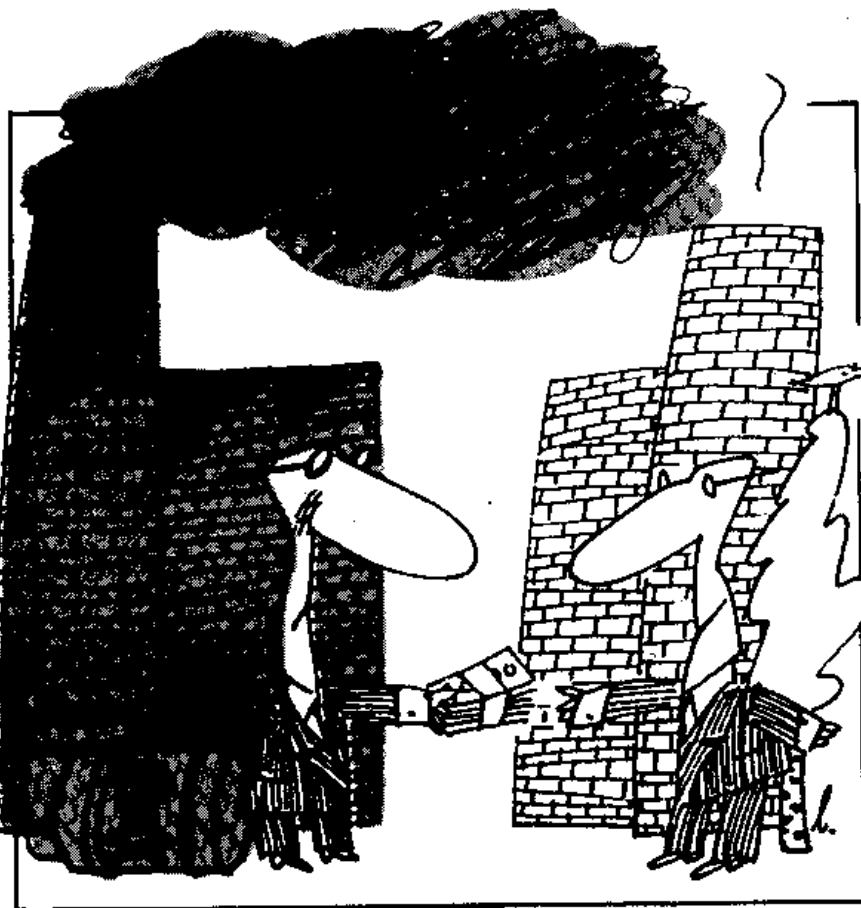


# Acid News



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NITROGEN OXIDES

## Emissions charge works well

THE CHARGE ON EMISSIONS of nitrogen oxides that has been in force for combustion plants in Sweden since 1992 has proved to be a really effective instrument for bringing down emissions. Only a few years after its introduction, emissions from the affected plants had become more than halved. The Swedish system is unique in that the money is returned almost in full to the payers, leaving no net income to the state.

This NO<sub>x</sub> charge is levied on all stationary plants for the production of energy, including those producing heat and electricity within industries – with the exception only where combustion is part of the process, as

in the case of plants for chemical recovery and preparation of the liquor in pulpmaking.

During the first few years the charge was paid for about 200 boilers and gas turbines with a total capacity of more than 10 megawatt (MW), producing 50 gigawatt-hours of useful energy per year. Then the lines were re-drawn, leaving no bottom limit for capacity after January 1, 1996, and in 1997 the limit for the production of useful energy was lowered to 25 GWh per year – thus making the charge applicable to ever smaller and ever more plants. By 1998 the number had almost doubled, to close on 400 units.

The charge is SEK 40 per kilogram of emitted NO<sub>x</sub> (equal to about 5 euro). Since however the total paid in (less the cost of central administration) is returned to the payers in proportion to their share of the total of useful energy that had been produced, there is no net cost to the payers as a bunch – and no net income to the state either.

This structuring of the system encourages payers to bring down their emissions of nitrogen oxides per unit of energy to the lowest possible level, thus making for a more efficient use of energy in the generating processes.

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

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### THE 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

# How long?

HOW MUCH LONGER are antiquated, inefficient, dirty coal-fired power plants to be tolerated in the European Union? The Commission had avoided including existing plants in the proposal put forward in 1998 for a revision of its directive for controlling emissions from large combustion plants, making it apply only to new ones – although its own analyses had shown that by the year 2010 85 per cent of the emissions of sulphur dioxide in the EU and 66 per cent of the nitrogen oxides will come from plants built before 1987 (see AN 1/99, p.9).

This did not pass unnoticed in the European Parliament, which voted for extending the directive to cover all existing LCPs, too, at its first reading in 1999. To give owners of existing plants time to adjust to the new requirements, it proposed a respite of five years. In other words, the requirements should not begin to apply until 2005. This respite could very well be used to reduce the demand for electricity in various ways, or to install new, much more efficient and cleaner units. Taking this second alternative would make it possible to close down a number of old plants, with consequent gain by way of eliminating much of the emissions of air pollutants that are damaging to health and the environment, but also of cutting down emissions of the chief greenhouse gas, carbon dioxide.

But these are not the only reasons why old plants fired with fossil fuels will need to be regulated. Another will be the gradual liberalizing of the European electricity market – one of the main aims of which is to give consumers lower prices. Doubtless a praiseworthy aim, which may however have an unfortunate side-effect: old plants spewing out pollutants may be kept in operation much longer than they would otherwise have been. That risk has been exposed, for instance, in a study by the consultant firm WEFA Energy,<sup>1</sup> published last year.

That study showed it to be cheaper, now and probably in future, to generate power in existing coal-fired plants than in combined-cycle gas turbine units fired with natural gas. The consultants therefore concluded that as a result of liberalization ex-

isting coal-fired plants will be an important constituent of the coming electricity generating mix in Europe. On the other hand they also point to the possibility of the role of coal becoming constrained just because of its effects on the environment – especially in view of the aim of the Kyoto protocol to reduce emissions of carbon dioxide.

There will be a risk, if everybody is hunting for a lower price for electricity, while it is increasingly being sold across frontiers, that there will be a kind of environmental dumping. Electricity from old, unregulated plants in Spain, Poland, Britain, and Greece, to mention a few, will out-compete electricity from modern, very efficient combined heat-and-power (CHP) plants, for instance, which can meet high environmental standards. Some consumers could, admittedly, in this way get their electricity cheaper, but only at the expense of the rest of us, who have to foot the bill for border-crossing air pollution – which not only we shall have to pay, but also our children and grandchildren.

A simple way to protect both health and the environment, while making for more level competition in a widening market for electricity, would be to apply environmental standards, either in the form of a tax on emissions or emission limit values, or both. Each plant would, as a basic principle, have as far as possible to bear its own costs to the environment. Although the proposal made by the European Parliament for emission limit values is certainly not radical, it could usefully serve as a first step. Modern technology, with or without a switch to cleaner fuels, could enable emissions to be brought down much lower. Even the standards proposed by the Parliament would however help to ensure that at least the oldest and dirtiest plants would be shut down. And those that were kept going would either have to be retrofitted for flue-gas cleaning or fired with cleaner fuel.

CHRISTER ÅGREN

<sup>1</sup> The role of coal in a liberalised power market in the period 1998 to 2020. WEFA Energy, 1999.



### **Swedish NOx charge**

*Continued from front page*

Those that succeed – bring down their emissions to a level lower than the national average – make a net gain, while those that carry on with relatively high emissions (higher than the average) land up with a cost.

The system is managed in Sweden by the Environmental Protection Agency (SEPA), which besides arranging the in and out payments also scrutinizes the emission figures that have to be handed in each year. The central administration costs amount to less than one half per cent of the total money involved.

The payers naturally have administration costs too, for instance in connection with their annual declarations. There is also the cost of monitoring the emissions. This is now done continuously for almost all boilers, and according to SEPA the annual cost is about SEK 80,000 for the average plant. Where the monitoring equipment can be made to serve several boilers at once, the cost per boiler naturally comes lower.

Although the charge system only became official in 1992, steps to reduce emissions of nitrogen oxides had actually started to be taken two years earlier, after the passing of a bill in Parliament in June 1990. Between 1990 and 1995 specific emissions from the affected plants dropped from an average of about 160 milligrams of NOx per megajoule (mg/MJ) of useful energy to 60 mg/MJ,<sup>1</sup> or by about 60 per cent. The total from all plants did not come down quite as much, however, the reduction being more like 50 per cent – since the total output of energy had in the meantime increased by almost a quarter. Then

**Money back for those companies that do better than the national average.**

in 1996 and 1997 a number of new plants, mostly with higher specific emissions, were brought into the system, with the result that specific emissions have on an average remained unchanged for the last three years.

The commonest method for reducing emissions has been either to adjust the combustion process so as to constrict nitrogen oxides, or otherwise alter the technology, for instance by installing low-NOx burners. Other measures include improving the efficiency of the the existing flue-gas cleaning, installing new such equipment, or switching fuel. In some cases the measures have actually led to a saving in costs, in other words they have been a pure gain for the company. The average cost of measures to reduce emissions as a result of the charge on NOx was, according to a study made for SEPA in 1996, SEK 7.5 (about 0.9 euro) per kilogram of NOx.

Measures to reduce emissions of nitrogen oxides have sometimes led to an increase of those of other air pollutants. Flue-gas cleaning can for instance cause the emissions of ammonia to increase, and improving the combustion process may lead to increased emissions of nitrous oxide and carbon monoxide. Undesirable side-effects of this kind could however be avoided by requirements to restrain emissions of these pollutants as well as of nitrogen oxides.

A couple of years ago the Agency made a rough estimate of the socio-economic advantage of NOx charging. The socio-economic worth of each kilogram of NOx that was eliminated was put at SEK 40. The actual cost of reducing one kilogram was estimated, in the light of experience with the charging system, to be about SEK 19 (split as follows: 7.5 for measures taken at the plant; 1.50 for monitoring; 0.35 for administration; and 10.00 for the emissions of other

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Proposing a strategy for attacking the climate problem the Commission has named emissions trading as a useful means of achieving EU aims.

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Review reveals a country deep in crisis, environmental as well as economic and institutional. Emissions have fallen but GDP still more.



## Sinner caught out

In the Swedish system with differentiated charges, owners who agree to run their ships on low-sulphur fuel obtain rebates on fairway and harbour dues.

Last year the Swedish Maritime Administration carried out checks on 150 of the 1300 vessels for which certificates had been sought and obtained to give the right to reduced charges. It turned out that three were using fuel oil with a sulphur content higher than the permissible. One was a big ferry belonging to the Stena Line, a company that has long boasted of an environmentally friendly attitude.

The three sinners now had their certificates withdrawn, and will have to start off again applying for a new one if they wish to obtain the rebates.

Source: Swedish Maritime Administration. Annual Report 1999.

## A clear winner

A competition arranged by the energy departments of nine EU countries for a refrigerator and freezer using the least electricity was won by Electrolux, which has designed a model taking only a third of the electricity normally needed for such equipment in Europe, or 219 kWh a year for the 193-litre refrigerator and 95-litre freezer. Mass-production of the combined refrigerator-freezer has already started.

Further information: [www.energy-plus.org](http://www.energy-plus.org).

## Not so car free

Car-free days in Italy have been more or less a bluff. Many cities said they were participating in the scheme only because they would otherwise have risked losing government grants. They have in any case made little effort to do anything.

This has come from Laura Radiconcini of the Italian environmentalist organization Amici della Terra, writing with reference to the optimistic report about car-free Sundays in Italy that appeared in the T&E Bulletin (and was reproduced in a shortened version in the last number of Acid News). She added among other things: "Rather than concentrate on Sundays, the challenge is to reduce traffic on workdays, but on this side the government has no proposals."

T&E Bulletin 86 and 87. Available in pdf format at [www.t-e.nu](http://www.t-e.nu).

# Now due to become a sulphur sensitive area

THE EU COUNTRIES have managed to persuade a majority within the International Maritime Organization (IMO) that the North Sea should be designated an "SOx Emission Control Area" in Annex VI of the MARPOL Convention. When traversing the area ships will henceforth have to run on bunker oil with a sulphur content of no more than 1.5 per cent. Otherwise the limit is 4.5 per cent.

The decision was made at the 44th session of IMO's Marine Environment Protection Committee early in March. The Baltic had been named a special area for sulphur in the autumn of 1997, when the Annex itself was adopted. See Acid News 4-5/97. But neither for the North Sea nor the Baltic will the limit be enforceable before the annex has been ratified by so many countries as to represent at least half of the world's tonnage.

So far, after two-and-a-half years, the only countries to ratify have been Sweden and Norway, representing no more than 4.83 per cent of world tonnage. Panama, commanding a whole 16.5 per cent, has however come out in favour of making the North Sea a sensitive area for sulphur, and the EU Commission

is urging all the EU member countries to ratify the annex without delay. Together with two of the countries that are candidates for membership, Cyprus and Malta, the EU countries control 20 per cent of world tonnage.

It is uncertain how emissions will be affected when the annex comes into force. The EU Commission has calculated, on the assumption that the average sulphur content of bunker oil is now 3-3.5 per cent, that the emissions of sulphur from ships in North Sea trade will be halved. But T&E, the European Federation for Transport and Environment, says that the average content of the fuel that is now used in the area is lower than that, being about 2.5 per cent. And if more countries start to apply differentiated harbour and fairway dues, which reward ships running on low-sulphur oil (see AN 4/99), the difference between the requirements of the annex and reality will be even less.

PER ELVINGSON

The protocol of the meeting of the MEPC can be found on internet: [www.imo.org/imo/meetings/mepc.htm](http://www.imo.org/imo/meetings/mepc.htm).

## Swedish NOx charge

*Continued from page 3*

air pollutants). There would thus be a socio-economic gain of SEK 21 for each kg of NOx that was eliminated.

So far the charge on NOx has, in the view of the Agency, well fulfilled its aim – of reducing emissions from stationary plants. It is however recognized that the system has certain limitations. While refunding the charge in relation to the output of useful energy certainly promotes a more efficient use of the fuel, it does not contribute to a more efficient use of energy. There is also a risk, if the charge should be allowed to remain unchanged for some time or not be extended to other classes of emitters,

that it will lose momentum – the average specific emissions will no longer continue to dwindle. As a means of counteracting that effect, the amount of the charge might be raised, or the system extended so as to embrace further industrial processes. The latter would however necessitate a change in the method of refunding.

CHRISTER ÅGREN

<sup>1</sup> The EU directive 88/609/EEC gives the limit values for emissions in milligrams of NOx per cubic metre (mg/m<sup>3</sup>). Emissions of 160 and 60 milligrams per megajoule (mg/MJ) of energy input would correspond, for plants burning coal or biofuels, to about 430 and 160 mg/m<sup>3</sup>. For plants fired with gas or oil it would be about 590 and 220 mg/m<sup>3</sup>.

# Debate on economic incentives

Better to institute regional systems than await global agreement

FROM THE POINT OF VIEW of effects on the environment, as a form of transportation shipping by sea can have great advantages. Provided its discharges to air and water are controlled. As regards emissions of air pollutants, that can be done either on a global scale, or through systems using incentives, which can be applied within a limited area. The latter is better, in that it can be put into place relatively quickly, as against global agreements.

Most of the delegates at the Green Shipping conference in Hamburg in February seemed to share this view. Arranged by the Department of Environment of the Free and Hanseatic City of Hamburg, this conference had drawn representatives of shipping businesses, harbour and environment authorities, mostly from countries bordering on the North Sea. Much of the discussion was about ways of constructing an incentive-based system, examples of existing systems being presented as well as ideas for alternatives.

The Swedish system, with differentiated fairway and harbour dues, was described by Stefan Lemieszewski of the Swedish Maritime Administration (see AN 4/99). In operation since 1998, it was claimed by Lemieszewski to have been distinctly successful. To give owners a still better incentive to run their ships on low-sulphur fuel oil, it is now proposed to raise the fairway dues slightly and so finance an increase in the rebate they get for using low-sulphur oil (the system has to be revenue neutral). Instead of SEK 0.90 per gross ton, the rebate would then be SEK 1.50. There are also plans for changing the scale of charging for nitrogen oxides, with a successive increase in the rebate down to 1.3 g per kWh (at present the full rebate is given for 2.0 grams). The aim is to bring down the emissions of sulphur and nitrogen oxides from shipping in Swedish waters by 75 per cent between 1998 and 2003. Lemieszewski thought that goal was within reach, while also pointing out that the incentive for shipowners to clean up

should be still greater if more countries were to introduce systems with differentiated charges.

The Norwegian system with a differentiated tonnage tax was described by Sveinung Oftedal of the Norwegian Ministry of Environment. This system takes in operational and accidental discharges as well as the



emissions of sulphur and nitrogen oxides. Oftedal emphasized the need for careful consideration of the aim of this kind of environmental indexing, remarking that the more criteria are put into it, the weaker will be the effect of each variable.

Most of those attending the conference seemed to think it only possible to differentiate harbour dues. But Per Kågeson, presenting a study<sup>1</sup> he had made for three European environmentalist organizations, was of a different opinion – considering that harbour dues alone, set by each port and negotiable in each case, to be insufficiently transparent. His proposal was that the EU should issue a directive to get both member and candidate countries to introduce fairway dues – so far only Sweden and Finland have done so among EU countries – and to differentiate them according to ships' emissions of sulphur and nitrogen oxides.

The environment department of the City of Hamburg presented a proposal of its own for a voluntary

system which it called Green Shipping. This was largely based on a study made especially for the conference by the Institute of Shipping Economics and Logistics.<sup>2</sup>

The city of Hamburg's idea was that harbour dues should be differentiated in such a way that vessels fulfilling IMO's minimum requirements would pay dues as now, while those with a better environmental performance would be given a rebate. Only so-called substandard ships, that fail to meet the IMO requirements, would have their dues raised. But seeing that the system is intended to remain revenue neutral for the ports, and the substandard ships are relatively few, there would be little room in this system for incentives (perhaps no more than 5-6 per cent off present harbour dues). Its effect in reducing emissions would seem likely to be small.

It now remains to be seen what will come of all this. The Hamburg authorities evidently intend to try and develop a scheme to which all ports could adhere. But more decisive may be what the EU Commission will propose. According to Article 7.3 in directive 1999/32/EC on a reduction in the sulphur content of liquid fuels the Commission is to "consider which measures should be taken to reduce the contribution to acidification of the combustion of marine fuels," and "if appropriate make a proposal by the end of 2000." It has in consequence employed a firm of consultants to evaluate ways of reducing the emissions of sulphur and nitrogen oxides from ships. But no outcome of that study has yet been presented.

PER ELVINGSON

<sup>1</sup> **Economic instruments for reducing emissions from sea transport.** Can be ordered free of charge from the Secretariat. Also available at [www.acidrain.org](http://www.acidrain.org) (choose the heading "Publications").

<sup>2</sup> **Incentive-based Instruments for Environmentally Acceptable Sea Transportation.** Bremen, January 2000. Institute of Shipping Economics and Logistics, Universitätsallee GW1 Block A, 28359 Bremen, Germany.

# European strategy outlined

Commission regards emissions trading as an important means of realizing EU aims.

THE EU COMMISSION warns that unless something is done, the Union's emissions of greenhouse gases will be likely to increase by 6-8 per cent between 1990 and 2008-2012, instead of declining by 8 per cent as envisaged in the Kyoto protocol. This came out in connection with its proposal for a strategy for attacking the climate problem.

The proposal comes in two parts: A proposal for a climate-change program for the Union,<sup>1</sup> and a green paper<sup>2</sup> in which the possibilities of cross-border trading of emission permits are examined.

It is intended that the EU countries shall be in a position to ratify the Kyoto protocol as soon as possible after the 6th Conference of the Parties to the Framework Convention on Climate Change (COP6) which is due to be held in the Netherlands in November.

If they are to do so in a convincing manner, it will be necessary, says the Commission, to have a legally binding document fixing the emission quotas that have been agreed among the member countries (see table). A plan for implementation will also be required.

"The picture is not rosy. We have to put in place additional measures at the Community level if we are to achieve what we promised at Kyoto. At the same time the Member States should not rely on the Community doing it all. Most of them are not on track for reaching their national targets," said Margot Wallström, environment commissioner, when presenting the proposals.

The Commission recalls recent advances such as the agreement made with the manufacturers to cut down the emissions of carbon dioxide from new cars, while deploring the fact that a proposal for a minimum level of energy taxes had been rejected by the member countries. It insists that such an arrangement would be of "utmost importance" within an overall strategy on climate change, urging the Council not to delay in adopting the proposal.

The way the strategy for carrying out the European Climate Change Programme is to be organized is also set forth in the communication – by the establishment of a multi-stakeholder consultative process, focused on the key areas for emission reduction, in which experts from the member countries, industry representatives, and environmentalist NGOs are to be involved as well as the various Commission services. A close time schedule will force the working groups to make their reports within twelve months. There is a list of the policies that might be applied, which will all have to be examined by the working groups.

It is primarily a matter of action in the energy, transportation, and industry sectors. As regards energy, the proposals include more use of renewables, augmentation of combined heat-and-power generation, capture of CO<sub>2</sub> and its disposal in underground reservoirs, as well as various schemes relating to energy efficiency, both in production and consumption. Among the proposals for

transportation are a revision of the present policy, a fiscal plan for reducing the emissions of CO<sub>2</sub> from private cars, and a European campaign to promote more fuel-efficient behaviour in driving.

The Commission regards emissions trading within the EU as an important means of realizing the Union's aims. It proposes making a start with it already in 2005, so that members can "learn by doing" before trading becomes general under the Kyoto protocol in 2008. The idea is that initially it should only be in emissions of carbon dioxide from large fixed point sources, which are the source of almost half of these emissions within the EU. The commissioners think the annual overall cost of the Kyoto undertakings can be cut from 9 to 7 billion euro if cross-border trading is allowed in the energy-generating sector and that of energy-intensive industry alone.

The idea of emissions trading is not altogether popular, and in the view of the Commission it is "a much misunderstood instrument." It has published the green paper in order to show how it regards trading, and to find out what others think on such matters as which sectors should first be included, the extent of the diversity that can be allowed between member countries, how the permitted emissions should be allocated among companies within the system, and how compatible it will be with other EU policies and measures. All interested parties are invited to report their views by September 15 at the latest.

PER ELVINGSON

<sup>1</sup> Communication from the Commission on EU policies and measures to reduce greenhouse gas emissions: Towards a European Climate Change Programme. COM (2000)88.

<sup>2</sup> Green Paper on greenhouse gas emissions trading within the European Union. COM (2000)87.

Both are available unabridged in all the EU languages: <http://europa.eu.int/comm/environment/docum>.

## Changes agreed for attainment of EU undertakings under the Kyoto protocol (in percent) – to reduce emissions of greenhouse gases by 8 per cent between 1990 and 2008/12.

	Burden sharing	Change 1990-1996
Austria	-13	+3
Belgium	-7.5	+12
Denmark	-21	+29
Finland	0	+11
France	0	0
Germany	-21	-11
Greece	+25	+7
Ireland	+13	+5
Italy	-6.5	+6
Luxembourg	-28	-43
Netherlands	-6	+12
Portugal	+27	+13
Sweden	+4	+11
Spain	+15	+3
U.K.	-12.5	-6



AGAIN ENERGY

## More efficient use and more renewables

PROPOSALS FOR cutting back EU emissions of greenhouse gases have of late been coming in quick succession from the Commission. Besides those described in the article opposite, there has been one for a plan of action for energy efficiency (April 26) and another for increasing the share of renewables in energy production (May 10).

The action plan has the stated aim of removing market barriers to the dispersion of energy-efficient technologies. There is said to be an economic potential for improving energy efficiency by more than 18 per cent over present practices. The aim must be to lower energy intensity by one percentage point a year beyond the current yearly baseline change. That would suffice, by 2010, to fulfill 40 per cent of the EU undertaking under the Kyoto protocol to reduce emissions of greenhouse gases. A further aim of the plan is to bring about, by 2010, a doubling of the share of cogeneration in the production of electricity, from 9 to 18 per cent.

There is however little in the way of measures in the plan. The Commission reiterates the need for a com-

mon minimum tax on energy products. It wants to see more attention paid to energy efficiency in, for example, EU regional policy, to see more goods labelled for electricity use, and in general to have more information given to the public. It also sets great hope on negotiated agreements with industry, which it says have hitherto worked successfully.

The proposed directive aimed at expanding the share of renewables in the energy field would have it doubled within the EU by 2010, from the present 6 to 12 per cent of the primary energy supply. Power generated from renewable sources should increase from 14 to 22 per cent. Targets are proposed for individual member countries, but are only indicative, not binding.

The controversial question as to how far the EU shall determine member countries' financial support of schemes to promote the production of energy from renewables is left aside for the moment, the Commission proposing that harmonized rules should wait for five years.

PER ELVINGSON

### NEWS IN BRIEF

#### Disfavouring cogeneration

The absence of any proposals for aiding the combined production of heat and power in the Commission's plan for a more efficient use of energy has been criticized by Cogen, the trade association for the European CHP producers. It says the Commission has merely made a repackaging of existing activities, with little that is radical or new. It finds this especially awkward at the time when electricity prices are not only low but falling.

This March the World Wide Fund for Nature, WWF, joined Cogen in issuing a warning to the effect that liberalization of the electricity market in Europe had brought down electricity prices so much as to undermine profitability for cogeneration. The fact that former utility monopolies were still dictating access to the grids was another cause of concern. According to WWF, the EU would have to set legally binding targets for at least a doubling of cogeneration and energy from renewable sources by 2010 if climate aims were to be achieved.

Further information: Stephan Singer, WWF European Climate and Energy Policy Unit. E-mail: [ssinger@wwfnet.org](mailto:ssinger@wwfnet.org).



#### Cost-effective to insulate

Forty per cent of the emissions of carbon dioxide in the EU comes from energy use in buildings – residential, commercial, and industrial. Taking steps to improve energy efficiency in them could reduce the emissions by 12 per cent, according to EuroACE, the European Alliance of Companies for Energy Efficiency in Buildings. In a study entitled *The Cost Implications of Energy Efficiency Measures in the Reduction of Carbon Dioxide Emissions from European Building Stock* it says that double glazing and insulation of walls and roofs of buildings can cut emissions more cost-effectively than a range of alternatives, including renewable energy development and increased use of cogeneration.

ENDS Daily, March 9, 2000.

## Not insignificant

There are now to be emission standards in the United States for small engine-powered equipment such as lawn mowers, weed trimmers and chain saws, previously unregulated sources. Under the new rules, which are to be phased in gradually, the emissions of hydrocarbons from these types of equipment will, according to the EPA, be reduced by 70 per cent from today's levels – which will mean 350,000 tons less per year.

Car Lines. No.2, March 2000.

## Diesel particulates and cancer

Particles in diesel exhausts are causing 125,000 individuals in the United States to fall ill from cancer sometime during their lifetime. The risk is greatest in urban conglomerations. The figure is that given by the State and Territorial Air Pollution Program Administrators and the Association of Local Air Pollution Control Officials. It is based on findings concerning the connection between exposure to diesel particulates and cancer reported in *Multiple Air Toxics Exposure Study II* from the South Coast Air Quality Management District in Los Angeles, California.

“The magnitude of the cancer threat from diesel particulates seals the overwhelmingly compelling case for aggressive and timely action by EPA for on road and nonroad diesel engines and their fuels,” writes Michael Walsh in the newsletter Car Lines, No.2, March 2000.

## IT for transportation

It is often thought that increased use of information technology in the transportation sector will bring gains to the environment. Such a possibility was referred to with enthusiasm by the transport ministers of the EU countries in last year's presentation of a strategy for integrating concern for the environment with transportation policy. But the faultiness of that presumption has now been exposed in a study made for the German Umweltbundesamt, showing road charging to be advantageous from the point of view of the environment, while IT-based systems that merely hasten the flow of traffic – say, by improving the functioning of traffic lights – can very well lead to worse problems in the way of air pollution and noise. This is because better flow will often increase the volume of traffic.

ENDS Daily, May 5, 2000.



CARBON DIOXIDE EMISSIONS

# Key to their reduction lies in power sector

Unless further measures are taken, EU emissions of greenhouse gases will increase about as much as they ought to be reduced.

IN KYOTO IN JAPAN IN 1997 the industrialized countries of the world agreed to take a tentative step towards reducing the global emissions of greenhouse gases. The EU countries for their part agreed on an overall reduction, to be shared out according to ability among them, of 8 per cent between 1990 and ca 2010 (average for the period 2008-12).

Up to 1996, the last year for which statistics are available, the EU as a whole had only managed to reduce its emissions of the three main greenhouse gases (carbon dioxide, methane, and nitrous oxide) by 1 per cent since 1990 – and that was only because of certain exceptional occurrences in two countries that were and are responsible for a large share of the emissions. In Germany emissions dropped by 11 per cent, largely as a result of industry being reconstructed and made more efficient in the former East Germany. In Britain they fell by 6 per cent following a switchover from coal to gas in the production of electricity. In almost all the other countries emissions had increased.

The likely development, if nothing further is done to check emissions of the chief greenhouse gas, carbon dioxide, has been examined in a report<sup>1</sup> made for the EU Commission that

was published at the end of last year. It has found that from 1995 to 2020 emissions can be expected to rise at a rate of 0.6 per cent a year. By 2010 that would amount to an increase (from 1990) of 7 per cent, and 14 per cent by 2020.

The reason for this rise will be the economic growth in the EU, which is estimated to run at 2.3 per cent a year from now up to 2010, and at 1.8 per cent thereafter. Primary energy consumption is expected to increase at a rate of 1 per cent a year to 2010, and 0.4 per cent from 2010 to 2020. The implied improvement in energy intensity can be expected to reach an annual rate of more than 1.5 per cent towards the end of the period covered by the report, due mainly to structural change on the demand side. Electricity prices are likely to have fallen, in 2010-2020, as a result of liberalization of the market to 15 per cent under current levels. There will be a continuous decrease of energy's share in companies' production costs and the total income for households.

Dependence on fossil fuels will remain high in the EU, staying at 80 per cent, with an increasing share of imports. Up to 2010 there will be an increasing use of natural gas at the expense of coal. After 2015, how-



ever, coal and lignite are expected to stage a comeback, in part because of an upward pressure on gas prices as a result of increased demand in East Asia, but also because a large number of nuclear plants will be due for scrapping.

Restructuring in the power sector is expected to be considerable. There will have to be an addition of about 300 GW, from 1990 to 2010, to the total EU capacity (from 570 to 870 GW), with a similar amount of new capacity to replace that of decommissioned plants. The number of new GTCC plants (gas turbine combined cycle) will probably have increased ten times during the same period, amounting by 2020 to almost 45 per cent of total installed capacity in the EU. This latter development will also explain the marked improvement in average efficiency that is to be expected in power production, from 34 to 45 per cent between 1995 and 2020. By 2020 new GTCC plants are likely to show an efficiency of 60 per cent – more than 50 per cent better than traditional coal and lignite plants.

The growth of power from renewables is likely to be modest but still noticeable. The expectation is for about 50 GW of new capacity by 2020.

In 2020 a third of the final energy demand will come from transportation, industry and households being next, each taking about 25 per cent. It is especially from transportation that the emissions of carbon dioxide are expected to increase during the period up to 2020. Put exactly, transportation will account for about two-thirds of the total increase.

That is the situation that can be expected as a result of decisions already taken. But three alternatives to the business-as-usual projections were also considered in the report.

1. Stabilization of the emissions of carbon dioxide at their 1990 level by 2010.
2. Reducing them by 3 per cent.
3. By 6 per cent.

The effects of each have been calculated by setting a ceiling on emissions and then letting a computer separate the necessary measures in a way that will make for the least possible cost to the EU as a whole, i.e. ignoring national and sectoral divisions. No consideration was taken, either, of the policy instruments that would be needed for bringing down

emissions.

It appeared from all three scenarios that reducing the *use* of energy would be more cost-effective than anything else. After 2020 however it would be more profitable to switch over to less carbon-intensive fuels.

Although new, energy-efficient techniques were given little place in those scenarios, sensitivity analyses show there to be a great potential for achieving reductions through such techniques. As it says in the report, “there may be a large scope for policy to promote best available technology.”

The key to reducing the EU’s emissions of greenhouse gases lies with electricity and steam generation. Most of the change in the carbon intensity of the EU energy system can be expected to occur in this sector, assuming the reduction of emission to be spread in the most cost-effective manner. It is calculated, for the period up to 2010, that almost 60 per cent of the whole required reduction of emissions will have to be achieved through adjustments in the generation of power and steam. And by 2020 it will have to be more than 70 per cent.

Taxes and constraints on carbon generally will naturally favour the use of renewables, since they will be more competitive when fossil fuels – coal, oil, and natural gas – have to bear the cost of their carbon content. By 2020 renewables would however only account for 8 percent of primary energy even according to the scenario with the stiffest limits on emissions. The EU target for 2010, with a 12-per-cent share for renewables, thus seems difficult of attainment, the reporters point out.

They have also calculated the cost of reducing emissions of CO<sub>2</sub> in the EU. They find that as a result of carbon constraints, the cost to the total energy system will increase by something like 25 to 55 billion euro per year – due to the increase in investment requirements, increased tariffs, etc. But, they note, “it is by no means a pure economic cost, since most of the additional funds will be recycled within the economy.”

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<sup>1</sup> **European Union Energy Outlook to 2020.** By P. Capros et al. Directorate General for Energy, European Commission, November 1999. ISBN 92-828-7533-4. Can be obtained from local outlets for EU publications.

## Cracking down

A federal authority in the United States has decided to prosecute yet more owners of old coal-fired power stations on the grounds that the plants had been unjustifiably modernized. Under the Clean Air Act plants built before 1977 do not need to install flue-gas cleaning, provided no major changes are made to increase capacity or extend the plant’s life (see AN 4/99, p.9).

While more power generators were thus being prosecuted, a settlement has been announced for one of the first cases that had been brought to court. The Florida company TECO Energy has agreed to pay a fine of \$3.5 million and either make arrangements for flue-gas cleaning or switch from coal to gas at several of its plants.

Car Lines, No.2, March 2000.



## Not enough

It will not be enough to lower the sulphur content of petrol and diesel fuel in the EU to a maximum of 50 ppm in 2005. It will have to come down below 10 ppm if the modern exhaust-cleaning equipment needed to reduce emissions of particles and nitrogen oxides is to function properly, according to a study made by the consultants FEV Aachen for VDA and the trade union IG Metall.

A coalition of car makers is pursuing the same line, having published in February a review of the World Fuels Charter, in which it says that a new sulphur-free fuel standard (meaning fuel with a maximum of 5-10 ppm sulphur) is needed for “markets with further advanced requirements for emissions control.”

The limits for sulphur in petrol and diesel fuel that have begun to apply in the EU as from this year are 150 and 350 ppm. In the United States the highest permissible content for petrol is now more than 300 ppm, but it is due to be lowered to 30 ppm in 2004. The limit for diesel is now 500 ppm, but the EPA has proposed lowering it to 15 ppm in 2006. The EU Commission has just started considering what standards are to succeed those that will come into force in the EU in 2005.

Car Lines, Nos.2 and 3 (March and May), 2000. ENDS Daily, April 28, 2000.

# Two bodies at loggerheads

AT ITS PLENARY SESSION on March 15 the European Parliament gave unreserved support to the Commission's proposal for national emission ceilings for four ozone-forming, acidifying, and eutrophying air pollutants. It voted down by an overwhelming majority (373 noes, 150 ayes) a move by its industry committee to substitute the much easier ceilings of the Gothenburg protocol (AN 1/00, pp.8-10) for the Commission's. Another proposal – from the conservative PPE group – to make the ceilings easier just for ammonia, was also rejected.

The members also gave support to the idea that the time by which the long-term aim – when there should be no exceeding of the critical loads – should be clearly stated in the directive. The year proposed for that was 2020. They wanted a similar statement to be included in the proposed directive for ground-level ozone – meaning that after 2020 there should be no exceeding anywhere of the levels that are critical both for human health and vegetation. A proposal from the PPE group for a softening of the ozone directive by doubling the number of days on which the WHO guide figure of 120 micrograms per cubic metre could be exceeded – from 20 to 40 days – was also voted down.

While the Parliament was thus giving very evident support to the Commission's proposals, and in some respects even calling for their tightening, little or no progress in dealing with these matters can be seen among the EU member countries as represented in the Council of Ministers. Portugal had repeatedly said it would be striving for a "common position" in this respect during its presidency, which should have meant at the latest during the meeting of the Council at the end of June. But in fact it has put the matter low on the agenda, and made very little effort to push for a solution. Portugal has moreover chosen not to bring up the Commission's proposal for a new daughter directive on ground-level ozone for discussion in the Council.



FRIMMERSDORF, GERMANY © CHRISTER ÅGREN

Several countries have been inconsistent that the matter of a compromise should be taken up simultaneously with the negotiations towards a common position in regard to the LCP directive (for large combustion

such plants would drop to a required level. Its weakness is that a number of old, often inefficient, and highly polluting plants could theoretically be kept going for many years in those member countries that impose no environmental requirements on such plants.

Arriving at a compromise that will permit the Council to take up common positions in regard to both directives (for NECs and LCPS) will undoubtedly require the matter to be given high priority in the Council. It will also require energetic assembling of data and the setting aside of adequate time for negotiation. Because that had not happened at the time of writing, it seems even more unlikely that any common position will emerge from the meeting of the Council on June 22-23.

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## *Controversy centres on emissions from existing plants*

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plants). The latter has now been lying on the Council's table for almost two years – since the summer of 1998. As reported many times in Acid News (latest in 1/00, p.13), controversy centres on whether and how the emissions from existing LCPs are to be regulated. The idea of making the directive include some sort of control for such plants is supported by most of the member countries. Several, too, are in favour in principle of the Parliament's desire to set specific emission limits for existing plants. That proposal has however met with strong opposition from Britain, Spain, and Greece.

Various compromise solutions have been discussed, one being to set some sort of bubble over each country's emissions from existing LCPs. That could admittedly lead to a guarantee that the total emissions from

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## **Away with old cars**

The UK Commission for Integrated Transport, an official advisory group, has proposed that the owners of old cars, unequipped with catalyzers, should receive up to £750 for scrapping their vehicles. It estimates that there are about 9.9 million such vehicles still on British roads. As an alternative to cash payments, it suggests giving owners season tickets on public transport.

The report, entitled *Pollution from Older Vehicles* is on internet: [www.cfit.gov.uk/pollution.rtf](http://www.cfit.gov.uk/pollution.rtf).

# Scrutinizing the Kyoto protocol

An examination has been made of its failings and merits, as well as analyses of the possible effects of differing interpretations.

THE UN Framework Convention on Climate Change was signed in Rio de Janeiro in 1992, and its first protocol five years later in Kyoto, Japan. Under the latter the industrialized countries undertook to have reduced their emissions of six greenhouse gases by 5 per cent as an average for the years 2008-12, from 1990 levels.

A lot of criticism has been directed at this protocol, not least on account of some flexible mechanisms that it allows, which could vitiate the countries undertakings. Moreover it provides no means of controlling emissions on a global scale – those of the developing countries are simply not covered.

This does not mean however that it will not be an effective instrument for tackling climate change. The authors of a voluminous study<sup>1</sup> even go so far as to conclude that “in several respects the Kyoto protocol may prove to be the most profound and important global agreement of the late twentieth century.”

Michael Grubb and his associates give a detailed account of “the road to Kyoto” – describing the attitudes initially taken by the various groups and reviewing the reports from the IPCC, the Intergovernmental Panel on Climate Change – together with an exposition of the strategies employed during the negotiations. They also present an extensive analysis of the terms of the protocol, and the possible effects of various ways of resolving differences in cases where there is as yet no agreement as to how certain passages are to be interpreted.

They note that in 1997 the emissions of the countries that had signed the protocol already lay 5 per cent under the 1990 figures – so that what they had agreed upon was in effect no more than a freezing of their emissions for the next fifteen years.

Among the unsolved matters are various so-called “flexible mechanisms,” including the possibility of trading in emission permits. There is

a danger, if such trading should be allowed to proceed unhibited, of even those reductions that have already been achieved being swallowed up. Generous allowances would on the other hand have the advantage of making it easier for most countries to ratify the protocol. Many have in fact been waiting for the matter of permit trading and other flexible mechanisms to be cleared up.

Grubb and associates urge the necessity of keeping in view the essential aim of the protocol when negotiating on details, saying: “Implementing the Kyoto Protocol without reference to long-term goals and trajectories would be like inviting the Treasuries to print money without any conception of inflation.”

They also consider a number of other pressing matters, such as how to bring the emissions from the developing countries into the general scheme. They regard it as unlikely however that failure in that respect would cause the whole program to collapse, observing “With so much invested, so much at stake, and so much more to do, there is no turning back.” They look on the protocol as a first step on the way to a truly global undertaking.

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**The Kyoto Protocol. A Guide and Assessment.** By Michael Grubb with Christiaan Vrolijk and Duncan Brack. 342 pp. Published by Royal Institute of International Affairs and Earthscan Publications Ltd, 1999.



## Special offer

Earthscan Publications are offering the report to readers of Acid News at a special price of £16.00, postage and packaging included, as against the ordinary bookshop price of £18.95. Make reference to Acid News 2/00 and send your order to Earthscan, attn. Nim Morthy, 120 Pentonville Road, London NI 9JN, England. Fax +44-171 278 1142. E-mail: nmorthy@earthscan.co.uk.

## Recent publications

**Environmental signals 2000. European Environment Agency regular indicator report (2000)**

The first in a series of regular indicator-based reports produced by the European Environment Agency. Its aim is to use environmental indicators to report on progress in a number of policy areas. It also starts to assess the reasons behind the rate of progress made in some of the main areas of environmental policy.

108 pp. Published by European Environment Agency, Kongens Nytorv 6, 1050 Copenhagen K, Denmark. Tel. +45 33 36 71 00. E-mail: eea@eea.eu.int. Internet: www.eea.eu.int. Available from all national outlets for EU publications. Can also be downloaded in pdf format from the Agency’s website (free of charge).

**Are we moving in the right direction? Indicators on transport and environment integration in the EU (2000)**

The first output of the the Transport and Environment Reporting Mechanism (TERM), set up by the Commission and the European Environment Agency at the suggestion of the joint Transport and Environment Council to gauge progress of integration policies in the transport sector.

Obtainable as above.

**Media Source Directory: A Journalist’s Guide to Environmental Contacts in Central and Eastern Europe (1999)**

Guide listing more than 1000 experts by country, with specialities and sectors (academic, business, government or NGO). Issued by the Media Information Service of the Regional Environmental Center for Central and Eastern Europe. Fax: +36 26 311-294. E-mail: info@rec.org. Also available via internet: www.rec.org/REC/Databases/Media/Media.html.

**Transboundary air pollution. The profit potential of further reductions (2000)**

An attempt to outline international progress in the field of transboundary air pollution, and to identify a number of areas where the data on which decisions are based can and should be improved. One of the conclusions is that it will be both possible and profitable to reduce emissions much more than so far decided.

16 pp. Available from the Swedish Environmental Protection Agency, Customer Services, 106 48 Stockholm, Sweden. E-mail: kundtjanst@environ.se.

# More widespread than thought

When nitrogen compounds are also taken into account, besides those of sulphur, there will be a likelihood of these problems occurring far from the most industrialized parts of the world.

THE COMPOSITION and circulation of gases in the atmosphere is becoming ever more affected by human activities – with additions of sulphur and nitrogen causing the acidification and eutrophication of soil and water. Acidification was seen to be a widespread problem in Europe and North America some thirty years ago. It is now well documented and international agreements have been made with the aim of cutting back emissions of the substances that cause it.

The possibility of trouble with acidification has of late been noted in other parts of the world as well. In the identification of problem areas, attention has however tended to focus on sulphur only, little or no regard being taken to depositions of nitrogen. Until now, when an attempt to describe the whole situation has been made in a study for UNEP, the United Nations environmental program, and the Netherlands Ministry of Housing, Spatial Planning and the Environment. Here the emissions and depositions of the three main acidifiers – sulphur dioxide, nitrogen oxides, and ammonia – the world over are set forth, together with the ecosystems' sensitivity to acidification and eutrophication and the parts of the world where the risks are overhanging.

## Emissions of sulphur and nitrogen

In 1990 world emissions of sulphur dioxide amounted to 148 million tons, or 74 million tons in terms of pure sulphur. Ships plying in international trade were responsible for 5 million tons of that total. About 80 per cent of the emissions from land came from the burning of fossil fuels and most of the rest from industrial processes. About 20 per cent originated in East Asia, and 15 per cent each from western Europe and the United States. About 10 per cent was from the former Soviet Union.

Emissions of nitrogen compounds

in the form of nitrogen oxides and ammonia are said to have been 44 and 54 million tons in 1990, expressed as pure nitrogen. The figure for oxidized nitrogen includes 13 million tons that were natural emissions from the soil. The anthropogenic emissions of nitrogen oxides came mainly from power generating and manufacturing industry, although the burning of biomass was also responsible for a considerable amount. There are however great differences between regions as regards the main sources of emissions. About 85 per cent of the emissions of reduced nitrogen (ammonia) is attributable to farming, and 13 per cent to the burning of biomass.

## Global emissions likely to increase

In order to pinpoint areas that may eventually be in danger of being affected, the authors set up a scenario for the likely development of emissions from 1992 up to 2015, taking as a starting point the business-as-usual scenario for coming energy use made by the IPCC, Intergovernmental Panel on Climate Change, early in the 1990s (IS92a), but adjusted so as to accord with plans subsequently made for reducing emissions.

As a result of international agreements the emissions of sulphur dioxide were expected to have declined by 20 per cent between 1992 and 2015, and those of nitrogen oxides by 10 per cent in Europe and North America. In fact however the reductions are likely to be much greater.

**Table 1. Anthropogenic emissions in 2015 as shown by projections made for the study. Difference compared with 1990 (index = 1).**

Region	SO <sub>2</sub>	NO <sub>x</sub>	NH <sub>3</sub>
USA + Europe	0.79	0.90	–
Rest of the world	1.31	1.17	–
Total world	1.03	1.13	1.19

The discrepancy can partly be explained by the fact that the calculations were made before adoption of the Gothenburg protocol in December last year.

Elsewhere the emissions both of sulphur and nitrogen oxides are thought likely to increase by about a third. That means that their global totals will rise by 3 and 13 per cent up to 2015. Increased stock farming and greater use of fertilizers will lead to an increase of 19 per cent in the emissions of ammonia. See Table 1.

## Areas at risk from acidification

Forecasts of acid depositions will not suffice for ringing in areas at risk from acidification, one reason being the varying ability of the soils to neutralize acid fallout. Some mapping has been done, but not without having to make a good number of assumptions. To get around the difficulty, the authors of the study have made three maps showing the areas at risk on the assumption of depositions for 1992, but a) with an average sensitivity, and b) and c) 50 per cent greater or 50 per cent less sensitivity.

In effect the three maps largely coincide. The critical loads turn out to be exceeded in just about the same places, although to varying degree. The situation is worst in Europe, North America, and China, but bad too in eastern South America and West Africa. It is also problematic in some other parts of Asia, such as the region around Norilsk in Siberia, where the local emissions are very great.

In contrast to previous maps of this kind, where only sulphur depositions had been taken into account, these, which also take in nitrogen, suggest that acidification can occur in ecosystems far from the heavily industrialized parts of the world. The projections for 2015 show some slight improvement for Europe and the United States, but an increased



risk for some parts of East Asia and eastern South America. See Table 2.

#### At risk from eutrophication

There have previously been no surveys of ecosystems' sensitivity to nitrogen additions on a world scale. The authors have filled out existing data on various ecosystems with assumptions as to a certain amount of

accord between sensitivity and climate – dry, cold climates making for high sensitivity, and their opposites for low sensitivity. In this case, too, the authors hedge against uncertainty by setting critical limits with a wide margin.

The most sensitive ecosystems were found to be in northern Canada, Scandinavia, and North Russia, but

also here and there in South America and Africa.

Medium estimates of the critical loads showed that in 1992 the limit for nitrogen was exceeded in 11 per cent of the world's ecosystems (with a variation between 7 and 18 per cent, depending on a low or high estimate of sensitivity). Besides revealing the grave state of affairs in the more densely populated parts of Europe and the United States, as well as on the Indian subcontinent and in China, the maps show there to be areas clearly at risk even in thinly populated places, in South America and Africa, but also in northern Canada and Russia.

According to the projections for 2015 the situation will remain largely unchanged in most of the industrialized world, while there will be some spreading of the areas at risk from eutrophication in the developing countries.

#### Transports of nitrogen to the sea via rivers

The results of computer modelling are also given in the study to show how inorganic nitrogen is being transported to coastal waters via the rivers. Here, too, airborne depositions account for an appreciable part of the total, amounting to 18 per cent by global reckoning. But by far the largest part – 58 per cent – comes in the form of fertilizers, both organic and synthetic, followed by human sewage, 24 per cent. Flows are greatest in Europe and South and East Asia, mostly because of the intensity of agricultural production in those areas and population densities.

#### Much uncertainty

An aim of the study, besides that of identifying areas at risk, was to reveal gaps in knowledge and the degree of uncertainty that prevails. It is emphasized that the results only give an idea of the trends, and that in a number of respects more research will be needed. This applies especially to areas at risk.

PER ELVINGSON

**Global assessment of acidification and eutrophication of natural ecosystems.** By Lex Bouwman and Detlef van Vuuren. UNEP/RIVM, 1999. UNEP/DEIA&EW/TR.99-6. RIVM 402001012.

The full report is available in pdf format at [www.rivm.nl/env/int/geo](http://www.rivm.nl/env/int/geo).

**Table 2. Per cent of natural and semi-natural ecosystems exposed to risk of acidification and eutrophication.<sup>1</sup>**

Region	Acidification 1992	Acidification 2015	Eutrophication 1992	Eutrophication 2015	Ecosystem most affected
Canada	15	14	5	6	Temperate forests
USA	24	23	21	22	Temperate forests
South America	14	19	12	14	Forests, <sup>2</sup> savannahs
Western Africa	14	16	16	17	Savannahs
Eastern Africa	3	4	8	9	Savannahs
Southern Africa	6	9	4	4	Savannahs
OECD Europe	38	31	32	32	Temperate forests
Eastern Europe	47	41	61	65	Temperate forests
Former USSR	6	6	9	12	Tundra and taiga
South Asia	6	9	32	36	Tropical forests
East Asia	16	17	19	232	Tropical forests
Southeast Asia	23	30	12	14	Tropical rainforests
Japan	11	16	6	9	Temperate forests
World	11	12	11	12	

<sup>1</sup> Where depositions are greater than the critical loads. Figures are based on medium assumptions of critical loads. In the study the margin of uncertainty is given in each case.

<sup>2</sup> Tropical seasonal dry forests.



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NON-ROAD MACHINES

## Share of emissions is increasing

Standards are insufficient, but technical solutions exist, may often be cost-effective.

ALL SORTS OF moveable and non-road machines are the source of a considerable part of the total emissions of air pollutants. In Sweden, according to a recent study by the Environmental Protection Agency,<sup>1</sup> they contribute 20 per cent of the nitrogen oxides (NO<sub>x</sub>), 7 per cent of the volatile organic compounds (VOCs), between 4 and 8 per cent of the particulate matter, and 6 per cent of the carbon dioxide that gets into the air. The share of each source is shown in the study, as well as the way emissions are likely to develop up to the year 2020, and the technical means that are available for reducing emissions.

Among the types of equipment that are chiefly responsible for all this are farm tractors, earth-moving equip-

ment, lift trucks, forestry and other off-road machines. Lighter types include lawn mowers, chain saws, and mobile compressors.

Some 170,000 of the tractors, 300,000 in all, are used in agriculture, together with 40,000 threshers. Forestry employs altogether about 10,000 machines in the form of harvesters and tractors. There are also the various types of movable equipment used at ports and in construction work, in mines and in industry. Of the country's 130,000 snowmobiles only 20 per cent are used for pleasure, the rest for work. With the exception of snowmobiles, which are usually powered with two-stroke petrol engines, almost all the equipment in question is diesel-driven.

The small kinds consist mainly of lawn mowers, of which there are about 1.2 million in Sweden, and chain saws. Most of the lawn mowers have four-stroke engines, the saws two-stroke.

A first step towards exhaust standards for new diesel engines in many types of mobile machinery in the EU came last year with directive 97/88/EC. A second step, which has already been decided upon, will come into force for such engines in stages between 2001 and 2004. The standards will only apply to diesel engines within the range of 18-560 kilowatt (kW). The directive does not include farm tractors and mobile generating equipment – the Commission having chosen to put the emission require-

ments for the former in another, existing directive, for type approval. Acceptance by the European Council is expected this year.

The Commission has moreover been enjoined to produce a proposal for a) a standard for petrol-driven machines, and b) for stricter requirements (a third step) for those with diesel engines, including mobile generators. The proposal should have been ready this year, but has been delayed – a principal reason being that the Commission is seeking to harmonize EU standards with those of the United States, where Phase 1 for small petrol-driven machines had been introduced in 1997. The EPA has recently put forward a proposal for a Phase 2, tightening up the requirements. For diesel engines, so-called Tier 1 emission standards were starting to be applied in 1996, followed by Tier 2 in 1999. Even more stringent Tier 3 standards are scheduled to come into force in 2005.

The requirements of steps 1 and 2 of the EU directive should result in a reduction of Sweden's emissions of nitrogen oxides from the machines in question by 40-45 per cent between 1995 and 2010. During that period emissions of VOCs would decline at the most by 10 per cent, and those of particles by 15-20 per cent. Since however the emissions from other main sources, such as road traffic, are expected to fall off more quickly, by 2010 the proportion from miscellaneous machinery is likely to be greater than it is today.

Among the measures for a still further reduction of the emissions from diesel-driven equipment that were analyzed in the study are the following:

**STRICTER EXHAUST STANDARDS.** It is assumed that the EU's step 3 will apply from 2008, and will halve the emissions of NOx and particles, and reduce those of VOCs by one third, compared with the effect of step 2. It is thought that the stricter requirements could be met simply by engine improvements – i.e. without after-treatment of the exhaust gases with particle traps or de-NOx catalyzers.

**ACCELERATED INTRODUCTION OF CLEANER EQUIPMENT.** It is assumed that procurement requirements and environmental classification, in combination with financial instruments, will have as a result that the

new machines sold in Sweden, including farm tractors, will fulfill the requirements of step 3 as early as 2006.

**PARTICLE TRAPS.** Retrofitting should make it possible to reduce particle emissions by 80-90 per cent or more. Particle traps combined with oxidizing catalyzers (CRT technique, Continuously Regenerating Trap) would in addition reduce the emissions of VOCs by about 80 per cent.

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*Advisable for all  
to make a careful  
analysis of emissions*

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**OXIDIZING CATALYZERS.** Fitted to diesel engines they can reduce VOCs by more than 80 per cent, as well as cutting down emissions of carbon monoxide.

**PARTICLE TRAPS PLUS EGR.** Retrofitting of EGR (Exhaust Gas Recirculation) can more than halve NOx emissions. Adding CRT (see above) would in addition reduce the emissions of VOCs by more than 70 per cent and those of particulate matter by about 85 per cent.

Conceivable measures for petrol engines that were also examined included:

**EXHAUST-GAS CLEANING.** There is already an American standard, which could be applied in Europe – through an EU directive, environmental classification, procurement requirements, or voluntary agreements. It would bring emissions of VOCs down by 70 and of NOx by 10 per cent. It would in addition cut down fuel consumption, and so carbon-dioxide emissions, by up to 30 per cent.

**RETROFITTING OF CATALYZERS.** It is estimated that this could halve both VOC and CO emissions from existing petrol-driven equipment, such as lawn mowers.

**SWITCHING TO ELECTRIC PROPULSION.** Could be accelerated, for lawn mowers, etc., through procurement requirements and environmental classification.

The study gives estimates both of the cost and the likely effect of the various measures in reducing emissions. It is said that by combining them as indicated above, the emissions of nitrogen oxides, VOCs and particulates could be reduced by up

to 60 per cent between 1995 and 2010, and further to 80 per cent by 2020. There should be a concurrent reduction of fuel consumption by about 20 per cent, and thus also of CO<sub>2</sub> emissions. He who made the study is however less optimistic, considering that NOx emissions can be reduced by no more than 50 per cent by 2010 and 60 per cent by 2020, VOCs by 35 and 60 per cent, and particles 45 and 70 per cent.

What in particular emerges from the study is that the emissions from these types of equipment, especially of NOx and VOCs, really are considerable, being put for the EU countries, for instance, at 7 per cent of their total emissions of nitrogen oxides. Since several countries have failed to report any emissions from these sources at all, that figure is most probably an underestimate.

It is also evident that the relative share of the emissions from such equipment is increasing – the reason being that the matter has long been overlooked. It should be noted, too, that some of the proposed measures for remedying the situation, such as the fitting of catalyzers, will mean that the improved fuels that are now coming into use in the EU for road vehicles will also have to be made obligatory for the types of equipment that are the subject of the Swedish study.

It turns out that several of the proposed measures would be highly cost-effective – in the sense that the cost per kilogram of pollutant that is eliminated would be low compared with that for many of the measures that have either been adopted or are under consideration for dealing with emissions from other sources. Some of the measures proposed in the study would also have the side-effect of reducing emissions of the chief greenhouse gas, carbon dioxide. It would therefore be advisable for all countries that are striving to bring down emissions of air pollutants in a cost-effective manner to make a careful analysis of their emissions from mobile equipment, and develop strategies for dealing with them, followed by action.

**CHRISTER ÅGREN**

<sup>1</sup> **Arbetsmaskiner – Utsläpp och förslag till tekniska åtgärder.** (Swedish only.) By Kjell Karlsson. Report 6001. Order from Naturvårdsverket, Kundtjänst, 106 48 Stockholm, Sweden. E-mail: kundtjanst@environ.se.

# Uncertainties as to effects

The computer models used to estimate the effect of reduced emissions of acidifying substances appear to give a much too optimistic picture of the coming situation in respect of the environment.

ALTHOUGH marking a step forward, the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone, now known as the Gothenburg protocol, inevitably has its deficiencies, among them being the uncertainty as to its effects on the environment.

According to the underlying calculations, it is expected to bring about a reduction, between 1990 and 2010, of the European emissions of sulphur dioxide by 63 per cent. Those of nitrogen oxides and volatile organic compounds should come down by 40, and of ammonia by 17 per cent.

That of course is all to the good. The question is just: What will be the actual effects?

Here uncertainty reigns, as in the case of all the calculations basing the protocol. As regards forest soils, the consequences have been studied in a project called *Coupling of CORINAIR*

*data to cost-effective emission reduction strategies based on critical thresholds*, funded by the EU.<sup>1</sup> Although the Swedish data base for critical loads was that used in the calculations, the methods that were developed for this project can easily be adapted for use in any country or region.

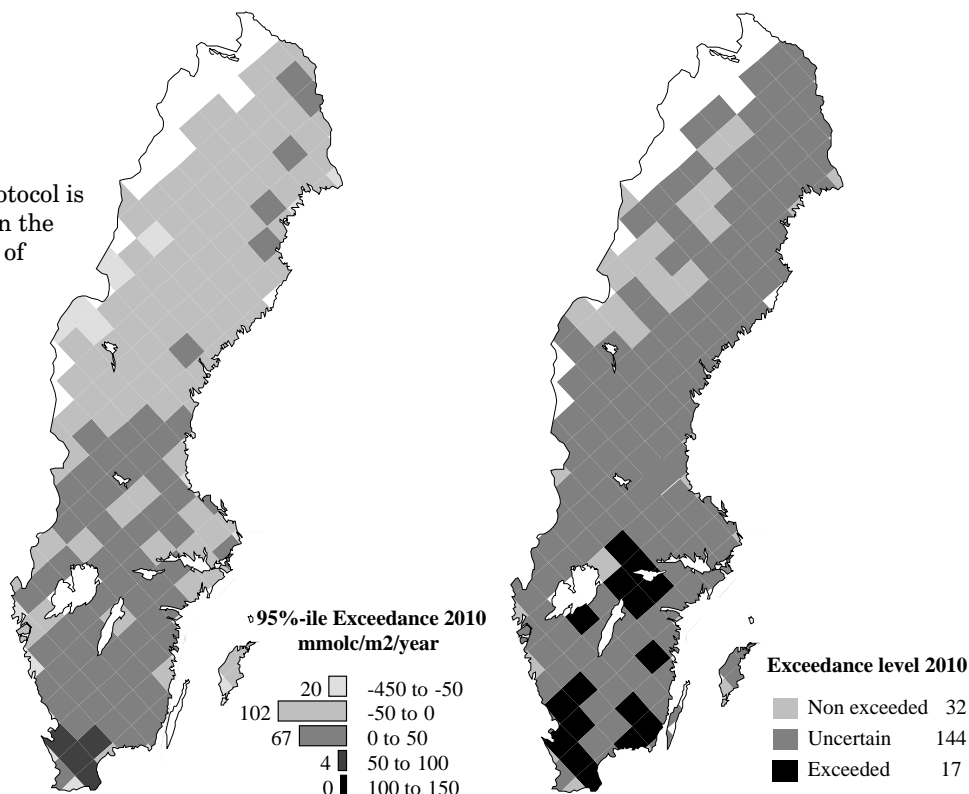
In the assessment, all the uncertain input parameters in the way of depositions, nutrient uptake, mineralogy, soil densities, soil moisture, etc. were run in the PROFILE computer model. Since the degree of uncertainty was more difficult to estimate in the case of some parameters than of others, they were each treated slightly differently.<sup>2</sup> National rather than European estimates were used for depositions, since they were available for individual sites as well as ecosystems. The model was run 1200 times for each site, each time with a slightly different input.<sup>3</sup>

It turned out that when the results were aggregated for Sweden, the depositions of sulphur and nitrogen would, when calculated in accordance with the protocol, in 2010 be smaller than the critical load for acidification in 122 of the 193 grid cells (50x50 km) into which the country is divided for monitoring purposes. But if the uncertainties are taken into account, only 32 of the 193 grid squares are projected to receive depositions below the critical load. Thus, leaving aside the element of uncertainty results in a gross overestimate of the protective effect of the protocol.

Assessments of sensitivity were also made in order to see how different input parameters would affect the uncertainty in the calculations of critical load and the extent to which the loads would be exceeded. These assessments showed that in southern Sweden uncertainty in regard to depositions was largely responsible

**Left.** If the 1999 Gothenburg protocol is implemented and uncertainties in the calculations are ignored, 122 out of 192 grid squares in Sweden are projected to receive a deposition below the critical load in 2010.

**Right.** If uncertainties are included in the calculation, the critical loads and the extent to which they will be exceeded becomes uncertain. The number of grid squares that with reasonable certainty will receive depositions below the critical load decreases to 32.





for the uncertainty concerning the exceeding of critical loads. And that is a part of the country where depositions are relatively high. In the north, where they are lower, uncertainty as to soil characteristics was a more important factor.

It should be borne in mind that in its present form the critical loads concept ignores all the temporal aspects. The fact that a site is now receiving a deposition below the critical load does not mean that recovery will automatically take place in the course of the next hundred years. Moreover, as the soil recovers from acidification, its pool of exchangeable base cations will increase, thus reducing leaching and leading to a severe retardation in the recovery of the stream waters from acidification.

Thus the Gothenburg protocol fails to yield solutions for all the problems it sets out to address. It does on the other hand provide an opportunity for testing our understanding of the processes that are involved. Modelling projections show it to lead to recovery in at least some areas. If funding should allow monitoring to continue for another decade, the data so obtained could be used to validate and perhaps improve the models used within the Convention on Long-Range Transboundary Air Pollution.

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<sup>1</sup> Alveteg, M, Barkman, A and Sverdrup, H. 2000. **Integrated Environmental Assessment Modelling—Uncertainty in Critical Load Assessments.** Final Report of the Swedish Subproject, EU/LIFE project. Reports in ecology and environmental engineering 2000:1. Available on internet through <http://www2.chemeng.lth.se>.

<sup>2</sup> Triangular distributions were used for parameters for which the uncertainty could easily be determined and rectangular distributions were used for parameters for which the uncertainty was more difficult to estimate. In a rectangular distribution all values within the uncertainty range are equally probably, whereas in a triangular distribution extreme values are less probable than values close to the best estimate.

<sup>3</sup> Detailed results at single-site level as well as on an aggregated level (50x50 km and 150x150 km) are also available on the internet address above.

## PARTICLES I

# Doubts refuted

WHEN THE US Environmental Protection Agency proposed air-quality standards for fine particles in 1997, a large grouping of industrial interests opposed them on the grounds that they were based on inadequate scientific evidence. The matter was brought before the Court of Appeals, which found the standards to be unconstitutional. It is now under consideration by the Supreme Court, and in the meantime measures to control high concentrations of particulates have been dropped.

The studies of which the industrial groups were especially critical were two concerning the long-term effects of exposure to particulate air pollution on mortality (Dockery et al. 1993 and Pope et al. 1995) and the National Morbidity, Mortality and Air Pollution Study, dealing with short-term effects.

The first two were subjected to an extensive sensitivity analysis using

alternative statistical methods, with consideration given to potential confounders. Their basic data was also scrutinized. This re-analysis by independent investigators validated the original studies, confirming that they were sound science. Re-analysis of the study of short-term effects also showed the original conclusions to be scientifically sound.

The results of these re-analyses were presented at the annual conference of the Health Effects Institute last April. This institute is a non-profit organization that funds and oversees research on the effects on health of pollution from automobiles and other sources. It is jointly funded by industry and the EPA.

The above is an extract from a report on the conference written by Deborah Sheiman Shprentz for the American environmentalist NGO Atmospherix.

## PARTICLES II

# Social costs high

THE NORWEGIAN Pollution Control Authority has found that long-term exposure to small particles (PM<sub>10</sub>) can be the cause of more than 2000 deaths a year in Norway. This finding is the outcome of a combination of scientifically confirmed studies of the connection between exposure to airborne particles, and its effects on health, mainly from the US, and of measurements and estimates of concentrations in Norwegian urban areas. The estimate of 2000 deaths assumes that the connection found between dose and response will also apply in cases of low exposure. In other words there will be no threshold effects.

The study is part of a larger Norwegian project to work out the socio-economic cost of various air pollutants. As regards particulates, the annual cost – assuming no threshold effects – is estimated to lie between NOK 10 and 28 billion (1.2 to 3.4 billion euro). Of this sum NOK 4 to 11 billion can be related to Norwegian emissions. Thus more than half of the cost is due to the effects

of other countries emissions.

The marginal cost of emitting one kilogram of PM<sub>10</sub> is said to lie between NOK 400 and 4000 (depending among other things on the size of the community where the emissions occur). Translated to the cost of a litre of motor fuel, that would correspond to NOK 1 to 10 per litre of diesel oil. The aggregate of Norwegian taxes on diesel, excluding value added, comes to just over NOK 4 per litre. The small-scale burning of wood for heating also gives rise to considerable emissions of PM<sub>10</sub>. For that the marginal cost is put at NOK 300-3500 per kg of particulate, which would correspond to NOK 3-35 per kg of wood.

While being careful to point out the considerable uncertainty relating to the estimates, the writers of the study insist that even with a low estimate of the costs, the socio-economic ones turn out to be great – something to which attention will have to be given when measures that will affect air quality are under consideration.

**PER ELVINGSON**

# The place of NGOs, then and now

Internationalizing their activity will seemingly be the next step, writes Andrew Tickle

IN MOST FORMER socialist countries, severe – though often only localized – damage to the environment (air, waters, forests, food chains etc.) was a common feature of Marxist-Leninist related policies that did not escape the notice of the public or informed scientists, including nature conservationists.

These latter groups had largely been left alone by the communist authorities and as such, had organized structures that had been denied to other groups critical of government policies. Their criticisms, aired both internally and abroad, plus the poor state of the environment, did much to add to the loss of legitimacy suffered by political leaders in the late 1980s.

When communist power finally broke down in 1989 and 1990, green activists were prominent in the new governments either as politicians or advisers. It was expected from there on that environmental policy would be a central concern in the new democracies, and that pressures to keep it there would be exerted increasingly by citizens and NGOs as part of a rapidly burgeoning civil society. In addition, the process of “returning to Europe” and more global integration would allow for the diffusion of more advanced environmental policies and technologies.

Now, ten years on, we are in a reasonable position to assess progress towards such goals. In some respects, the role of environmental NGOs in policy decisions is a useful “litmus test” of progress. Despite auspicious beginnings in the early 1990s, and the inflow of considerable foreign aid and know-how, environmental NGOs have not established themselves as significant political players in many central and east European countries. For many, of course, this is not their intention, and those that have focused on local, discrete project-based issues have often fared best. But, in general, three major problems affect NGO effectiveness in post-communist countries.

Firstly, resources are poor, both as regards finances and an appropriate skills base. These two problems are obviously related. Without money, NGOs cannot become more professional, and without professional fundraising, resources remain restricted. This is revealing itself currently as foreign donors and agencies are beginning to re-direct what were always likely to be short-term aid programs away from the region. Unfortunately, too much of this help during the

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*Perhaps too much  
was expected  
ten years ago*

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1990s had been project-based rather than focusing on capacity-building for the future.

Secondly, post-1990 national politics often have a strong authoritarian hangover from the communist past and inclusive, participative policy-making is rare indeed (as it is in western Europe). Thus far, NGOs have often been excluded from consultation and, at worst, have even become the targets (once again!) for secret police surveillance.

Finally, national priorities are thought to be elsewhere. Governments have their minds on “higher things” (joining NATO, the EU, the WTO, etc) and the public at large is understandably more concerned at rising prices, lack of jobs, and the increasing disparity between rich and poor. It is no surprise therefore that they have little patience with giving time or money to environmental causes, no matter how worthy they might be.

However, to some extent, this paints too black a picture. Few environmental NGOs in the region have desires to turn themselves into a slick, multinational lobbying operations. Furthermore, some real successes have been achieved in the region, for

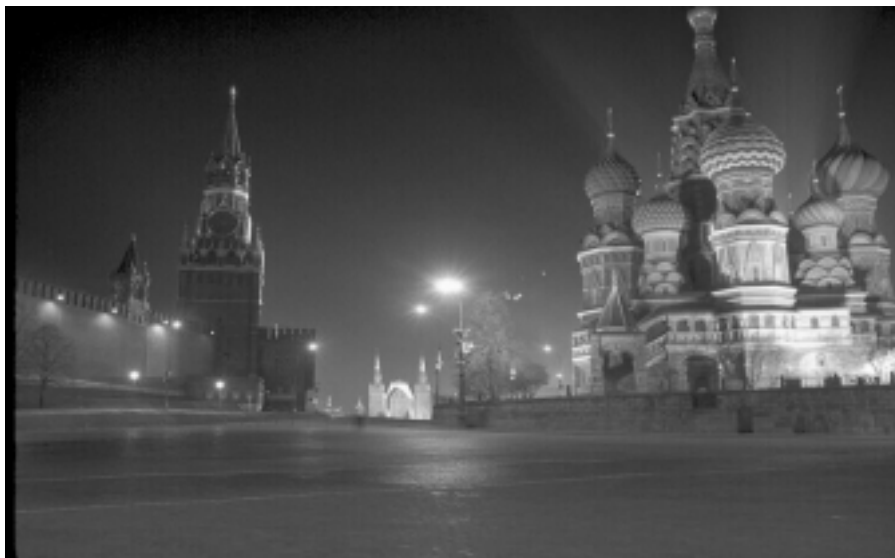
example in relation to the rescinding of multilateral development bank monies for nuclear projects in the Czech Republic and Slovakia. Less organized forms of environmental protest have also fared well, particularly at the grass-roots level.

Perhaps too much was expected ten years ago. Since then a complex process of re-building political and social institutions has been in progress, and clearly NGOs have had a hard fight to get their voice heard and their concerns raised in the general political tumult. Not surprisingly they have focused most of their attention on national issues and – probably correctly – largely neglected international dimensions. This seems sensible, given both the scale of problems within many countries and the need for self-legitimation with both publics and politicians. For some countries and some issues, international dimensions are however becoming unavoidable, especially given the increasing shift in environmental decision-making to supra-national institutions such as the European Union and the United Nations. Such internationalization of NGO activity is seemingly the next step as the new “global” century dawns. A key question is whether central and east European environmental NGOs are ready for it.

ANDREW TICKLE

Andrew Tickle lectures in environmental policy at the University of London. He is also member of the board of directors of Greenpeace in the Czech Republic. Two years ago he published a book,<sup>1</sup> together with Ian Welsh of Cardiff University, Wales, examining the role of central and eastern European environmentalist groups during and following the breakdown of communism.

<sup>1</sup> **Environment and Society in Eastern Europe.** Edited by Andrew Tickle and Ian Welsh (with a foreword by Václav Havel). Paperback, £14.99. ISBN 0-582-22763-1. Available from Longman, Edinburgh Gate, Harlow, CM20 2JE, UK. Internet: [www.awl-he.com](http://www.awl-he.com).



RUSSIA

## The state of the environment

Although emissions of air pollutants have dropped considerably in the last ten years, the decrease has actually been less than that for industrial output and the economy in general.

LAST YEAR'S REVIEW by the OECD of environmental performance in the Russian Federation reveals a country deep in crisis, environmental as well as economic and institutional.

As regards the environment, the OECD refers to a number of policy reforms that were presented during the first half of the nineties with the idea of developing a more open and market-orientated economy following the collapse of the Soviet Union in 1991. It was to be a matter among other things of extending the use of economic instruments, decentralizing and devolving policy implementation, and expanding public information and participation.

The OECD reporters quickly note however that the implementation of these reforms is running up against a number of severe problems, largely due to the general socio-economic decline, inflation (undermining the effect of economic instruments), budgetary shortages, and cuts in civil service staff. Environmental matters have also had a low priority at the federal level – especially since 1996, when the office of environment minister was abolished.

Coming on top of the previous Russian favouring of energy and re-

source-intensive activities, the current institutional and economic problems have meant that the environment is in dire straits, giving cause for criticism in almost all respects.

Although the emissions of air pollutants have dropped since 1990 – by 37 per cent for carbon dioxide and sulphur dioxide, 34 per cent for particulate matter, 29 per cent for nitrogen oxides, and 25 per cent for volatile organic compounds – the decrease has been less than that for the GDP. A relative increase in the country's dependence on heavy industry has meant that the use of energy in relation to GDP has gone up, and is now

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### Infelicitous new move

As part of a reorganization of the country's central administration, Vladimir Putin, the new president, has decided to abolish the state committee for environmental protection, which had been set up when the environment ministry was dropped in 1996. The committee's responsibilities will now be taken over by the ministry of natural resources – a move that is viewed with concern both by environmentalists and the OECD.

ENDS Daily, May 23, 2000.

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three times greater than the average for all the European OECD countries (which now include Poland, Hungary, and the Czech Republic). Although the Russian emissions of carbon dioxide and sulphur dioxide are high in relation to the country's GDP, they nevertheless come out lower than the OECD average when calculated on a per-capita basis. In absolute terms they do however remain large – Russia coming third, after the United States and China, in the global listing of CO<sub>2</sub> emissions.

Emissions of air pollutants from traffic are still relatively small. The situation is however changing fast; car ownership for instance increased by 73 per cent between 1990 and 1996, albeit from a low figure. There is now one car for every ten Russians, as compared with one for every other German.

The local air quality is still very poor in many Russian cities, being the cause of greatly reduced life expectancy in black-spot areas. A third of all Russians are said to be living in places with high pollution peaks.

Besides exposing the state of the environment in Russia, the OECD has set up a list of proposed measures for dealing with the various problems that the country is facing – urging amongst other things stronger enforcement of environmental laws and a streamlining of the regulatory framework. The potential for improving energy efficiency is said to be very great, and many of the necessary investments would pay for themselves within a short time. A part of the problem is however the lack of capital.

The OECD reporters also think the polluter pays and the user pays principles should be employed to a greater extent, and energy price reforms carried out so as to make the price of energy correspond more closely to the real cost, thus making it more profitable to use energy more efficiently.

The review was made by the OECD Centre for Cooperation with Non-Members with the full support of the Russian authorities.

PER ELVINGSON

**OECD Environmental Performance Reviews: Russian Federation.** OECD 1999. 230 pp. 180 francs. Available in English and Russian. OECD Publications, 2, rue André-Pascal, 75775 Paris Cedex 16, France. Internet: [www.oecd.org](http://www.oecd.org).

# Vehicles and fuel

IN MAY the Environment Protection Agency in the United States made known its proposals, intended to take effect in 2007, for an emission standard for heavy-duty vehicles and one for the sulphur content of diesel fuel. Requirements for 2004 had already been presented last October.

The emission standard the Agency is proposing for particulate matter from heavy-duty engines will be 0.01 grams per brake horsepower-hour (g/bhp-h), to take full effect in the model year 2007. This will amount to a 90-per-cent improvement over the present standards. It will mean that all diesel-driven heavy vehicles will have to be equipped with particle traps, while petrol-driven vehicles will escape that necessity.

For nitrogen oxide and hydrocarbon emissions standards of 0.20 and 0.14 g/bhp-h are proposed, as against 4 and 1.3 g/bhp-h at present. These standards are proposed to be phased in gradually between 2007 and 2010 for diesel vehicles, but to apply full out in 2007 for petrol driven. The reason for this difference is that the necessary technology is considered to be already well developed for petrol engines but will need further work on the diesel side.

A marked cut is proposed for the sulphur content of the diesel fuel used in highway vehicles, from 500 to 15 ppm (parts per million). This is mainly because engines designed to meet the new emission standards will need fuel with a lower sulphur content if they are to function properly. Since the 2007 models of engines and vehicles will already be on

sale the year before, the new sulphur standard for fuel will apply from June 1, 2006.

The EPA calculates that the new standards will mean an increase of 3-4 cents per gallon in the price of diesel fuel, and \$1000-1600 per vehicle, depending on size. The average price of a heavy-duty truck is now \$150,000, and that of a bus \$250,000.



When fully implemented in 2030 the new program will, according to the EPA, bring a reduction of 2.8 million tons per year in the nation's emissions of nitrogen oxides. For non-methane hydrocarbons and particulate matter the annual reductions are calculated to be 305,000 and 110,000 tons.

Reuters news agency reports applause for the program from environmentalist and health groups, which say the new rules could be the most important thing the EPA will be doing this year to protect public health. The American Petroleum Institute on the other hand has called the proposals "extreme," saying they are an unrealistic move that could threaten the nation's energy supply.

The EPA is allowing a period of 90 days for comment on its proposals, its aim being that the program shall be adopted before the current administration's time in office comes to an end in January 2001.

PER ELVINGSON

Sources: *Car Lines*, No.3, May 2000. Reuters May 18, 2000.

The EPA's proposals can be seen in full on the web: [www.epa.gov/otaq/diesel.htm](http://www.epa.gov/otaq/diesel.htm).

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## Coming events

**WREC-2000.** Brighton, England, July 1-7, 2000. World Renewable Energy Congress. *Information:* Ali Sayigh, World Renewable Energy Network, 147 Hilmanton, Lower Early, Reading RG64 HN, England. E-mail: [asayigh@netcomuk.co.uk](mailto:asayigh@netcomuk.co.uk). Internet: [www.wrenuk.co.uk](http://www.wrenuk.co.uk)

**Working Group on Strategies and Review.** Convention on Long-Range Transboundary Air Pollution. Geneva, Switzerland, August 30-September 1, 2000.

**Solar Energy in Architecture and Urban Planning.** Bonn, Germany, September 12-15, 2000. *Information:* Eurosolar, Kaiser-Friedrich str. 11, 53113 Bonn, Germany. Internet: [www.eurosolar.org](http://www.eurosolar.org).

**16th Annual Mobile Sources/Clean Air Conference.** Steamboat Springs, Colorado, USA, September 19-22, 2000. Arranged by the National Center for Vehicle Emissions Control and Safety.

**Wind Power for the 21st Century.** Kassel, Germany, September 25-27, 2000. *Information:* German Wind Energy Promotion Association, FGW. Tel. +49-40-2780 9182. Internet: [www.wip-munich.de](http://www.wip-munich.de).

**2nd Euro Environment 2000 Conference on Industry and Environmental Performance.** Aalborg, Denmark, October 18-20, 2000. *Information:* Else Herfort, conference secretariat. Tel. +45-9935-5555. E-mail: [euro@akkc.dk](mailto:euro@akkc.dk)

**XIV IUAPPA Clean Air Conference.** Miraflores, Peru, November 26-30, 2000. *Information:* SPAGAL, P.O. Box 14, 0246 Lima 14, Peru. E-mail: [idefe@terra.com.pe](mailto:idefe@terra.com.pe).

**Sixth Conference of the Parties to the UN Framework Convention on Climate Change.** Hague, The Netherlands, November 13-24, 2000.

**China International Environment and Renewable Energy Conference and Exhibition.** Beijing, P. R. China. November 28-December 1, 2000. *Information:* Yong Zhang, tel. +86 10 65 157760. E-mail: [cisc@midwest.com.cn](mailto:cisc@midwest.com.cn).

**Executive Body for the Convention on Long-Range Transboundary Air Pollution.** Geneva, Switzerland, December 4-7, 2000.

**Acid Rain 2000: 6th International Conference on Acidic Deposition.** Tsukuba, Japan, December 10-16, 2000. *Inquiries:* Acid Rain 2000, c/o International Communication Specialists, Sabo Kaikan-bekkan, 2-7-4, Hirakawa-cho, Chiyodaku, Tokyo 102-8646, Japan. E-mail: [acid2000@ics-inc.co.jp](mailto:acid2000@ics-inc.co.jp).