.htm or contact Peter Wicks, Environment DG, Unit ENV. D3, 200 Rue de la Loi, B-1049 Brussels, Belgium.

© PER ELVINGSON

SULPHUR-FREE MOTOR FUELS

Beneficial both for the environment and health

But will the gains outweigh the extra cost? The answers to a Commission questionnaire show opinion to be divided.

AS FROM 2005, the sulphur content of petrol and diesel fuel will not be allowed to exceed 50 ppm (parts per million), a marked lowering from today's levels. The change is a result of pressure from the European Parliament when the present directive for motor fuels (98/70/EC) was being debated in l997-1998.

The question now is whether it should be lowered still further. The auto makers think it should, and when Germany joined in and supported them by proposing sulphur-free fuel, the Commission decided to take the matter up by sending out a questionnaire last May on certain points that all interested parties were invited to answer. The whole process has been kept public, and the replies can all be read on internet.

There can hardly be any doubt that it would be beneficial for the environment and health to have motor fuels with less sulphur, but here another question arises: Will the gains be sufficient to be thought to justify the extra cost?

The advantages of having sulphur-free motor fuels (defined as those with a sulphur content of less than 10 ppm) have been summarized by SENCO Consultants, in a report to the British government, in two main aspects:

- ❏ They reduce emissions from existing catalyst-equipped vehicles, particularly from the latest generation of petrol vehicles. For nitrogen oxides, the introduction of sulphur-free petrol may reduce fleet emissions by almost 50 per cent in 2010. There would also be lesser emissions of particles, especially from diesel-driven vehicles.
- ❏ They enable new catalyst technology to be introduced into the market. This is important for the introduction of more fuel-efficient cars to reduce emissions of carbon dioxide from road traffic.

Since it will be easier with low-sulphur fuels to make vehicles that can meet future environmental requirements, the manufacturers are naturally enthusiastic about the idea. Their trade association ACEA describes it as "a prerequisite for the implementation of some of the most promising emission abatement technologies."

The oil industry is not so pleased, claiming the positive effects will be negligible (Concawe, the oil companies' European organization for environment, health, and safety, in its reply to the questionnaire). It also points out that lowering the sulphur content will result in increased emissions of carbon dioxide from the refining process. While admitting that low-sulphur fuel will ease the introduction of vehicles with better fuel economy, it still maintains that the net effect may well be negative for several years to come. Others think it will be about zero to begin with but positive later on.

Of the countries replying the Netherlands is clearly supporting the oil industry's view, whereas in Britain the Department of the Environment, Transport and Regions is inclined to agree about the benefits and to tone down the problems.

T&E, the European environmentalists' umbrella organization for transportation matters, considers it would not only be cost-effective to reduce sulphur content, but that it should be done without delay. Among the reasons given are that it will be necessary in order to meet the coming air-quality standards for nitrogen oxides and particles.

Opinion is divided as to the additional cost of producing "sulphur-free" fuels – the oil industry claiming it will be much more than the vehicle makers estimate. The British department of the environment puts the extra cost of fuel with a sulphur content of less that 10 ppm at 0.2 pence per litre (taken over a period of fifteen years). For a typical car user, this would be equivalent to roughly £2.50 a year. For a heavy vehicle travelling 112,000 km or so a year it would amount to £80 per annum, or about an 0.1-per-cent increase in annual running costs for a 38-ton truck.

The various replies are now being gone through by a panel of independent experts. Its conclusions will be taken into consideration by the Commission when it comes to deciding whether the revised directive on motor fuels is to include further requirements as to the sulphur content of petrol and diesel fuel. A proposal is expected next year.

PER ELVINGSON

The questions put by the Commission and the replies it has received can be found under the address http://europa.eu.int/comm/environment/sulphur/index.htm or be ordered from Duncan Johnstone, DG Environment ENV.D3, European Commission, Rue de la Loi 200, 1049 Brussels, Belgium. E-mail: ENV-Sulphur-Review@cec.eu.int.

Various options, one best

Although no ideal solution, natural gas combined cycle appears eminently possible from this study

IF THE WORST coal power stations in Europe were replaced by new combined cycle natural gas plants, emissions of sulphur would be eliminated, and those of nitrogen oxides and carbon dioxide would simultaneously be cut, respectively, by 98 and 75 per cent. Taking all the costs into account, it would often be profitable too.

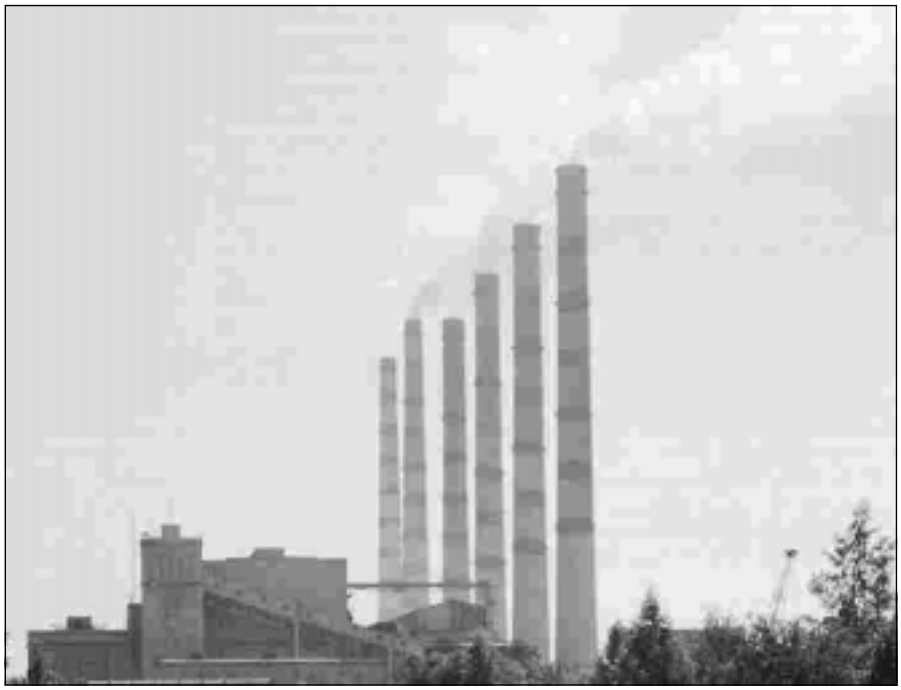
The worst power plants in Turkey, Bulgaria, and Spain let out more than 50 grams of sulphur dioxide for each kilowatt-hour of electricity. Emissions of 10 grams of SO_2 per kWh are common for coal-fired plants in the EU, and still commoner in eastern Europe. Each gram of SO_2 converts to about 1.6 grams of concentrated sulphuric acid. The average European uses some 6000 kWh of electricity a year – which means that if generated in these plants, it would give rise to more than 90 kilograms of sulphuric acid per person!

EU emission standard for plants built from 1987 on is 140-700 grams of SO_2 per gigajoule (g/GJ) of fuel,[1] depending on size, corresponding to 0.2-1 per cent sulphur without cleaning. There are no limits for plants built before 1987. In Spain plants are burning lignite with a sulphur content up to 7 per cent.

The best coal-fired plants with the most efficient flue-gas cleaning, such as the combined heat-and-power one at Västerås in central Sweden, emit about 6 g/GJ – in other words, a bare hundredth of what is permitted for certain plants according to the directive. Actually the best plants are even better, since they generate both heat and power and operate at 90-per-cent efficiency, as compared with 30 per cent for older plants producing only electricity. The emissions from Västerås amount to 0.024 grams of SO_2 per kWh of useful energy, which is 1/2000 of that from the dirtiest plants, or 1/400 from the kind of plant that is fairly common in the EU.

Still better however are new gas-fired plants. Since there is no sulphur in natural gas, such plants do not give rise to any sulphur emissions.

The situation is similar as regards emissions of nitrogen oxides, which in the case of the worst plants can exceed 700 g/GJ. The EU emission limit value for plants built after 1987 is 230 g/GJ fuel input. The best coal-fired plants now emit approximately 35-50 g/GJ.



The best natural gas combined cycle plants not equipped with catalyzers for reducing nitrogen oxides emit less than 15 ppm (8 g/GJ fuel input), corresponding to 50 mg/kWh of electricity. With the best flue-gas cleaning , the emissions of can be brought down still further, to about 2 ppm, or 1 g/GJ fuel input.

Combined cycle plants fired with natural gas better in every respect

As can be seen from the table below, the combined cycle plants fired with natural gas are better in every respect than old coal-fired plants, and definitely better even than the best new ones.

There are other environmental effects from the burning of coal, besides those accruing from the emissions of sulphur and nitrogen oxides.

Since coal has a higher content of elementary carbon as compared to natural gas, when burnt it gives rise to significantly higher amounts of carbon dioxide. Moreover greater efficiency can be attained from the burning of a gas than from solid fuels. Coal contains large amounts of heavy metals, which are let out through the chimney or retained in the ash, thereby creating a disposal problem that does not occur with natural gas.

In the life-cycle aspect, natural gas has even further advantages over coal. More methane is let out from coal mining than from drilling for natural gas, and the mining, washing, and transporting of coal, as well as the production of lime for its desulphurization, add to the environmental debit of firing with coal.

Gas is however not always the best alternative. In Sweden for example environmentalists have always been against developing the use of natural gas because it would push aside biofuels. During the last fifteen years the use of biofuels, coming mainly from the forests, has greatly expanded in Sweden. Sweden is perhaps exceptional in being a rather sparsely

populated country where 60 per cent of the land area is covered by forest, with forest-product industries forming a great part of the economy. Moreover district heating is well developed in urban areas, and emissions of CO_2 have been taxed since 1991.

But the Swedish example nevertheless shows that large-scale use of biofuels works in a modern country, from the technical, economic, and environmental points of view – at least for generating heat and to some extent for heat-and-power. In less forested countries there may be better conditions for energy crops, agricultural waste and solar heating.

Although renewables alone can not replace coal in the short term, they could well make a growing contribution to energy production alongside natural gas. Some such development will in any case obviously be necessary for attainment of the long-term aim of climate policy – namely, stabilization of the concentrations of carbon dioxide in the air at a lower level than the present.

Coal-fired power plants cause major environmental problems – especially the older ones with low efficiency and no modern equipment for abating pollution. A number of options are conceivable for dealing with the worst plants:

Let them continue to operate. This is untenable in consideration of the effects of their emissions on public health and their contribution to other environmental problems, such as eutrophication, acidification, and global warming. Stricter emission limits for the EU, which will apply to the candidate countries too, and emission caps in the Kyoto and Gothenburg protocols, will soon make this alternative either impossible or extremely expensive. Many of the plants are now technically worn out and dependent on nearby unprofitable coal mines as well as unsustainable subventioning.

Replace with efficiency and renewables. Efficiency is the best "source" of energy, since it would cut out all emissions of pollutants. Demand-side efficiency often makes economic sense, but it also calls for changes in attitudes, traditions, and institutions, which would all take time. The outlook is best in countries with the highest electricity consumption.

As for electricity from renewable sources, windpower is still quite expensive, and solar cells inordinately so. Modern technology for converting biofuels to electricity is neither technically nor economically mature. The potential for the production of heat-and-power from biofuels is limited, although best in industry. It needs to have a district heating network in place before it can be applied, since installing a new one would add too much to the cost.

Although it is possible to replace some of the more polluting plants with improved energy efficiency and generation from renewables, this cannot be done quickly in all cases.

Replace with nuclear power. Since 1990, no nuclear power station has been ordered in Europe other than two in France. In most countries no orders have been considered for 20 years or more. Many reactors have on the contrary been shut down. In an increasingly competitive market for electricity, new nuclear plants are out of the picture.

The possibility of keeping old plants in operation for a longer period than had been planned is also

Continued on next page

Emissions of SO_2, NOx and CO_2 from various types of coal-fired and gas fired plants.

	SO_2 g/GJ fuel	NOx g/GJ fuel	SO_2+NOx g/GJ fuel	SO_2+NOx mg/ kWh electricity	CO_2/kWh electricity
Coal: worst available fuel and technology	4000	725	4725	57000[A]	1.3 kg
Coal: bad, but common fuel and technology	700	500	1200	12000[B]	1.0 kg
Coal: new plant, decent technology	70	70	140	840[C]	0.8 kg
Natural Gas: combined cycle, Dry Low NOx technology	0	8	8	48[D]	0.33 kg
Natural Gas: SCONOx	0	2	2	12[E]	0.33 kg

[A] At 30% efficiency. [B] At 34 % efficiency. [C] At 42,5 % efficiency. [D] At 60 % efficiency. [E] At 60 % efficiency.

EU IN BRIEF

Cleaner motorbikes

Germany is about to introduce financial incentives for cleaner motorcycles by linking the road tax on them with emissions from 2001. Motorcycles which meet the standards recently proposed by the EU Commission will be favoured. The Commission's proposal affects all new models from 2003 and new motorcycles from 2004, with more stringent curbs in 2006.

T&E Bulletin No. 92, October 2000.

Emission limits for pleasure boats

EU legislation on emissions from the engines of pleasure craft is now being proposed for the first time.[1] On October 27 the Commission put forward an idea for a directive covering all boats from 4 to 24 metres in length, as well as inflatables and "personal watercraft" such as jet skis. Although small when considered generally, the pollution and noise from these sources can have a strong local effect. The Commission also suggests that it will be to the advantage of the engine manufacturers to have uniform rules for the whole EU market.

There are calculated to be about 3.6 million motorboats in the EU countries and those of the European Economic Area. It is proposed that there should be emission limits for hydrocarbons, NOx, carbon monoxide, and particulates, to become applicable in 2003-04 for all except two-stroke engines, which would have until 2005 to develop the necessary technology. The final proposal will result in lower emission cuts than in an earlier draft, which would have brought them down by three quarters. The Commission estimates that the limits now proposed would cut pollution as follows:

	CO	HC	NOx	Part.
Spark-ignition engines	42%	89%	-	-
Compression ignition engines	5%	23%	31%	29%

[1] COM (2000)639.

NEWS IN BRIEF

Getting car emissions down

The average emissions of carbon dioxide from new cars sold in the EU are on the way down. By agreement between the manufacturers and the EU Commission they are to have been reduced by 25 per cent between 1995 and 2008. The Commission is now urging the car makers to hurry on and reduce these emissions by 2 per cent per year so that they can attain the target in time. So far the pace has only been 1.5 per cent among European car makers. The Japanese and Korean manufacturers have not managed even that, their reductions having stayed at 1.15 and 0.4 per cent a year respectively. The Commission nevertheless thinks the agreement has its value and is worth retaining.

ENDS Daily, July 24 and October 6, 2000.

Soon a 1-litre car

Volkswagen is not content with having been the first to mass-produce a car with a fuel consumption of 3 litres per 100 kilometres. In the midst of the outrage in Europe over high fuel prices, Ferdinand Piech declared that a 1-litre car would be on the road before he retired as managing director, probably in 2003. The announcement was made during an interview with Stern magazine, where Piech revealed that the car would be made of composite material and would be ultralight. The high cost of fuel and the consequent demand for cars with a low consumption was said to be a main reason for the move.

VWD, September 20, 2000.

Choosing the right car

Anyone in Britain wanting to buy a car that best suits the environment should visit the Vehicle Certification Agency's website **www.vca.gov.uk** where he will find not only figures for fuel consumption but also which models already meet the coming EU requirements in respect of emissions (Euro IV). It also indicates the likely vehicle excise duty payable for each model following the introduction of the new CO_2-based graduated VED regime for new cars from 2001.

The EPA has started a similar website in the United States, in which car models are ranked according to their emissions of air pollutants. The address is

www.epa.gov/autoemissions

Figures for fuel consumption are given on **www.fueleconomy.gov**

Continued from previous page

limited, since it would often require a lot of new investment, which would be difficult to recoup. Nuclear power will therefore in all likelihood continue to drop away.

Replace old coal-fired plants with new ones. What is known as Clean Coal Technology can certainly bring a great improvement in efficiency, and also result in greatly reduced emissions of NOx and SO_2 from coal-fired plants. But the emissions of carbon dioxide would still remain high in relation to the amount of energy produced. Being very expensive to build, new plants of this kind are in any case out of the question in most parts of Europe. One that has just started up at Lippendorf in Germany, burning lignite, with a capacity of 2x933 MW_e, has for instance cost DM4.5 billion – almost US$2 billion, or more than $1000 per kW.

Fit flue-gas cleaning on existing plants. To date German legislation, for example, and to some extent that of the EU, has aimed at causing existing plants to be equipped for desulphurizing and de-NOx-ing the flue gases. Although that may be a workable interim solution for fairly good modern plants, it has distinct limits. For one thing it has no effect on CO_2, and for another it costs a great deal – around US$100/$kW_e$ for desulphurization at a new coal-fired plant, and $50-70 for catching NOx. Although it has been forced down of late, the cost of such additional equipment can be very high if it has to be fitted to an existing plant. Not only can it easily amount to half the price of a new gas-fired plant (see below), but it will also take a long time from conception to a fully functioning plant. There would also be the extra operational costs and the risk of breakdowns.

Replace with the latest types of plant fired with natural gas. No ideal solution, but eminently possible. Most of the plants ordered of late have been natural gas combined cycle units. The capital cost of such plant, according to the US Department of Energy, is $449/$kW_e$, as against $1102 for a corresponding coal-fired plant. Gas-fired combined cycle plants have several advantages over coal-fired ones. They are more reliable in operation, can be built quickly and in much smaller sizes. They can thus easily adjust to developments in the demand for electricity, without being too much affected by long-term forecasts. Gas is admittedly more expensive than coal, but the low capital cost of the plant makes it easier to adapt to changing operational conditions. Operators will not lose so much money, either, by running plants intermittently when electricity prices are lower, and making up for it when they are high.

The environmental advantages, which include relatively low emissions of CO_2, mean that gas is much less sensitive to changes in legislation, taxes, or the introduction of CO_2 permit trading. On the contrary, such moves would add to the competitive edge of combined cycle gas. All aspects considered, such plants would seem to be a highly realistic alternative to the continued operation of old, inefficient, and dirty plants burning fossil fuels. And then there are the environmental gains.

The next step, after it has been proved that some coal-fired plants could with advantage be replaced by gas-fired heat-and-power units, will be to squeeze the size of the replacement by ensuring a more efficient use of the energy so produced, and adding a certain amount of energy from renewables. Many of the worst plants are in countries with a surplus of generating capacity, and in such cases shutting down without new investments in additional power-generating capacity would be best from the points of view both of the environment and the economy.

FREDRIK LUNDBERG

Freelance writer specializing on energy and the environment.

[1] For coal 1 g/GJ corresponds to 2.86 mg/m^3; for gas 1 g/GJ corresponds to 3.70 mg/m^3.

Note. Nitrogen compounds affect the environment in much more complicated way than sulphur. Nitrogen oxides can contribute to acidification, eutrophication, and the formation of ozone and small aerosol particles. Nitrous oxide (N_2O) not only affects the ozone layer but is also a greenhouse gas. Whereas the emissions of N_2O from modern gas-fired plants are about 2g/GJ, from ordinary coal-fired power plants they will often be as much as 25-50 g/GJ (although they can vary markedly according to the type of plant as well as operating conditions). Moreover, some flue-gas cleaning arrangements may let out ammonia to the extent of 2 g/GJ of fuel. But gas-fired combined cycle plants do not let out any ammonia if they employ so-called Dry Low NOx technique, or catch NOx in an SCONOx reactor.

Every fourth tree damaged

The situation has worsened around the Mediterranean but improved in Central Europe.

WHEREAS forest damage has increased in the Mediterranean region during the last few years, there has been some recovery in central Europe. In Europe generally about a quarter of the trees are showing signs of defoliation.

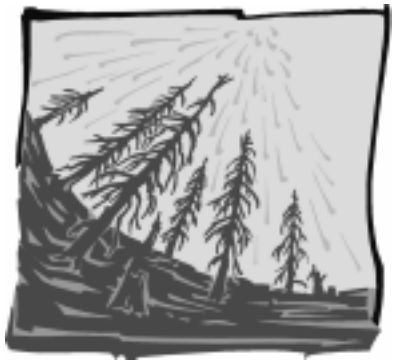
In a Europe-wide program for watching the state of the forests which has been going on since 1986 a great number of trees are being observed for possible loss of leaves or needles every year. Thirty nations are engaged in the monitoring, now involving a regular scrutiny of 5700 sample plots in a l6xl6 km network, representing nearly 129,000 trees.

In the last survey 23 per cent of the trees in the sampling plots were assessed as damaged – meaning that they had lost more than 25 per cent of their leaves or needles in comparison with reference trees of the same species. That would be about 1 percentage point less than in the previous year.

But for Europe as a whole there were great regional differences.

There has been a sharp increase in the Mediterranean region of the mean defoliation of all species. Of the main tree species in that part of Europe the greatest increase was observed in common beech (*Fagus sylvatica*), Scots pine (*Pinus sylvestris*), and maritime pine (*Pinus pinaster*). Dry weather conditions have been given as the explanation, although the influence of ozone is also suspected.

On the other hand mean defoliation has dropped considerably in the subatlantic region, comprising Poland, western Slovakia, the Czech Republic, and eastern Germany. The improvement there was most pronounced for Scots pine, the proportion of trees that were classified as damaged having decreased from 46 to 25 per cent during the last five years. In this case the explanation was thought to lie in the favourable weather conditions. It is difficult however to separate the possible influence of the great decrease in sulphur pollution from the effect of such natural phenomena.



The regional variations can also be seen from the table, where the figures are from the national inventories.

Results from national forest-damage surveys, 1996-99. Percentage of trees with defoliation above 25 per cent.

	1996	1997	1998	1999
Albania	–	–	10	10
Austria	8	7	7	7
Belarus	40	36	30	26
Belgium	21	17	17	18
Bulgaria	39	50	60	44
Croatia	30	33	26	23
Czech Rep.[1]	72	69	49	50
Denmark	28	21	22	13
Estonia	–	–	9	9
Finland	13	12	12	11
France		25	23	20
Germany	20	20	21	22
Greece[2]	24	24	22	17
Hungary	19	19	19	18
Ireland	13	14	16	13
Italy	30	36	36	35
Latvia	21	19	17	19
Lithuania	13	14	16	12
Luxembourg	38	30	25	–
Moldova	41	–	–	–
Netherlands	34	35	31	–
Norway	29	31	31	29
Poland	40	37	35	31
Portugal	7	8	10	11
Romania	17	16	12	13
Slovak Rep.	34	31	32	28
Slovenia	19	26	28	29
Spain	19	14	14	13
Sweden	17	15	14	13
Switzerland	21	17	19	19
Ukraine	46	31	52	56
U.K.	14	19	21	21
Yugoslavia	4	8	8	11

[1] Until 1997 only trees older than 60 years were assessed. [2] Excluding maquis.

Since 1994 intensive monitoring of 900 sample plots, spread over thirty countries, has become part of the all-Europe program. The aim is to get a better insight into the causes of defoliation. Among the findings so far are the following:

❑ Depositions of atmospheric nitrogen and sulphur do affect nutrient status and to a lesser extent tree vitality. In 30 per cent of the plots the nutrient status is either insufficient or unbalanced.

❑ Following the reduction of emissions, the depositions of sulphur have decreased much more than those of nitrogen on most plots during the last decade. On about 50 per cent of them, however, nitrogen deposition is more than 14 kg per hectare a year. Above that level adverse effects may occur, specifically on the ground vegetation.

It says in the annual report on the monitoring program that it is usually impossible to identify the causes of deterioration in stands or individual trees. Statistical evaluations indicate a complex system of environmental conditions and stress factors. The main factors that are statistically relevant for explaining defoliation are tree age, soil acidity, plant-eating insects and fungi, climatic extremes and/or water availability, as well as air pollutants such as sulphur and nitrogen compounds and ozone.

"Further reduction of emissions is still needed to guarantee the multiple functions of forests in Europe as a basis for a sustainable forest management," says the EU Commission in its presentation of the report.

PER ELVINGSON

Forest Condition in Europe. 2000 Executive Report and **Intensive Monitoring of Forest Ecosystems in Europe. Technical Report 2000.** Both available on the internet at the address: http://europa.eu.int/comm/dg06/fore/index_en.htm. Can also be ordered from Federal Research Centre for Forestry and Forest Products, ICP Forests, Leuschnerstr. 91, 21031 Hamburg, Germany (www.dainet.de/bfh/inst1/12).

Are levels decreasing?

SINCE THE EMISSIONS of nitrogen oxides and volatile organic compounds, which do most for the formation of ozone, have dropped by 15-20 per cent in Europe during the last ten years, it might be supposed that ozone concentrations would follow. But from an analysis[1] of concentrations during the period from 1989 to 1998 they evidently have not.

One explanation is that they may have been less, but the drop has been masked by the great variations caused by the weather. Ozone is formed under the influence of sunlight, so the concentrations will usually be higher in warm summers than when the weather is rainy. Variations that are due to the weather will moreover be greatest in northern Europe, where emissions have dropped most.

Gaps in the network of monitoring stations also make it difficult to discern trends. In some places, particularly in France and southeastern Europe, the stations are too few to give a complete picture. In Spain many stations are located too close to the sources of pollution to be representative of a wider region.

[1] **Transboundary Photo-oxidants in Europe**. EMEP Report 2/2000. Available from Meteorological Sythesizing Centre – West, Norwegian Meteorological Institute, P.O. Box 43-Blindern, N-0313 Oslo, Norway. Internet: www.emep.int.

Improve railways

Five weighty industrial groups are calling for improvements in EU railway services. These five – the employers confederation Unice, Eurocommerce, Eurochambres, the European Shippers' Council, and the chemical industry association Cefic – say that freight moving is being hampered by congestion on the roads and that they would "happily embrace rail transport as an alternative [to roads] but unfortunately it cannot rely on a properly functioning and competitive supply of rail transport services." They claim that liberalization is the key to reversing a precipitous decline in rail freight transport over the last decades.

ENDS Daily, September 22, 2000.

Muddle over ceilings and standards for ozone

TO JUDGE from the common position on ozone (taken at the meeting of the Council in October) the EU environment ministers think it is quite in order to have a worse quality of the air than the Commission and the Parliament would like.

None of them has anything against the long-term aim of the directive, namely that concentrations should not exceed the level set by the World Health Organization for the protection of health, which is 120 $\mu g/m^3$ (60 ppb) as an eight-hour average.

But it is on one part of the aim for 2010 that there is disagreement. The Commission had proposed that the level could be exceeded on no more than 20 days a year from 2010, in which it was supported by the Parliament at its first reading of the directive. But in order to bring round Greece, Spain, Italy, and Portugal, who wanted 40 days, the Council agreed on a compromise, making the maximum 25 days.

The Council also wanted the requirements to be weaker than the Commission proposed on two further points. For one thing it would somewhat lower the target for 2010 for the protection of vegetation. In addition it only wanted action plans to be set up when the threshold value of 240 $\mu g/m^3$, averaged over three hours, had been reached. That would be aiming much lower than the Commission, with its proposal for starting as soon as the threshold level had been averaged over just one hour.

There is a close connection between the air-quality directive for ozone and that for national ceilings on emissions. It was under the assumption that its proposal for ceilings on the emissions of nitrogen oxides and volatile organic compounds, the substances that give rise to the formation of ozone, would be accepted by the member countries that the Commission reckoned its limit for ozone concentrations would be realized.

But taking the less ambitious ceilings agreed by the Council in June (see AN 3/00) as an excuse, a lot of countries are now out to get generally weaker standards for air quality.

Here however the European Environmental Bureau (EEB) points out an error in their reasoning – saying in a release to the press that "the shortfall in emission reductions expected as a result of the NEC directive can easily be made up by reducing shipping emissions and by implementing local measures, as transboundary emissions of ozone or ozone precursors are only part of the problem."

Several of the demands made by the Parliament at its first reading of the directive were found unacceptable by the Council. One was the desire to have the so-called target values for 2010 made binding, instead of being merely guide values. The Parliament also wanted the long-term aim, when there would be no exceeding at all of the threshold values, to have been reached by 2020.

The directive will now be going to the Parliament for a second reading.

Benzene and carbon monoxide

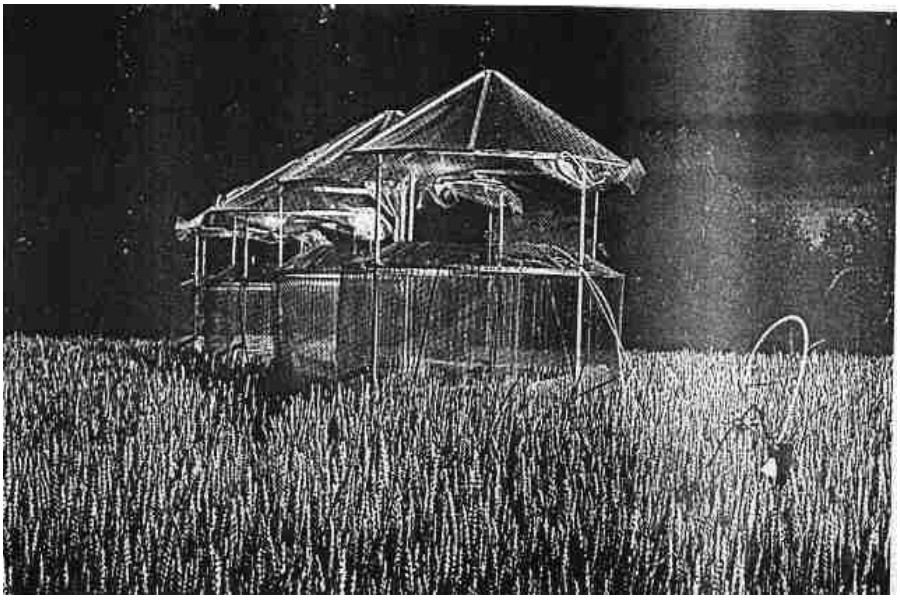
Air-quality standards for benzene and carbon monoxide, which were agreed by the Council this October, will mean that as from 2010 the concentrations of benzene in the air may not exceed 5 micrograms per cubic metre, and those of carbon monoxide 10 milligrams after 2005.

It is expected that the measures already taken will cause the emissions of benzene, which come mainly from road traffic, in general to drop heavily (see p.6). But unless further measures are taken, it will be difficult in 2010 to meet the standards in places where traffic is heavy. The directive allows member countries however to apply for an extra five years (at the most) in which to comply.

The standards for benzene and carbon monoxide forms a second daughter directive to the framework one on air quality dating from 1996.

Correction. In our last issue it was wrongly reported that agreement was about to be reached on 10 micrograms per cubic metre as the limit for concentrations of benzene in the air.

Harvests affected by ozone at current levels



Researchers have used field studies to assess the effect of various degrees of ozone exposure on plant growth. How much ozone plants actually take up will depend on local humidity and their stage of growth.

ALTHOUGH THE EFFECTS of ozone at ground level have turned out to be somewhat less in Europe than previously supposed, they nevertheless remain considerable. High concentrations in the summer of 1994 are estimated to have reduced the wheat harvest by 12 per cent, corresponding to an economic loss of about 1.5 billion euros.

Since 1996 the accepted method of measuring the extent of the damage to crops caused by ozone has been to note total harmful exposure during the three months from May to July. To be considered harmful, exposure must have been more than 40 ppb (parts per billion) as an hourly average for at least 3000 so-called ppb-hours. The method is known as AOT40, where AOT stands for the accumulated exposure over a certain threshold, and 40 that the threshold value is 40 ppb.

The damage will not only depend however on exposure during these three months. The humidity of air and soil are also important factors. During dry periods the plants close their stomata, thus lessening the uptake of ozone. Much depends also on the stage of their life cycle at which plants are exposed, since sensitivity will vary.

In order to estimate the effects on crops more closely, scientists are now developing computer models that take humidity and phenology into consideration as well.

According to the usual method of calculation (AOT40), in the summer of 1994 the critical exposure for crops was exceeded over most of Europe. Values three times above the critical were noted in most parts of France, Belgium, Germany, and some of Italy.

The losses for wheat must have amounted to 13 million tons

But if consideration is also taken to soil humidity and phenology, the area of highest exposure moves further north.

The worst damage may then be expected in France, Belgium, the Netherlands, Germany, and parts of Italy, while the effects will be less in the south of Europe. In southern France, for instance, wheat ripens so early that ozone levels in June and July will have no effect on the harvest. In Spain, Greece, and a great part of Italy the climate is so dry that the plants' uptake of ozone is limited, and so also the damage. Here however the fact that some of the crops are heavily irrigated has not been taken into account.

All told, the new estimates suggest that the harvest losses for wheat in Europe must have amounted to 13 million tons in 1994, and that would be about 1.5 billion euros. Although the average drop in yield was 12 per cent, the variations from country to country were considerable. The highest harvest losses caused by ozone, 30 per cent, occurred in Belgium and Luxembourg. There was a loss of 15-20 per cent in France, the Netherlands, and Germany. The greatest part of the total loss occurred however in France, where the wheat harvest was lowered by 6.7 million tons. The next to suffer most were the German farmers, who lost 3.7 million tons, as against less than a million tons in any of the other countries.

A comparison of the effects on five different kinds of crop in France in 1994 showed sugar-beet growers to have suffered the most, losing 16 per cent of their crop. Wheat came only next, with 10 per cent, despite it being the more sensitive of these two crops. The reason was that the growing period for sugar beet happened to coincide with high concentrations of ozone in June and July, when wheat had already attained full growth.

The authors of the report from which these figure have been taken are careful to point out that the concentrations of ozone were relatively high in Europe in 1994 (they vary with the weather from year to year), and also that that there is still a great uncertainty in the estimates. Researchers will now be trying to hone their methods, and also to see if they can find out how the natural flora (biodiversity) is being affected by ground-level ozone.

PER ELVINGSON

Air Pollution and Vegetation. UNECE ICP Vegetation Annual Report 1999/2000. Obtainable from CEH Bangor, University of Wales, Deiniol Rd, Bangor, Gwynedd LL57 2UP, United Kingdom. E-mail: gmi@ceh.ac.uk. See also http://icpvegetation.ceh.ac.uk.

NORTH AMERICA

Attacking the causes of smog

BY FINALIZING a draft agreement that aims to lift the smog that costs thousands of lives all over North America each year, Canada and the United States have pledged to step up their fight against air pollution.

The agreement, reached after eight months of discussions between Canadian and US officials, aims specifically at ground-level ozone in the eastern half of North America – the industrial heartlands of both countries.

The United States will reduce NOx emissions by 35 per cent by 2007, which implies a 70 per cent reduction of summertime emissions from power plants and major industrial sources. The aim is to reduce annual US emissions by 36 per cent by 2010.

The annual emission caps for Canada will, by 2007, be 39 kilotons of NOx from fossil-fuel power plants in southern Ontario and five kilotons of NOx in southern Quebec. Canada also plans to tighten its vehicle emission standards and bring them into line with those in the US. Canada estimates that the total NOx reductions in the Canadian transboundary region will be 44 per cent by 2010.

Both sides also pledged to cut emissions of volatile organic compounds (VOCs). When combined with nitrogen oxides in sunlight, these substances create ground-level ozone.

Official approval of the agreement, which also commits the two countries to ongoing pollution reduction, is expected to take place in Ottawa in early December.

Sources: Car Lines 2000-5, and Environment Canada, news release October 13, 2000.

HUNGARY

In the wake of change

While there has been a notable improvement in the state of the environment, much remains to be done if the country is to approach EU standards, not least as regards air quality in cities.

IN THE COURSE of the nineties Hungary underwent great political and economic changes, among which was the return to democracy together with the need to make preparations for membership of the European Union.

In its review of the Hungary's environmental performance OECD reports a substantial reduction of environmental pressures during this period. Emissions to air and water have come down, partly on account of the fall in industrial activity in the early nineties, partly because of the investments made in pollution control and some major legislative and institutional changes bearing on the environment.

Emissions of air pollutants nevertheless remain considerable. Those of sulphur dioxide are still high – despite a drop of 35 per cent between 1990 and 1997 – being three times greater than the OECD average per GDP unit. The emissions of nitrogen oxides per GDP unit are on the OECD average, but calculated per capita only half as great. Since 1992 they have however been on the rise, largely because of steadily increasing road traffic, which answers for 55 per cent of the emissions.

Between 1990 and 1997 the emissions of carbon dioxide decreased by 14 per cent. The per-capita emissions was lower than the OECD average for Europe, but markedly higher if calculated per unit of GDP.

The quality of the air in cities is not at all good – about half of their inhabitants being exposed to moderate or high levels of ambient air pollution. Here and there the situation has even become worse, largely on account of increased road traffic.

The OECD's recommendations include:

- ❏ Setting up institutions with more muscle for environmental protection, in order to achieve better planning of the necessary measures and better analysis of the problems, and enforce legislation and regulations at the national, regional, and local levels.
- ❏ Furthering adjustment towards EU regulatory standards, as for example by adopting the directive for large combustion plants and the EU standards for air quality.
- ❏ Continuance of efforts to improve energy efficiency in all respects.
- ❏ Cutting down subventions and enforcing the polluter-pays principle.

PER ELVINGSON

Environmental Performance Reviews: Hungary. OECD 2000. 198 pp. 200 francs. OECD Publications, 2, rue André-Pascal, 75775 Paris Cedex 16, France. Internet: www.oecd.org.

Continuing from our last issue, with its Special Section marking the Secretariat's twentieth anniversary, are here two further articles looking back over developments of the past two decades, one from the scientific and the other from the political point of view, together with more witnesses to the usefulness of our publications and activities in general.

It was the realization that acidification and the deaths of fish in Scandinavian freshwaters were due to long-range transboundary air pollution that set going scientific and political activity to attack the problem on a large scale.

TWENTY YEARS ON

The decisive role of research

SCIENTIFIC FINDINGS contributed largely to the setting up of the Convention on Long-Range Transboundary Air Pollution, and during its twenty years of existence scientific research, calculations, inventories, and computer modelling have underlain the work of the convention – all having helped to provide a scientific base for the development of strategies and arriving at agreements for dealing with air pollution.

In the following the main scientific results and discussions forming the background for the convention in 1979 and for the signing of the Gothenburg Protocol in 1999 will be discussed, with focus mainly on the atmospheric deposition of acidifying substances. While other pollutants, such as photochemical oxidants, have probably been the subject of just as much research, the development of policy for attacking air pollution has nevertheless hinged on acidification.

It was largely due to a Swedish scientist, Svante Odén, that acidification came, in 1967, to be recognized as an international problem in political circles.

Odén showed that the precipitation was becoming acidified on a wide scale, and that the results could already be seen in Sweden's lakes and streams. He laid the cause on the increasing emissions of air pollutants in Europe – a hypothesis that has since been confirmed in all important respects by later research. At first, however, his conclusions were met with scepticism. Air pollution was then regarded as a local problem for urban environments and industrial areas, which could be met by building high chimneys and so "diluting" the pollution by letting it out higher up in the air.

Actually several decades previously there had been an unexplained death of fish in Norwegian rivers, the reduced numbers of salmon being particularly worrying. The phenomenon had also been observed in Swedish waters, and Odén's findings provided the explanation. It became generally accepted that acidification was the cause. All those dead fish were taken as proof of what acidification could do, easily impressing both politicians and the public.

In view of the first world conference on the environment that was to be held in Stockholm in 1972, some Swedish scientists made a case study of acidification. In their report they not only described the effects, but also the necessary measures for combating it, and what that would be likely to cost. Theirs was the first attempt at a synthesis and evaluation of the whole problem. They also described what could happen if acid emissions were permitted to go on increasing, and gave the possibilities of containment as well as demonstrating the connection between in-

Continued overleaf

Continued from previous page
dustrial trends in Europe generally and the adverse effects on health and materials and the natural environment.

After the initial awakening to the problem, it had to be decided whether it really was of international scope. A project was consequently set going in 1971, under the auspices of the OECD, to make an inventory of the emissions of air pollutants, their concentrations in the atmosphere and depositions on land and water, and to develop a model for calculating their flows back and forth across borders and the way to apply it. Research had to be done to determine these movements and the connection between emissions and depositions. From the outcome presented in 1976 it was clearly evident that air pollutants were being carried across national borders, and that measures to deal with this problem would have to be instituted simultaneously by a number of countries if they were to be successful.

The reliability of the research was often questioned during the seventies. Now and then there was a heated debate in several countries as to the causes and effects of acidification, which continued until well into the eighties. In Britain the main contender was the Central Electricity Generating Board, which held on to its sceptical attitude regarding the causes of acidification until the middle of the decade. After that it did however become generally accepted that there was a connection between the European emissions of sulphur and the acidification discovered in Scandinavia.

A matter that was much debated from the very start was whether soil was becoming acidified or not. It was not until the middle of the eighties that evidence was produced to show that acidification of the soil had in fact been taking place since the beginning of the century as a result of atmospheric deposition. The first proof came from a study made in Sweden where the researchers had managed to reconstruct not only sampling plots but also the methods for testing and analysis that had been used in the 1920s. From this it emerged that the degree of acidification of forest soil in southern Sweden had markedly increased during the intervening fifty years.

Among the matters needing further research are the way the natural environment will recover from acidification and how long it will take. A roofed-over area of forest near Gårdsjön in West Sweden enables studies to be made of possible developments when acid depositions decline.

A main reason for the growing awareness that something would have to be done to check the emissions of sulphur and nitrogen oxides in Europe was the discovery of forest decline in the eighties – although opinion was strongly divided as to whether those emissions were the cause. The hypotheses that were put forth included everything from natural causes (climate change, insect attack, and what not) to damage arising from soil acidification and the direct effects of gaseous pollutants. Despite intensive research in the eighties, no clear explanation could be found, and the cause-effect connection is still largely unsolved. A number of ways in which air pollutants can affect the vitality of forest trees have nevertheless been proved.

A concept that has now become prominent is that of critical load

A concept that has now become prominent in the debate on acidification is that of critical load. It is not known who first minted the expression, but its international breakthrough came at a scientific workshop arranged by the Long-Range Transboundary Convention at Skokloster in Sweden in March 1988. Many scientists had been sceptical of the term, maintaining that it was impossible to determine the limits of what nature could withstand, that all additions of pollutant would give rise to stress in ecosystems, and that no one can define any clear point at which stress will be unacceptable. Many on the other hand saw the possibilities of using such an easily understood concept to provide a clear aim for action.

In the end scientists became agreed on definitions and preliminary values for critical load, and widespread research was then started in Europe with this concept as a basis. Methods and models for determining critical load were subsequently worked out, and places where it was being exceeded in Europe marked out. The use of this concept made it possible to quantify the environmental goals at which measures had to be aimed. The long-term aim came to be to ensure that the pollutant fallout over all European ecosystems would be less than the critical load.

The early eighties saw a revival of the analytic approach used in Sweden for the case study made for the UN environment conference in 1972. The instigator was the International Institute for a Applied Systems Analysis (IIASA), which by developing its RAINS computer model was able to estimate the effects of various scenarios concerning energy and the control of emissions on ecosystems. The aim was to show the consequences in the way of cost and environmental improvement of various changes in the volume of emissions.

Similar models were developed at Imperial College in London as well as at the York, England branch of the Stockholm Environment Institute.

These models were of great importance for the development of cost-effective strategies for action. The information they provided could be used for clearly defining the proposed measures and analyzing the effects of different strategies. In this way the most cost-effective ones could be chosen – in other words, those that would have the greatest effect at the least possible cost. The analyses made by RAINS served as a basis for the negotiations leading up to the sulphur protocol 1994. Models were subsequently developed to take in still more pollutants and still more effects in the run-up to the Convention's Gothenburg Protocol and the proposed EU directive for national ceilings on emissions.

What, then, of the future?

Now that the pollutant fallout is diminishing and the recovery of the environment is becoming ever more evident, it may seem reasonable to ask whether there is really a need for more research. Bringing down the emissions of air pollutants will however not alone suffice to solve the problem. In many places acidification has so emptied the soil of neutralizing substances that it will take unknown decades before it has recovered. There is not even a probability of a natural return to the conditions existing before the onset of industrialism. It will therefore be a matter of urgency to find out what recovery will involve and how it can be hastened.

For the concept of critical load, as hitherto defined and applied, the primary aim has been to protect ecosystems and human health from the effects of pollution. Should the aim instead be to attain a sustainable development, with ecosystems that can ensure both the provision of life's necessities and a diversity of species, critical load will probably have to be differently defined. It must be remembered that there are other possible approaches, and that other measures may be found necessary, according to what is thought desirable for the ecosystem.

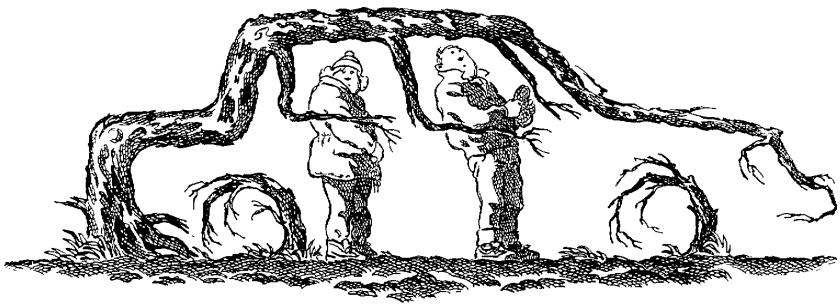
Preparations are now being made to include particles in future strategies for the protection of health. During the next few years research will in fact be largely taken up with the development of strategies for dealing with this problem, which will be worked into a revision of the Gothenburg Protocol and the EU directive for national ceilings on emissions that can be expected within a few years.

Limiting the concentrations of particles will not only affect direct emissions but also the emissions of gaseous pollutants that contribute to their formation in the air. These pollutants are already covered both in the protocol and the directive but the particle problem may bring further need for control.

Research knows no frontiers. Findings that have been found acceptable in one country can usually be made applicable in another. The recent dropping off of research into the matter of transboundary air pollution has unfortunately brought a decline of the total available expertise, making it no longer possible to cover the same wide field. If anything like a complete view of the situation is to be obtained, research on an international scale will have to be reintensified.

PERINGE GRENNFELT

Professor, scientific director, Swedish Environmental Research Institute.



© CLAUS ALBRECHTSEN

Kind words from readers

… explains it well

Acid News is outstanding as a magazine giving an overview of the relevant developments in the sphere of continental air pollution. And what is more, it explains this very complicated matter for people who are not specialists. This is no easy task, since it has become so very complicated. Acid deposition is not the only worry, eutrophication and ozone are related problems, while particulate matter and health issues are about to be added, and even climate change. Acid News manages to explain all this very well.

JOHAN SLIGGERS

Coordinator of acidification policy, Ministry of the Environment, Netherlands.

… broad view valuable

For Slovenia, which had major problems with air pollution in the 70s and 80s, Acid News was a very important source of environmental information and in this way helped in bringing about the considerable reduction of SO_2 emissions that occurred in the late 90s. The Swedish NGO's view on air pollution problems still is very relevant, not only as regards the scientific and technical background and matters concerning LRTAP and climate conventions, but also in the preparation and implementation of EU directives. Acid News is valuable for its broad view and independent expert input.

DUSAN HRCEK

Director, Hydrometeorological Institute, Ministry of the Environment and Spatial Planning, Slovenia.

… support vital

The activities of the Swedish NGO Secretariat on Acid Rain have been of importance all over Europe. Especially important is its information on air quality issues in Central and Eastern Europe, where support is vital to groups working in this field.

FERENC JOO

National Secretary, Hungarian Traffic Club.

… believed accurate

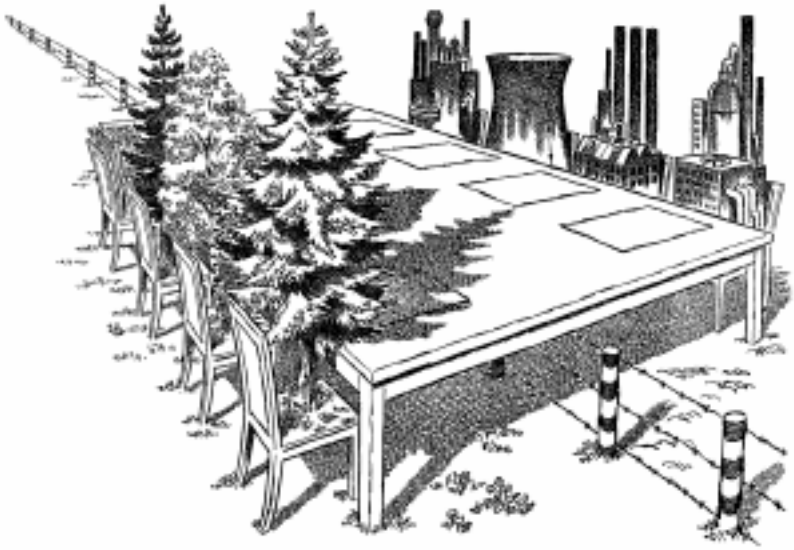
Many years ago one of the first precise and targeted awareness raising campaigns to reach me was that from the Swedish NGO Secretariat on Acid Rain. I believe the information supplied by the Secretariat to be very accurate and representative.

PRUDENCIO PERERA

Director for Environment Quality and Natural Resources, Environment Directorate, EU Commission.

Convention producing results

Despite its regional character, it may well provide a model for attacking similar problems elsewhere, either regionally or on a world scale.



© CLAUS ALBRECHTSEN

AS CONVENTIONS GO, even at twenty years the Convention on Long-Range Transboundary Air Pollution (CLRTAP) is a young convention. It has nevertheless already come to be regarded as a pioneering international instrument for the protection of the environment – paving the way for close cooperation between forty-six countries of the industrialized world for the solution of common environmental problems. Protocols arrived at under this convention are committing the signatories to take legally binding measures to deal with the chief air pollutants affecting health as well as the environment.

Despite its regional character, the convention may well provide a model for attacking similar problems elsewhere, either regionally or on a world scale, as now in the case of persistent organic pollutants (POPs). It has in any case already produced results by way of reduced pollution: since 1980 the European emissions of sulphur to the air have for instance become more than halved.

There was no certainty however of anything like this occurring when the convention was signed in 1979. Although there was already considerable scientific evidence that air pollutants were being borne over long distances, with serious effects on the environment, its coming about may have just as much been a result of high politics – since it was after the Helsinki conference in 1975 that the environment emerged as a suitable arena for cooperation across cold-war frontiers.

When the first sulphur protocol, calling for a 30-per-cent reduction, was signed in 1985, it was not so much fresh scientific revelations that caused politicians to act, as the pressure of public opinion on the continent arising from the disclosure of forest decline in Germany.

Proceeding to the year 1994, what was most striking about the second sulphur protocol, the negotiations for which were completed in that year, was the very little difference between the scenario presented by the researchers and the actual terms of the protocol. These developments are illustrative in several ways.

Firstly, the forces driving developments have varied from time to time. While scientific knowledge has always been requisite, it has not always alone sufficed to get countries to agree to make binding commitments. Knowledge based on research has nevertheless tended to gain steadily increased importance as a basis for agreement. And while consideration for the environment has all along been the main issue, effects on health have come more and more to enter the picture.

Result of close interplay between scientific work and policy making

Secondly, the press and other media have been central in spreading information and arousing public opinion, so forcing politicians to act. In this respect the need has gradually altered, the first necessity having been to explain the essentials for making a start; now after eight protocols have been rowed home, covering all the most polluting substances, the need has to be made clear for an active follow-up. It is a matter not only of effective implementation of the existing protocols, but also of their re-negotiation and tightening of their requirements, bearing in mind not only the necessity of protecting the environment and health but also the socio-economic considerations, such as the cost-effectiveness of further measures.

Two outstanding aspects of the convention have been its ability to provide innovative solutions and its innate dynamism. Both are the result of a close interplay between scientific work and policy making, as well as the introduction and use of the critical-loads approach. The decision taken in 1988 to make the concept of critical loads a pattern for policy making has turned out to have been highly prescient. The novelty has lain not least in enabling the development of procedures making it possible to arrive at projections and scenarios that are sufficiently robust to provide the basis for future international agreements.

Besides its purpose of reducing the effects of air pollution, the critical loads approach aims at finding a cost-effective distribution of emission reductions between the participating countries. Innovation also comes in here, both in respect of the development of computer models and the

formulation of the protocols. Policy making can be said to be circumscribed by the availability of scientific knowledge, but the possibility of using scientific knowledge to the outmost will depend to a great extent on the maintenance of close contacts between the scientific experts and the policy makers. With its form for cooperating and negotiation defined, the convention provides an effective framework for such interaction, while also allowing for national initiatives.

Since development has been steadily towards more complicated and more sophisticated protocols, this cooperation between scientists and policy makers has become ever more necessary for the success of the negotiating procedure. Scientists have come to know better where research is needed, and policy makers to understand how much science can tell them, and how attainable the results will be.

Continuous contacts among individuals on both sides have led to a feeling of great mutual respect, which in turn has brought dynamism to the development of new protocols. Research has consequently given marked impetus to the convention proceedings, as well as securing the necessary political support.

The 1999 Protocol to abate acidification, eutrophication, and ground-level ozone has marked a new phase in the work under the convention, the focus now tending to be on renegotiation and/or extension of the scope of existing protocols and ensuring of their implementation. Efforts to draw political attention have at the same time increased as well as demands for funding to maintain the network of science that has given the convention its particular strength.

But there are now fresh challenges to be faced, one being the need to adapt to a Europe that is no longer divided into East and West, and to a European Union that will gain in importance through the gradual inclusion of ever more countries, and have its own programs for dealing with air pollution. A high degree of harmonization in various respects, both political and technical, will be to the advantage of all parties.

Another challenge will come from the increasing globalization of the problem of air pollution – the realization that it is not simply regional. It will not be from pure altruism, either, if we share with other regions the knowledge and experience gained during twenty years of combating air pollution in the ECE region, which includes not only Europe but also North America. An exciting task for a lively twenty-year old.

JAN THOMPSON

Chairman of the Executive Body of the Convention.

© BURKI

More kind words

… relevant, saves time

Allow me first to say that I particularly appreciate receiving Acid News regularly. This newsletter provides a lot of relevant information and actually helps me to save time by offering this "collection" of news items. I have found that over the years Acid News has provided particularly important information from Eastern Europe, for instance on existing large power plants, and also on the available technologies for reducing emissions.

HARALD DOVLAND

Deputy Director General, Ministry of the Environment, Norway.

… correct, easily digestible

In the lengthy process towards agreements on the abatement of acid rain I always found particular strength, as secretary to the Executive Body of the Convention on Long Range Transboundary Air Pollution, in the well-founded and balanced contributions of the Swedish NGO Secretariat on Acid Rain, and I am convinced that progress in the negotiations was facilitated by its inputs, which I perceived as correct and easily digestible. The Secretariat proved to be a competent awareness-raising actor that provided solid knowledge to the policy-oriented negotiators at their numerous meetings and to the scientific experts.

LARS NORDBERG

Former Secretary to the Executive Body of the CLRTAP, Sweden.

… helps on policy process

I would underline the utility of your activities in the policy process and the capability to help the decision process by providing a different perspective to environmental problems to all interested actors. I wish to recognize the positive and useful work of the Secretariat. In particular I would underline the utility of the information provided by Acid News, both from the point of view of ability to influence and put pressure on policy makers in respect of relevant issues. The informational and other activities of the Secretariat helped on the European policy process and surely influenced the attitude of many countries.

GIOVANNI VIALETTO

ENEA, Air Pollution Section. Advisor to the Ministry of Environment, Italy.

Total in Europe unchanged

Improvements in northern Europe have been balanced by increases in the south.

SINCE 1978 the movements of air pollutants around Europe have been registered by EMEP, the European Monitoring and Evaluation Programme. The centre for coordination of the information from a network of stations all over Europe is in Oslo, Norway, where a highly advanced computer model has been developed for calculating the transboundary travel of pollutants.

The model contains data on the manner in which various substances become transformed in the atmosphere and the length of their stay there. The latest figures for each country's emissions are fed in and run together with meteorological data for the year in question. Having the pollutants traced from their source to the place of deposition makes it possible to see whether the countries are fulfilling the commitments they have made in international agreements and also whether the overall aims of such agreements are being met.

The latest report from the EMEP differs in some respects from its predecessors.

Data on emissions from shipping in the Mediterranean has now been included, and the monitoring area extended to take in the whole of Turkey. The Turkish emission figures have consequently increased four times for sulphur, and by a quarter for nitrogen oxides. Many countries have moreover sent in revised data for previous years. With some exceptions the differences are small, but both France and Spain have now reported higher figures for their emissions of ammonia, the one by 50 and the other by 20 per cent.

With the changes taken into account, the levels of the anthropogenic emissions of sulphur dioxide, nitrogen oxides, and ammonia in Europe turned out to be about the same as they were in the last of the years reported. The increases in southern Europe (Turkey and Mediterranean shipping) have made up for reductions elsewhere. Compared with 1990, in 1998 the overall emissions of these substances were 44, 21, and 15 per cent lower. Included here are emissions from ships in international trade, which are assumed to have remained unchanged since 1990. Country-by-country figures are given in Table 1 below. The degree of uncertainty is greatest for ammonia and lowest for sulphur.

Some natural emissions of sulphur do not appear in the table, although they affect depositions. These are emissions from volcanoes in Italy, producing 2 million tons of SO_2 a year, and emissions of dimethyl sulphide from bacteria in the sea, amounting to about 0.7 million tons.

Table 1. European emissions of sulphur dioxide, nitrogen oxides (calculated as NO_2), and ammonia. 1000 tons a year.

	Sulphur dioxide		Nitrogen oxides		Ammonia	
	1990	1998	1990	1998	1990	1998
Albania	*72*	*72*	*24*	*24*	*31*	*31*
Armenia	72	3	46	11	25	*25*
Austria	91	46	193	170	80	72
Belarus	637	190	285	164	*219*	*219*
Belgium	372	203	339	301	107	99
Bosnia & Herzeg.	480	*480*	*80*	*80*	*31*	*31*
Bulgaria	2008	1251	361	223	144	66
Croatia	180	90	88	76	37	23
Cyprus	46	49	18	22	*4*	*4*
Czech Republic	1876	443	742	413	156	80
Denmark	183	77	279	231	100	104
Estonia	252	110	68	46	*29*	*29*
Finland	260	90	300	252	38	38
France	1268	837	1877	1652	813	827
Georgia	248	33[3]	130	55[3]	*97*	*97*
Germany[b]	5321	1292	2709	1780	765	625
Greece	502	540	326	382	79	74
Hungary	1010	591	238	217	124	74
Iceland	24	27	26	28	*3*	*3*
Ireland	186	176	118	122	112	127
Italy	1651	1021[3]	1938	1685[3]	466	467[3]
Latvia	119	40	93	42	44	13
Lithuania	222	94	158	60	84	35
Luxembourg	15	4	23	17	7	7
FYR Macedonia	17	17[3]	*6*	6[3]	*17*	*17*
Moldova	265	32	100	22	49	25
Netherlands	202	113	580	441	226	177
Norway	53	30	219	224	23	27
Poland	3210	1897	1280	991	508	371
Portugal	343	334[2]	306	374[2]	98	97[2]
Romania	1311	912[1]	546	318[1]	300	221[1]
Russian Feder.[a]	4460	2208	3600	2488	1191	675
Slovak Republic	543	179	225	130	63	35
Slovenia	196	123	63	64	24	19
Spain	2049	1498[2]	1156	1194[2]	472	517[2]
Sweden	119	49	338	257	61	59
Switzerland	43	28	166	123	72	71
Turkey	833	1288	670	851	*321*	*321*
Ukraine	2782	1132[3]	1097	455[3]	*729*	*729*
United Kingdom	3737	1615	2788	1754	366	350
Yugoslavia	508	521	66	66	*90*	*90*
Baltic Sea	*228*	*228*	*352*	*352*	0	0
North Sea	*454*	*454*	*648*	*648*	0	0
Rem. NE Atlantic[a]	*901*	*901*	*1266*	*1266*	0	0
Mediterranean	*1189*	*1189*	*1639*	*1639*	0	0
Black Sea	*57*	*57*	*86*	*86*	0	0
Sum	40595	22564	27656	21802	8205	6971

Italics = No official figure, data drawn from open sources. [a] Part within the EMEP area of calculation. [b] Incl. East Germany in 1990 figures. [1] 1994 data. [2] 1996 data. [3] 1997 data.

Data for the emissions of non-methane volatile organic compounds are also given in the report, showing them to have fallen by about a quarter, from at least 26 million tons in 1990 to less than 20 million in 1998. As in the case of ammonia, however, the figures are relatively uncertain.

There have also been changes from previous years as regards the calculation of cross-border movements of pollutants. The grid squares on the maps now measure 50x50 kilometres instead of 150x150 as they did previously. But the modelling itself has also been improved in various respects, making it possible for instance to plot the effect of emissions from sources outside the EMEP area with greater certainty. The depositions of sulphur and nitrogen oxides from such sources amounted in 1998 to 14 and 23 per cent of the total for the EMEP area.

Tables 2-4 show the amounts of sulphur dioxide, nitrogen oxides, and ammonia crossing national frontiers. It should however be borne in mind that the weather will affect such transports differently from year to year, and that the figures can thus only be approximate.

By running data on critical load for acidification and eutrophication in the computer model an idea can be obtained of how much of the ecosystem area in each country was still getting more than the critical load in 1998, and how much the situation has changed since 1990.

As regards acidification the proportion of the area where the limit is being exceeded has on the whole shrunk, but in many of the countries of central and eastern Europe more than 40 per cent of the ecosystem area was still being subject to acid deposition above the critical load in 1998. In southern Europe the situation is better, with only 10 per cent of the ecosystem area suffering excess.

In most countries eutrophication seems to have got worse between 1990 and 1998. In 70 per cent of the countries the critical load was being exceeded on more than half of the ecosystem area. It was worst in central Europe, where the limit was being exceeded over the whole ecosystem area in several countries.

PER ELVINGSON

The information in the article, as well as that in the tables, has been taken from **Transboundary Acidification and Eutrophication in Europe**. EMEP Summary Report 2000, which is available from Meteorological Synthesizing Centre – West, Norwegian Meteorological Institute, P.O. Box 43-Blindern, N-0313 Oslo, Norway. See also www.emep.int.

Table 2. Sulphur budget for Europe 1998. Depositions of sulphur, 100 tons S a year.

Tables 2-4 appear in a separate file that can be downloaded from www.acidrain.org/acidnews.htm

How to read the tables

For country and area codes, see table opposite. To find the contribution from other countries to a certain country, follow the horizontal row starting from the relevant country code on the far left. To find the contributions from a certain country to other countries, follow the vertical column starting from that country's code at the top.

REM includes contributions to and from North Africa and Asian countries within the EMEP area. NAT is natural emissions from sea, VOL emissions from volcanoes (reported by Italy).

BIC, Boundary and Initial Conditions, signifies contribution from sources outside the EMEP area.

Table 3. Oxidized-nitrogen budget for Europe 1998. Depositions of nitrogen, 100 tons N a year.

Tables 2-4 appear in a separate file
that can be downloaded from
www.acidrain.org/acidnews.htm

Table 4. Reduced-nitrogen budget for Europe 1998. Depositions of nitrogen, 100 tons N a year.

Tables 2-4 appear in a separate file
that can be downloaded from
www.acidrain.org/acidnews.htm

More research on health effects

The Health Effects Institute, HEI, is an independent, nonprofit corporation to provide relevant science on the health effects of pollutants from motor vehicles and from other sources in the environment. Supported jointly by the US Environmental Protection Agency (EPA) and industry, HEI has funded and published numerous studies and research reports. Several of them are available free of charge on the HEI homepage: www.healtheffects.org.

A greater danger

Air pollution kills more people than road accidents each year in Europe. This is the main finding of a study that appeared in The Lancet medical journal in September.[1] It estimates that 6 per cent, more than 40,000 cases per year, of all deaths in the three countries studied – Austria, France and Switzerland – are attributable to particles in the air. Half of these are linked to pollution from traffic. The costs of treating illnesses associated with traffic pollution was put at 1.7 per cent of GDP across the three countries.

The study was commisioned by the WHO and its principal findings were presented in 1999 (see AN 3/99, p.15). It has since been subjected to the customary peer-review process before being published.

[1] **Public health impact of outdoor and traffic-related air pollution: A European Assessment**. The Lancet, Vol. 356, pp. 795-801. Available at www.thelancet.com/journal.

Ian Britton, http://freefoto.com

In London too

Londoners are more likely to die from traffic pollution than in a road accident, according to a new report. Experts have concluded that around 380 deaths a year can be linked to air pollution from traffic in the capital – which is 150 more than die in road accidents. The report, commissioned by the NHS Executive in London and backed by the Greater London Authority also concludes that transport-related pollution puts another 1,200 people in hospital every year. Minor respiratory problems caused by breathing in exhaust fumes could be affecting as many as half a million.

Reuters, October 12, 2000.

The report *On the move* can be found at www.doh.gov.uk/london/onthemove.pdf.

Zero emissions still required

It has been definitely restated by the California Air Resources Board that 10 per cent of the new cars sold in the state in 2003 will have to be non-polluting. Serious attempts had been made by some parties either to get this requirement scrapped or at least postponed.

The ruling on zero emission vehicles, passed in 1990, is deemed to have been highly effective in forcing on the development of vehicles driven electrically or by fuel cells. In terms of vehicles, 10 per cent would amount to 20,000 a year. Four other states – New York, Massachusetts, Maine, and Vermont – have moreover decided to follow California's example.

Further information: www.arb.ca.gov/msprog/zevprog/2000review/2000review.htm

To help clean the air in New Delhi

As from January 1 it will no longer be permitted to operate commercial transport vehicles that are more than twelve years old, and two-wheelers more than fifteen years old in the Indian capital. The ban follows an earlier Supreme Court directive which removed buses older than eight years old and auto-rickshaws more than ten years old from the city.

Delhi is the most polluted city in India, and is rated as the fourth most polluted city in the world. Of the three million vehicles registered in Delhi nearly two million are two-wheelers, according to the Central Pollution Control Board. And because of their two-stroke engines, these are currently amongst the most polluting vehicles, adding greatly to the hydrocarbon levels in the air.

ENS, September 25, 2000.

Recent publications

Acid Rain, Acid Snow (2000)

By John Slade. A personal consideration of the acidification problem from a North American viewpoint. 80 pp. $9.95. Published by Woodgate International, P.O. Box 190, Woodgate, New York 13494, USA.

EU Fuel and vehicle tax policy (2000)

By M. Fergusson and I. Skinner, Institute for European Environmental Policy, London. Examines taxes on fuels, vehicles and use of the infrastructure, and their possible contribution to an environmentally sustainable policy for transportation in the EU. Analyzes the various interests and processes underlying the development of tax policies at the European level, explaining the existing state of play, the problems caused by current arrangements, and the various obstacles to further greening of the taxation system for motor vehicles.

72 pp. Order No. 5084. Published by the Swedish Environment Protection Agency, 106 48 Stockholm, Sweden. E-mail: kundtjanst@environ.se. Also available at www.euroest.environ.se.

Transport Infrastructure Financing on European Level (2000)

By M. Viehhauser and C. Henriksson, Inregia AB, Stockholm. Gives a detailed description of the funds and loans for the transport infrastructure in the EU. Looks at the instruments employed in the planning process and the role they play in decision making. The environmental adaptation of the transport infrastructure could be improved, argue the authors, not least by a general employment of strategic environmental impact assessments.

169 pp. Report 5084. Available from the Swedish EPA, as above.

Integrating environment in transport policies (2000)

By O. Bina and J. Vingoe, Environmental Resources Management, London. Most EU member states are starting to engage in environmental integration in the transport sector, but the differences in approach are significant, according to this report, which compares developments in thirteen countries. It notes that moves towards the setting of tangible aims are proceeding slowly, and mostly concern air pollution.

60 pp. Report 5083. Available from the Swedish EPA, as above.

Underused resource

The five countries surrounding the North Sea – Germany, UK, Netherlands, Belgium, and Denmark – have an offshore wind resource that is three times their total electricity consumption, according to a study made for Greenpeace by the German Wind Energy Institute. "If one per cent a year of the offshore resources of these five North Sea countries were used to displace coal until 2012 (the end of the Kyoto Protocol First commitment period), the North Sea offshore resource alone could be saving 186 million tons a year in CO_2 emissions – equal to 10 per cent of their current CO_2 emission rates," notes Karl Mallon, Energy Analyst for Greenpeace.

Greenpeace is calling on the five North Sea countries to establish a licensing scheme to open up the offshore wind resource to private industry as a key part of their climate response strategy. It says offshore renewable energy is currently being held back by institutional barriers, red tape, and a lack of political will.

Further information: *North Sea Offshore Wind – A European Powerhouse*. Available at internet: www.greenpeace.org.

Ratings for environmental effect

A comparison of the environmental impact of the eight most important electricity-generating technologies made in a Spanish life-cycle assessment (LCA) shows the country's lignite-fired power stations to be the worst from the environmental point of view, getting far the worst marks (1735) for negative effect. Among renewables, mini-hydroelectric schemes score best at 5 points, with wind power close behind at 65 points. Nuclear power rates 672 points, while solar power generation fares relatively badly, scoring 461 points.

The LCA will put pressure on the central government to ensure a greater inclusion of environmental costs in the price structure of the electricity market before complete liberalization is introduced in 2007, according to ENDS Daily.

The study was made by Spain's Institute for Energy Saving and Diversification (IDAE), which is attached to the ministry of science and technology.

ENDS Daily, October 12, 2000.

Further information: IDAE, www.idae.es. The report *Impactos Ambientales de la Producción Eléctrica* available from biblioteca@idae.es

Price most important factor

Energy is being used more efficiently in the United States. The American Council for an Energy-Efficient Economy has ranked all of the fifty states and the District of Columbia for the amount of energy and emissions intensity as a unit of the nation's gross domestic product. New York, Hawaii, and California were the top three performers examined between 1970 and 1999, while Alaska and North Dakota came at the bottom of the rankings. The top states cut their energy use per capita by about 10-20 per cent during 1970-1997, while the worst states saw it rise by 30-90 per cent during the same period.

"While differences in energy prices have the strongest correlation to overall score, the top states have done more to promote energy efficiency than have the low-ranking states," said Toru Kubo, the report's co-author.

Reuters, September 20, 2000.

Tax not to blame

Europe's road freighting industry should accept that its economic problems stem from deep-seated economic factors rather than high fuel taxes, declared the German and British ministers of transport on November 5.

The joint statement followed protests against high fuel taxes that swept western Europe in September, leading to concessions by several governments. Germany has so far stood firm in its intention to continue raising fuel taxes above inflation under the government's program for ecological tax reform. The UK has also resisted the protesters demands, although some concessions are expected to emerge when the finance ministry unveils its first outline of next year's annual budget.

The European Commission has announced that tax concessions made by France, Belgium, the Netherlands and Italy are to be investigated to ensure that they comply with EU rules for state aid.

ENDS Daily, November 7, 2000.

Coming events

EU Environment Council. March 8, 2001.

World Sustainable Energy Day. Wels, Austria, February 28-March 2, 2001. Conference and exhibition. Organized by O.Oe. Energiesparverband, Landstraße 45, A-4020 Linz, Austria. Internet: www.energiesparverband.at.

EU Environment Council. June 7-8, 2001.

Second International Symposium on Air Quality Management at Urban, Regional and Global Scales. Istanbul, Turkey, September 25-28 2001. *Information*: Prof.S.Incecik, Istanbul Technical University, Department of Meteorology, Faculty of Aeronautics and Astronautics Maslak-Istanbul 80626 Turkey. Internet: http://atlas.cc.itu.edu.tr/~aqm2001

COP7 - Seventh Conference of the Parties to the UN Framework Convention on Climate Change. Marrakesh, Morocco, October 29-November 9, 2001.

Nitrogen. 2nd Conference. Potomac, Maryland, USA, October 14-18, 2001. Information: Rhonda Kranz, The Ecological Society of America, 1707 H Street, NW, Suite 400, Washington, DC 20006, USA. E-mail: nitrogen@esa.org. Internet: http://esa.sdsc.edu/n2001.

Electronic subscription?

Would you like to help us reduce expenses, and at the same time get Acid News sooner? We can offer electronic subscriptions free of charge.

Subscribers will receive an e-mail notifying them of publication and giving brief notices of the articles in the issue. By linking up to our homepage you can then either read the whole number on-line, or download it in pdf-format.

If you are interested, send an e-mail with your name and e-mail address to: per@acidrain.org.

You can, if you wish, continue to receive the printed version while at the same time subscribing electronically. Just let us know if you want both.