

Acid News



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EMISSION CEILINGS

To get more at less cost

THERE IS NOW a study¹ showing the estimates of the cost for achievement of the interim targets of the proposed directive on national emission ceilings (NECs) to be too high. An alternative scenario to that used so far in the calculations would cut the figure by two-thirds. This would be in line with the results of analyses already made by the EU Commission to determine the effects of scenarios giving low CO₂ emissions. The annual costs were then 40-60 per cent lower. (For an account of the circumstances surrounding the NEC directive, see box on page 5.)

Opposition to the proposed directive has so far come mainly from certain industrial groups – especially those engaged in the production of electricity or otherwise involved, directly or indirectly, in the use of fos-

sil fuels, as well as from UNICE, the Union of Industrial and Employers' Confederations of Europe. Concern has also been voiced by some member states of the EU, mainly in southern Europe. Criticism has commonly focused on the supposed high costs of implementing the proposed NEC directive. Rarely, if ever, are any of those who are complaining willing to admit that the costs may be over-estimated.

The Commission had based its estimate of the cost of implementing the directive solely on "end-of-pipe" measures. Measures aimed at improving efficiency in energy production and transportation were not included, nor was fuel switching – despite the fact that some of them can reduce emissions at little or no cost. Moreover the energy scenario em-

ployed in the analysis stands in total contradiction to the commitments made by the EU and its member states in the Kyoto protocol for reducing emissions of the chief greenhouse gas, carbon dioxide. This is a matter of major importance, since the energy scenario largely determines the levels of the emissions of air pollutants generally, including sulphur dioxide and nitrogen oxides.

In the view of the three environmentalist organizations that have issued the new study, a major shortcoming of the Commission's work is the failure to develop and apply a more appropriate energy scenario – one that would better reflect the commitments of the Kyoto protocol. This was why these organizations commissioned a consultant to de-

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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.

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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

They've got it wrong

IN THE DEBATE on the EU Commission's proposed directive for national emission ceilings, the representatives of industry are insisting that the ceilings in the directive should be the same as those in the protocol that was signed in Göteborg at the end of last year. This view seems to be shared by some EU member countries, in particular in southern Europe. In this matter the industry is represented primarily by UNICE, the European industry and employers' association, but the same views are also being voiced by Eurelectric, for the European power interests.

The Göteborg protocol, the content of which is given on pages 8-9 of this issue, certainly marked a step forward, in that it made clear that international agreements could be made to rest on scientific grounds and in accordance with the critical-loads approach. But the emission reductions that the signatories undertook to make by 2010 were totally inadequate. In the case of some countries and some pollutants the ceilings were so liberal as to allow even higher emissions than would result from existing legislation. This applies especially to Portugal, which would allow its emissions of all four of the pollutants in the protocol to exceed those in the reference scenario. Finland would let NO_x and VOCs be higher, while toeing to the line of the reference scenario for SO₂ and ammonia.

The reason for these anomalies is that the ceilings of the protocol were in effect set by the signatories themselves, there having been no proper negotiation. In a great majority of cases the figures are an expression of what the countries believe their emissions will be in 2010 as a result of existing legislation. In other words, that was the end of their commitments.

In the Commission's proposal, the ceilings have been set after a careful analysis of the ways by which specified temporary objectives for ground-level ozone and acidification could be met at the lowest possible cost for the EU as a whole. So far little opposition has been voiced to these objectives – even by the coun-

tries that would like to have much higher ceilings – and they have the full support by the EU Parliament's environment committee.

But the industry representatives even question the effects the objectives would have, opining that the extra improvements that could be expected as a result of the proposed ceilings would be "very small, local, and their significance is very uncertain" (UNICE press release, December 1, 1999).

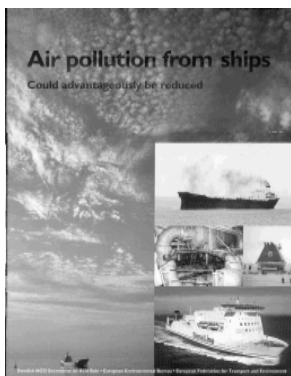
According to calculations recently published by the Dutch Environment Ministry (see p.9), the differences would however be very great. Some 4000 annual cases of premature mortality could for instance be avoided, and about 175,000 life-years saved annually if the Commission's proposal were adopted. In addition the damage from ground-level ozone, acidification, and eutrophication would be reduced by as much as one fourth.

It is also worth noting that the annual net benefits for the EU (estimated benefits minus estimated costs) would amount to euro 6.2 billion if emissions became reduced according to the protocol, while the same net benefits of reductions in line with the Commission's proposal are estimated to euro 24.5 billion. All the figures are for the year 2010, and it should be noted that it is just those countries that would have to make the greatest reductions that would also mark up the greatest gains.

That outmoded and declining industries such as coal and oil should be opposing the Commission's proposal could hardly be unexpected. They are naturally trying to defend their short-term interests by delaying inevitable decisions yet a few years more. It is difficult on the other hand to understand the hesitation of popularly elected decision makers to take measures to protect their electors' health, as well as the environment we have to all live in, and generally to act in a manner that should be obvious to anyone.

CHRISTER ÅGREN

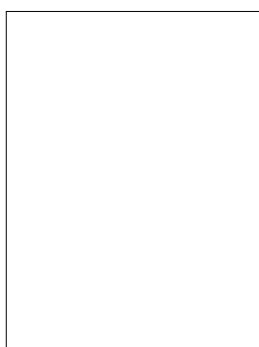
New publications



• Air pollution from shipping • Nedsæt udslip fra skibe • Bekämpfung der schiffsbedingten Emissionen • Réduction des émissions en provenance des navires • Bestrijding van scheepvaartemissies • Heitgaaside emissiooni vähendamine veetranspordis • Päästöjen vähentäminen merenkulussa • Samazināt izmešus no kuģiem ...

Emissions from ships could be reduced very cost-effectively compared with what would have to be done to achieve similar results ashore. The study advertised below is summarized in an 8-page pamphlet in eleven languages: English, German, French, Flemish, Danish, Polish, Russian, Estonian, Lettish, Lithuanian, and Finnish.

Air Pollution and Climate Series



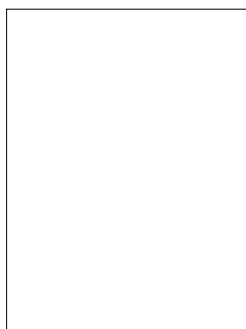
Economic instruments for reducing emissions from sea transport

Except for its large emissions of sulphur and nitrogen oxides, shipping has clear advantages, as regards the environment, over other modes of transport. In comparison with the additional measures that would have to be taken on land, reducing emissions at sea could however well pay. The technical means are available, and are described in this study along with the political possibilities and suggested incentives for shipowners.

Acidification in 2010

Even if all the planned measures aimed at cutting down the emissions of acidifying air pollutants during the next ten years should in fact be carried out, acidification is likely to remain a threat to many plant and animal species as well as whole ecosystems.

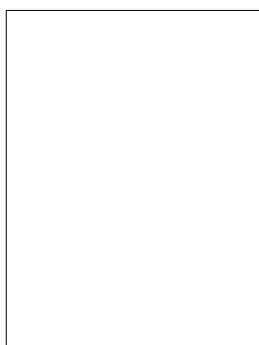
In this study the outlook has been examined in the light of various assumptions as to the possible trend of emissions. It appears from it that the problems of continued acidification may have been considerably underestimated.



Ground-level ozone in southern Europe

This is the first time there has been an overall survey of the problems associated with ground-level ozone in southern Europe, where concentrations frequently exceed levels that can be injurious both to health and vegetation.

It must seem surprising, in view of the threat to important industries such as agriculture and tourism, that governments of the region should be opposing international efforts to abate emissions of the substances that cause the formation of ozone.



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HOW TO ORDER. Single copies of any of the above can be had from the Secretariat (free of charge within Europe). Please call for quotation if more copies are required.

More publications that can be had free from the Secretariat were advertised on the back page of the last issue of Acid News. For a complete list, see www.acidrain.org

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Directive setting emission limits for heavy-duty vehicles will crack down most heavily on particles and nitrogen oxides, the emissions of carbon monoxide and hydrocarbons being relatively low from diesel engines.

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Except for scattered studies, ground-level ozone has been a largely neglected problem for southern Europe. There has now been made a study however aimed at covering the whole ground.

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Looking at the EU, a Californian research group has found that it would not only cost less than supposed to reduce emissions of carbon dioxide but would actually be profitable.

Getting more for less

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velop an alternative energy scenario for the fifteen EU member countries, and to use the RAINS computer model for investigating its effects on costs as well as on the environment.

The assignment given to Sustainable Environment Consultants Ltd (SENCO) was to produce some scenarios reducing the total emissions of CO₂ in the EU by 15 per cent between 1990 and 2010. This figure was selected because it is widely recognized that such a reduction is both practically achievable and politically acceptable. In 1997 the Commission had in fact itself presented a cost-effective strategy for reducing the emissions of CO₂ by 15 per cent, and the European Parliament has repeatedly spoken out in favour of such a target for the Union.

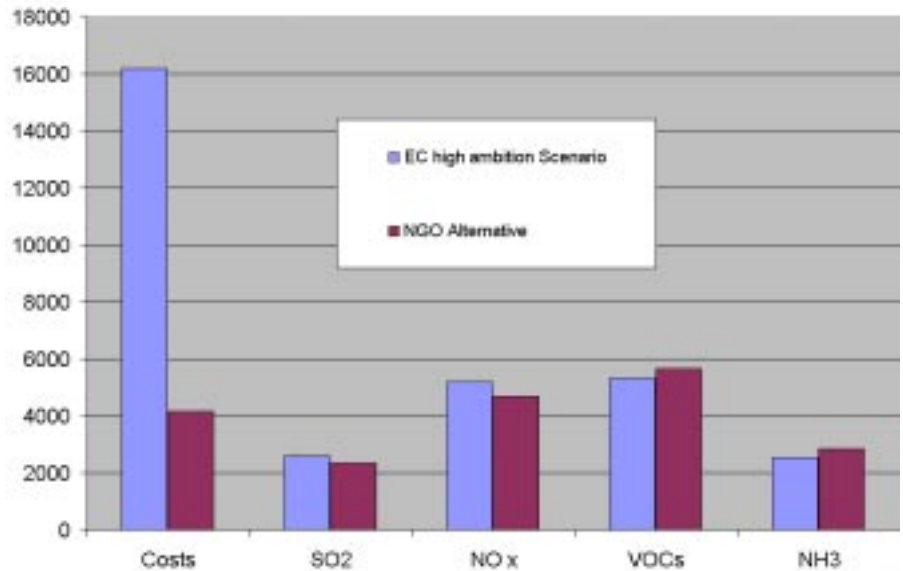
In the study the chief means for achieving this reduction have been management of demand (energy saving), improved efficiency in the use of energy, and an increased use of sources emitting little or no CO₂. It was further assumed that the total output of nuclear power would decline at a rate of 5 per cent a year as from 2005. There is a full account in a separate report.

It should be noted that any extra measures for the abatement of CO₂ that SENCO has analyzed are being introduced at the earliest from the year 2000, and would therefore have up to ten years to take effect. Judgement as to the measures to adopt was determined by technical feasibility, cost effectiveness, and the speed at which they could be set in. Key measures among those proposed are:

- Increased efficiency in the use of electricity.
- More energy-efficient motor vehicles.
- Energy conservation in buildings.

The principle scenario for the study, the Carbon15 energy scenario, entails a 15-per-cent reduction of the emissions of CO₂ by 2010, with a continued fall after that date. The fact that reduction could be sustained, and with some margin of safety up to 2020, is evidence of robustness in the scenario.

In working out strategies for emission abatement, data on the expected future use of energy has been inserted in the computer models for integrated assessment, such as RAINS



Comparison of the estimated costs for achievement of two sets of environmental quality targets, with Commission estimates based on the so-called Baseline energy scenario and the NGO's on an alternative low-CO₂ energy scenario. Emissions in thousands of tons, costs in millions of euros a year.

developed by IIASA, the International Institute for Applied Systems Analysis. A first step was to assess the environmental situation in 2010 that would be likely to result from current strategies for emission control, a so-called reference scenario (REF). This takes into account both national

Such a reduction is both practically achievable and politically acceptable

and international legislation, and the various commitments that have been made. It serves as a starting point for optimizations performed with computer models for integrated assessment, in other words it is assumed that by 2010 all countries will have at least achieved the emission reductions of the reference scenario.

With the assistance of the IIASA, the Carbon15 energy scenario was inserted into the RAINS computer model. Changed assumptions as to energy use in the different countries will cause the estimates of the reference scenario also to change. The improvements in energy efficiency and conservation as well as fuel

switching coming from the Carbon15 scenario will mean a lower use of fossil fuels (coal, heavy fuel oil, petrol, and diesel) in the various sectors, compared with what it would have been according to the Commission's analysis.

Unsurprisingly, the emissions of SO₂, NO_x, and VOCs in 2010 in the reference scenario will be lower when Carbon15 is added. For the EU as a whole, the emissions of SO₂ and NO_x will be about 30 per cent less, and those of VOCs 8 per cent, compared with the figures in the Commission's analysis. The emissions of ammonia, originating primarily in agricultural activities, remain unchanged. Starting from lower emissions, this "new" reference scenario will be nearly one-third less costly in comparison with the original one, the estimates dropping from euro 58 billion to 40 billion.

For the Commission's analyzing a further scenario was constructed, in order to illustrate the potential of a full application of current technologies for emission control. Called the Maximum technically Feasible Reductions scenario (MFR), it serves two purposes: firstly giving an indication of the extent to which achievement of the long-term objectives for environment and health will be possible



More energy-efficient vehicles are a key element in the alternative energy scenario, Carbon 15. The diesel version of the Volkswagen Lupo, with a fuel consumption of only 3 litre per 100 kilometres, is an example of progress in this direction.

by 2010 if only technological measures for abatement are applied, and secondly providing an upper limit for the country-by-country emission reductions that can be assessed in the optimizations of the computer model.

By using Carbon15 instead of the Commission's energy scenario, the potential for greater reductions in the MFR scenario will increase. Emissions of SO₂ and NOx will come down by another 25-30 per cent, and those

of VOCs by about 10 per cent. The emissions of ammonia will remain on about the same level. Although the MFR scenario, based on Carbon15, results in lower emissions, the cost of attainment will be lower too.

The main aim of the study now being described was to investigate the effects of using the Carbon15 energy scenario while at the same time achieving the same interim environmental quality targets as were set by the Commission for its NEC directive. As could be expected, the modified input assumptions for the use of energy result in a somewhat changed allocation of measures for emission control. For the EU as a whole the new scenario (H1_{new}) gives lower emissions of SO₂ and NOx than would have been the case with the proposed NEC directive (see table p.6).

Despite the greater reductions, there will be a substantial fall in the costs for controlling SO₂ and NOx. The emissions of VOCs and NH₃ will on the other hand be slightly higher – since better environmental goals can be attained, and lower cost, by

Continued on page 6

The NEC Directive

ON JUNE 9, 1999, the EU Commission approved a proposal for a new directive on national emission ceilings (NECs) for four ozone-forming, acidifying, and eutrophying air pollutants – sulphur dioxide (SO₂), nitrogen oxides (NOx), volatile organic compounds (VOCs), and ammonia (NH₃).

This new directive would, if implemented, result by 2010 in a marked reduction of the damage caused by air pollution in the European Union. The amount of exposure to ozone that affects health would be lowered by 36 per cent, that affecting vegetation by 20 per cent, the area of sensitive ecosystems still unprotected against acidification by 32 per cent, while that unprotected against soil eutrophication diminish by 13 per cent. Moreover the levels of small particles (PM₁₀) that are injurious to health and are formed in the atmosphere from emissions of SO₂ and NOx would also drop.

These are estimated improvements over the situation as it would be in 2010 if the NEC directive should not be implemented (i.e. with emissions as in the reference scenario). Compared with the

situation in 1990, the improvements would be still greater, with health-related exposure to ozone falling by 76 per cent, vegetation-related by 53 per cent, while the areas where the critical loads for acidification and eutrophication are being exceeded would shrink by 88 and 37 per cent.

For the EU as a whole the NEC directive would ensure a reduction of SO₂ emissions from their 1990 levels by 78 per cent, and those of NOx by 55 per cent, of VOCs by 60 per cent, and NH₃ by 21 per cent. These figures may be compared with those of the reductions that are already likely as a result both of current national and international commitments and existing and impending EU legislation, as they appear in the so-called reference scenario. According to that scenario, between 1990 and 2010 the emissions of these four pollutants would come down by 71, 48, 49, and 12 per cent respectively. The Commission estimates that the total extra cost of reducing emissions in line with the NEC directive to be euro 7.5 billion a year in 2010. The cost of reductions according to the reference scenario is put at euro

58 billion a year for 2010. It is however recognized, even by the Commission, that all these figures are overestimates.

The Commission has also estimated the quantifiable gains in terms of money that could be expected from the extra reductions of emissions as proposed in the directive. Here account was taken chiefly of the effects on human health and farm crops, as well as on modern buildings and materials. The calculations showed such gains to amount to euro 17-32 billion for the year 2010.

It should however be noted that a number of gains have not been included, chiefly because they cannot yet be satisfactorily quantified in monetary terms. Among them are less acidification of soil and water, less eutrophication, fewer effects on biological diversity, less risk in the long term of lowered forest productivity, reduced direct effects of NO₂ and VOCs on health, and less damage to historical buildings and monuments. To conclude: although only some of the benefits can be assessed in terms of money, those that are so quantifiable can be accounted as worth as much as four times the supposed (overestimated) costs.

Emissions and cost of control according to the “new” H1 scenario (H1_{new}) resulting from application of the Carbon15 energy scenario and according to the “old” H1 scenario (NEC) – that selected by the Commission for setting national emission ceilings. Emissions in 1000 tons, costs in millions of euros a year.

	Sulphur dioxide		Nitrogen oxides		VOCs		Ammonia		Costs (million euros)	
	H1 _{new}	NEC	H1 _{new}	NEC	H1 _{new}	NEC	H1 _{new}	NEC	H1 _{new}	NEC
Austria	43	40	71	91	173	129	67	67	0	119
Belgium	76	6	122	127	96	102	69	57	507	1053
Denmark	90	77	116	127	84	85	71	72	0	6
Finland	113	116	82	152	129	110	31	31	0	0
France	170	218	555	679	969	932	725	718	331	916
Germany	358	463	923	1051	1008	924	473	413	608	2147
Greece	252	546	212	264	175	173	74	74	0	338
Ireland	33	28	40	59	40	55	126	123	2	44
Italy	312	566	647	869	905	962	432	430	0	403
Luxemb.	4	3	8	8	6	6	7	7	1	4
Netherl.	63	50	202	238	142	156	105	104	716	971
Portugal	91	141	99	144	127	102	67	67	3	57
Spain	439	746	660	781	650	662	353	353	0	22
Sweden	57	67	91	152	181	219	48	48	0	87
UK	433	497	994	1181	1036	964	274	264	557	1348
EU15	2532	3637	4822	5922	5721	5581	2920	2826	2724	7514

Continued from previous page

reducing emissions of the other two pollutants. All told, the annual costs with the new scenario are estimated to be euro 2.7 billion for the year 2010. This should be compared with the estimated cost of euro 7.5 billion for implementing the NEC directive. Thus the structural changes envisaged in the Carbon15 energy scenario could, if carried out, reduce the cost (also estimated) of meeting the interim environmental quality targets by nearly two-thirds, or 4.8 billion a year.

For most countries and pollutants, application of the Carbon15 scenario for optimization gives lower ceilings for emissions. The cases where emission ceilings would be significantly lower than in the proposed NEC directive can be explained by the fact that emissions in the new reference scenario are lower than in that used by the Commission. There are also cases where the ceilings of the H1_{new} scenario are higher than those of the proposed NEC directive. This is true for some countries' emissions of

VOCs and ammonia. It can be largely explained, too, by the initially lower emissions of SO₂ and NO_x in the new reference scenario, with its relaxed

*Programmed to achieve
the targets at the
lowest cost to the EU*

demand for further control measures for VOCs and NH₃, which would be relatively expensive.

Whatever the starting point, the RAINS computer model is programmed to achieve the targets set for environmental quality at the lowest cost for the EU as a whole. The Commission's interim targets for 2010 would be achieved by the ceilings proposed in the NEC directive – but they can also be achieved, and with quite a margin of safety, by the ceilings of the H1_{new} scenario. In fact the latter yields up to 10 per cent better environmental results, in respect both

of exposure to ground-level ozone and of acidification, than the emission ceilings of the proposed NEC directive.

The main purpose of the study was not however to suggest alternatives to the ceilings put forward in the Commission's proposal, but to illustrate the huge cost savings that could follow from adoption of a more clever approach for solving interrelated environmental problems. It must be obvious from what has just been said that if the EU and its member countries were to take the necessary action for reducing the emissions of the main greenhouse gas, carbon dioxide, the costs for reducing those of ozone-forming, acidifying, and eutrophying air pollutants would be significantly lower than is at present anticipated.

In its preparations for the NEC directive, the Commission also tried scenarios with higher and lower environmental aims. But due primarily to the high cost that would be entailed in meeting the more ambitious interim targets, that scenario was dropped as the basis for a NEC directive. When optimization in computer modelling was repeated with the higher aims of the H3 scenario, but using the Carbon15 energy scenario, the estimated costs dropped by nearly three-quarters, from euro 16.2 to 4.2 billion (see chart, p.4).

The reasons for this dramatic difference are essentially the same as those given in the case of the H1_{new} scenario. As regards ozone exposure, the “new” H3 scenario results in a higher level of environmental protection, but with a somewhat worsened situation for acidification and eutrophication. For all four environmental quality areas the results are markedly better than could be expected from the proposed NEC directive.

Obviously then, assumptions as to future energy use will have to be key inputs when projecting emissions of pollutants. The expected use of energy will be decisive for the outcome of the analyses of strategies for abating emissions. It is a matter both of the total amount of energy used and its attribution to different sources – coal, oil, nuclear, etc. If the total used – and especially that part generated from fossil fuels – is overestimated, estimations of the cost of reducing emissions will also be exaggerated. An overestimation of future energy



More conservation of energy in buildings is another key element in the Carbon 15 scenario.

use will also result in an underestimation of the possibilities of reducing the emissions of air pollutants, which in turn will result in the interim targets for environmental quality being set lower than they need be. Inflated cost estimates are, moreover, likely to make any proposals politically less acceptable.

Just now there are several EU programs aimed at controlling atmospheric pollution, in sum covering a range of pollutants, including SO₂, NO_x, VOCs, PM₁₀, CO, and CO₂. So far they have mostly been considered separately, despite the strong linkages between them. This lack of integration, together with the focus on “end-of-pipe” measures, has meant that the estimated costs of meeting their separate objectives have been generally put too high. As mentioned, the scenario for the conversion and use of energy is what largely determines the estimates for the emissions of all the above pollutants. This scenario is therefore a key input to the computer programs. Its design gives an opportunity for investigating measures that will bring down the emissions in all programs, and so reduce the cost of meeting the various objectives.

The study demonstrates the importance of a more integrated approach to environmental policy. By linking the abatement strategies for the four pollutants of the NEC directive with those for reducing the emissions of carbon dioxide, the estimated costs of abatement can be substantially reduced. It is suggested that the resultant cost savings should be used for better protection of human health and the environment from the effects of air pollution. That would mean aiming higher than the Commission in its proposal for a directive on emission ceilings.

A conclusion is that analyses, such as that made of the NEC directive,

should be based on energy scenarios that are more politically as well as environmentally anchored. Doing so will not only result in more accurate estimates of the cost, but also in strategies that will provide the double benefit of reducing air pollution with its related problems, both locally and throughout Europe, while also reducing the emissions of the chief greenhouse gas, carbon dioxide.

While supporting the Commission's proposal for an NEC directive, the three organizations that have published the present study wish to emphasize that the proposed figures for national emission ceilings must be regarded as no more than minimum targets. In view of the reductions that will be needed to achieve long-term objectives for environmental quality, as well as of the substantial benefits to human health, the environment, nature, and cultural objects that are at stake, at least the amount of money suggested by the Commission, euro 7.5 billion, should be spent as a first step. Although the overall figure of euro 7.5 billion may seem large, it still only represents an average of euro 20 per inhabitant. The study shows that with a reasonable and realistic energy policy, a higher level of environmental protection and also higher benefits than envisaged by the Commission could be obtained for the same amount of money.

CHRISTER ÅGREN

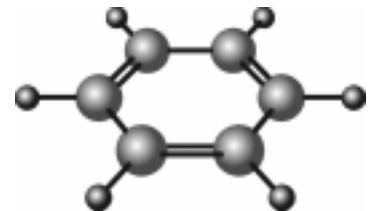
¹ **Getting more for less – an alternative assessment of the NEC directive.** Published jointly by the Swedish NGO Secretariat on Acid Rain, European Federation for Transport and Environment (T&E) and the European Environmental Bureau (EEB). Copies can be obtained from any of the publishers. Also available in pdf format from the Secretariat's website www.acidrain.org (choose heading Publications).

US tightening up

Stricter standards for car emissions and motor fuels are scheduled for introduction in the United States in 2004. The proposals put forward by the EPA in May last year (see AN 2/99, p.20) were presented, with only minor changes, as final rules by President Clinton just before Christmas. This means, for instance, that the sulphur content of petrol will have to be lowered from 300 to 30 ppm, and that the emission standards will be the same for all cars, no matter whether they are of the light passenger type or are big SUVs, sport utility vehicles. The difference will be greatest for the heavy types, which at present get off much more leniently than ordinary cars.

The refiners are not pleased at the new regulations. The car makers, on the other hand, are rejoicing at the prospect of fuels with improved quality, even though they had hoped for more time to meet the emission standards. Representatives of environmental interests, the Sierra Club and the Environmental Defense Fund, told Reuters that they were very pleased with these decisions.

Source: Reuters, December 21, 1999.



Trouble with benzene

In December 1998 the EU Commission had put forward a proposal for a directive setting new air-quality standards for benzene and carbon monoxide (COM(98) 591, see AN 1/99, p.7). At the first reading last December the EU Parliament voted not to accept that part of the directive which would allow agglomerations experiencing “severe socio-economic difficulties” in meeting the target for benzene to apply for a five-year derogation from the limits.

The Council of Ministers then produced a compromise proposal allowing a five-year derogation provided the concentrations of benzene in the air did not exceed 10 µg/m³ as a yearly average (as compared with 5 µg/m³ in the directive). Spain was the only country to vote against the compromise, considering the level of benzene far too difficult to attain. The directive will be coming up for a second reading in Parliament this spring.

Effects of the new protocol

Even if carried out, the promised reductions of four pollutants will still not suffice

THE Protocol to Abate Acidification, Eutrophication and Ground-level Ozone, which was formally adopted and signed by twenty-seven countries in Göteborg, Sweden, on December 1, 1999, is the eighth of those agreed during the twenty years of the Convention on Long-Range Transboundary Air Pollution. It sets national emission ceilings, which are binding, for four acidifying, eutrophying, and ozone-forming air pollutants: sulphur dioxide (SO₂), nitrogen oxides (NOx), volatile organic compounds (VOCs) and ammonia (NH₃). Provided the signatories adhere to the ceilings set for them, and emissions in the countries that have not signed are brought into line with the reference scenario (as a result of legislation already passed), between 1990 and 2010 the European emissions of SO₂ should have gone down by more than 60 per cent, NOx and VOCs by about 40, and those of NH₃ by 17 per cent. See Table 2.

The protocol also sets emission limit values for a number of specified sources, such as large combustion plants and motor vehicles. These will become mandatory for new stationary sources one year after the protocol's coming into force. For existing stationary sources the implementation date is either one year after its coming into effect or December 31, 2007, whichever is the later. In the case of a country with "an economy in transition," the implementation date for existing stationary sources is eight years after the coming into force.

The limit values for new combustion plants are largely similar to those proposed by the European Commission in July 1998, which have however not yet been passed into EU legislation (AN 3/98, p.11). For existing large combustion plants the limit values are approximately the same as those in EU directive 88/609/EEC, which have been mandatory for all new plants in the member states since 1987.

But there is no certainty of limit values being adhered to by all coun-

tries, since there is a loophole in the protocol making it possible to evade the requirements. As an alternative to the mandatory requirements a country "may apply different emission reduction strategies that achieve equivalent overall emission levels for all source categories together."

The standards of the protocol for motor fuels and new mobile emission sources, as well as the dates for their application, are largely in line with the most recent ones in the EU. Again, countries with an economy "in transition" are allowed extra time for implementation of the

*Evident from studies
that the effects will
be far from sufficient*

standards – in this case up to five years. There is also an annex to the protocol containing measures for reducing the emissions of ammonia from farming. Furthermore there is a requirement for the use of BAT, best available techniques, both on stationary and mobile sources.

The United States and Canada had to be treated differently, since the advanced computer modelling

that has been done for Europe, and has served as basis for the negotiations, does not take in North America. In the first place, these two countries have made commitments only for SO₂, NOx, and VOCs, being agreed that they have no problems with transboundary movements of reduced nitrogen compounds (ammonia and byproducts). Secondly, no commitments for emission ceilings could be set for them at the time of the protocol's adoption, since bilateral negotiations are still underway for these matters, and are not likely to be finalized until later this year, or possibly next. It is expected that emission ceilings for the USA and Canada will be added to the protocol later, when these two countries ratify or approve the protocol.

During the negotiations for the protocol Russia had taken advantage of the possibility of defining a so-called PEMA, Pollutant Emission Management Area. This option is open only for a few very large countries, with a land area of more than 2 million square kilometres. It means that a country can restrict its commitments to certain well-defined parts of its territory. Russia has made its PEMA cover approximately 500,000 sq kilometres in the north-western part, bordering on Finland and the three Baltic States. Otherwise only Canada and the United States have indicated an intention of falling back on PEMAs.

The twenty-seven countries that signed the protocol are listed in Table 1. Four other countries – Belgium, Greece, Poland, and Russia – have declared their intention of signing in the near future. (The protocol is open for signatures until May 30, 2000.) Others not signing were the European Community, Belarus, Ukraine, Lithuania, and Moldova. There were also some countries that did not participate in the negotiations, and so not in the preparatory work either, among them being Albania, Bosnia-Herzegovina, Estonia, F.Y.R. Macedonia, Yugoslavia, Georgia, and Turkey.

Table 1. Countries that signed the protocol on December 1, 1999.

Armenia	Austria
Bulgaria	Canada
Croatia	Czech Rep.
Denmark	Finland
France	Germany
Hungary	Ireland
Italy	Latvia
Liechtenstein	Luxembourg
Netherlands	Norway
Portugal	Romania
Slovakia	Slovenia
Spain	Sweden
Switzerland	UK
USA	



The Community's avoiding to sign the protocol is explained by the fact of negotiations being in process for the Commission's proposed directive on national emission ceilings (see AN 4/99, p.4). According to the EU environment commissioner Margot Wallström, the aims of that directive could be jeopardized if the Commission should be seen to be endorsing the more lax objectives of the protocol. It would undermine the EU's policy for combating ground-level ozone and acidification.

The less stringent emission cuts of the protocol would obviously fall far short of the targets for reducing ozone and acidification in the Com-

mission's proposal for a directive on national emission ceilings. The area of ecosystems in the EU, where critical loads for acidification would still be exceeded in 2010, despite implementation of the protocol, is for instance estimated to be 5.3 million hectares, which is 1 million hectares more than would result from application of the NEC directive. Exposure of the population to injurious levels of ozone, expressed according to the cumulative population exposure index, would be nearly one-third higher, or 398 instead of 301 million persons ppm-hours.

The Dutch Ministry of Environment recently published two studies¹

of the protocol. The first describes the preceding analysis, comparing the emission ceilings of the protocol with those of other scenarios discussed during the negotiations, and showing among other things their estimated costs for abatement and the effect on the environment. The second study describes the analysis of the quantifiable benefits (in terms of money) that can be expected from reduction of the emissions, again comparing the outcome of the protocol with that of other scenarios. As in the case of earlier analyses of this kind, only those benefits are considered which can be assessed in terms of money, thus omitting a series of important benefits in the form of less damage to the natural environment and to the cultural heritage with its historic monuments.

It is evident from these studies that the effects of the new protocol will be far from sufficient for achievement of the preliminary aims for 2010 that were agreed in January 1999 (set forth in the guiding scenario, G5/2r.) There is a summary of the calculations in Table 3. Compared with what will be needed to come up to the internationally agreed long-term aim – no more exceeding of the critical loads for pollutants anywhere – they are of course even more inadequate.

In the second Dutch study, the annual monetary benefit of the protocol, as estimated by AEA Technology,

Continued on next page

Table 2. Estimated emission reductions between 1990 and 2010. For the present members of the EU (EU15), the other European countries (non-EU), and Europe as a whole. Emissions from shipping plying in international trade have not been included. According to the reference scenario (REF), the protocol (PRO), and the guiding scenario (G5/2r).

	Sulphur dioxide			Nitrogen oxides			VOCs			Ammonia		
	REF	PRO	G5/2r	REF	PRO	G5/2r	REF	PRO	G5/2r	REF	PRO	G5/2r
EU15	71%	75%	80%	48%	50%	54%	49%	53%	57%	12%	13%	25%
non-EU	55%	54%	67%	24%	28%	33%	18%	19%	26%	13%	21%	23%
Europe	62%	63%	73%	38%	40%	45%	37%	40%	45%	12%	17%	24%

Source: Amann, M. et al (November 1999).

Table 3. Environmental improvements. Calculated situation in 2010, according to the reference scenario (REF), the protocol (PRO), and the guiding scenario (G5/2r).

	Acidification ¹			AOT60 ²			AOT40 ³			Eutrophication ⁴		
	REF	PRO	G5/2r	REF	PRO	G5/2r	REF	PRO	G5/2r	REF	PRO	G5/2r
EU15	6433	5332	3486	466	398	298	7183	6804	5714	48461	47639	38890
Non-EU	10908	9829	4397	103	82	48	5916	5396	4526	68032	60726	55396
Europe	17341	15161	7883	570	480	346	13099	12200	10240	116494	108365	94287

¹Area of ecosystems with acid depositions above their critical loads for acidification (1000 hectares). ² Cumulative population exposure index (million persons x ppm x hours). ³ Cumulative vegetation exposure index (1000 km² x excess x ppm x hours). ⁴ Area of ecosystems with nitrogen depositions above the critical loads for eutrophication (1000 hectares).

is put at euro 12.8 billion for the year 2010. In the IIASA estimate the costs would be about euro 2.8 billion. The benefit-to-cost ratio would thus be 4.6, in other words the benefits would outweigh the costs 4.6 times. It is interesting to note that an even higher benefits-to-costs ratio would be obtained from comparison with the guiding scenario, G5/2r. Then, the annual costs for 2010 would be euro 8.5 billion, and the quantifiable benefits five times more, or euro 42.3 billion.

This only underscores the need for continued effort to bring down the emissions of the four pollutants still further. That can be done both within the framework of the Convention and elsewhere. The ongoing negotiations in the EU for an NEC directive offer a golden opportunity for the member countries to take one more step in the right direction. The matter is especially pertinent now that ten or more countries are wanting to become members of the EU, and the obligations of a coming NEC directive will have to apply for them too.

The protocol provides, moreover, for an update. Article 10 specifies that there are to be reviews, and that the first "shall commence no later than one year after the present Protocol enters into force." It is therefore important that the signatories ratify it without undue delay. (Ratification by sixteen countries is needed for it to come into force.) Previously it has taken anything from two to almost six years to get the Convention's protocols ratified.

CHRISTER ÅGREN

Note. The full text of the protocol can be found at the Convention's homepage: www.unece.org/env/lrtap.

¹ Amann, M. et al (1999). **Integrated Assessment Modelling for the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone in Europe**. Publicatierieks lucht & energie nr. 132.

Holland, M. et al (1999). **Cost-Benefit Analysis for the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone in Europe**. Publicatierieks lucht & energie nr. 133.

Both studies are available from the publishers, the Dutch Ministry of Environment, Distributiecentrum VROM, Postbus 351, 2700 AJ Zoetermeer, The Netherlands. Price NLG 30.

Exercising pressure brings results

OF LATE the Bond Beter Leefmilieu, the federation of environmentalist organizations in the Flemish-speaking part of Belgium, has been making great efforts to get the new Belgian and Flemish governments to alter their stance in regard to the proposals of the European Commission for a directive, and the Convention on Long-Range Transboundary Air Pollution for a protocol, for national ceilings on the emissions of acidifying and ozone-forming air pollutants.

At the time of the last meeting of experts dealing with the new multi-pollutant protocol of the Convention last September, the Bond Beter Leefmilieu had its attention drawn by the Swedish NGO Secretariat on Acid Rain to the weak bids that had been made by the Belgian representatives during the first round of discussions. The reductions of the four pollutants – SO₂, NO_x, VOCs and ammonia – that the Belgians said they would be willing to accept would have been far below those calculated as necessary for achievement of the environmental target that had been set during the negotiations. They were even less than the Belgian representatives had themselves previously proposed. They were also lower than the EU average, despite the fact that to reach the targets for environmental quality, Belgium's reductions should, if they followed the optimized reduction scenario (G5/2r), be amongst the highest in Europe. The concentration of dense road traffic, much industry, and intensive farming onto a small land area makes Belgium a net exporter of acidifying pollutants and ozone-forming substances.

The BBL quickly reacted by arranging a press conference together with the European Environmental Bureau, at which they presented a sharp analysis of the government's line of action, comparing the proposed emission cuts with the targets and aims of its current policy for the environment. From this it could be seen that for some industries the emission reductions which were, according to the Flemish Environ-

mental Policy Plan 1997-2001, to be attained in 2002, went further than those wanted for 2010 by Belgian industry for the negotiations on national emission ceilings. In those negotiations the Belgian government would also be failing to reach the goals for the environment set by the Flemish regional government and parliament.

Furthermore, neither the Flemish nor the Belgian authorities had given official notice of the Flemish plan, although it had been in force since 1997. Consequently the emissions aimed at in that plan had never been registered as agreed measures in European modelling. This meant that in Belgium's case the difference between measures already decided upon and necessary further measures appeared larger and so more expensive than it should have been – which can explain the reluctance of the Flemish and Belgian governments to take further steps.

The official Belgian proposals would also have failed to take account either of a resolution that had been passed in the Flemish parliament to the effect that the high concentrations of ozone should be resolutely dealt with, or of the Flemish government's view that Flanders should be innovative in pushing for international agreements. So the BBL made Belgium's attitude in regard to the protocol on emission ceilings a test case for the new Belgian government (where the Green Party is now also represented for the first time). In an open letter to all the ministers that were involved, deep concern was expressed at the official attitude.

All these efforts have not been without result. The Flemish minister of environment turned to the MINA-Raad for advice as to the attitude Belgium was to take on emission reductions at the meeting of the EU Environment Council in October. (The MINA-Raad is the Flemish environmental advisory committee on which environmentalist organizations such as the BBL as well as industry are represented.) This was the first time the Commission's pro-



posal for national emission ceilings was discussed at such a meeting.

The MINA-Raad urged compliance with existing undertakings such as those made at Kyoto and in the Flemish Advisory Policy Plan. In the view of the Raad, further reductions could be achieved through measures to bring about structural changes and the use of financial instruments, which have so far not been tried.

In the wake of this consultation with the MINA-Raad the Belgian minister of environment, Magda Aelvoet, announced at the meeting of the EU Environment Council on October 12 that Belgium would be agreeing to greater reductions than it had previously been willing to commit itself

to – lowering its ceiling for sulphur dioxide from 121,000 to 106,000 tons a year by 2010, and that for nitrogen oxides from 184,000 to 181,000 tons. In answer to a question in parliament, Ms Aelvoet

agreed to look for further reductions before the protocol comes up for review. Steps would also be taken to see how measures to reduce emissions of carbon dioxide also affected those of acidifying and ozone-forming substances.

In future, too, environmentalist NGOs would be drawn into the discussions at an early stage, and on the same footing as industry. This will give the BBL and like organizations greater influence on the role Belgium has to take when international agreements are being made in the respect of the environment.

BART MARTENS

Policy advisor, Bond Beter Leefmilieu.

Two at least doing it

The last round of negotiations before formal signing of the new multi-effect protocol under the Convention on Long-Range Transboundary Air Pollution took place in August and September. The commitments then made by most countries were far from adequate for attainment of the previously agreed aims of the protocol. To somehow get around the dilemma, the possibility was given for any country that so wished to improve on its original commitments.

As reported above Belgium did so, and so did Sweden, where an environmentalist group also acted. In this

case it was the Swedish Society for Nature Conservation, which took up the matter at a seminar on national targets for environmental quality. In consequence the Swedish government raised its bid for a reduction of the country's emissions of nitrogen oxides by 20,000 tons (the emission ceiling was lowered from 168,000 to 148,000 tons a year). A slight improvement was also made for ammonia. Moreover Sweden's minister of environment wrote to his opposites in the other countries urging them to initiate similar moves.

NEWS IN BRIEF



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Heading the windpower league

Last year there was an increase of 30 per cent in installed capacity for windpower in the EU countries. More than half of the increase was however in a single country, Germany, which thereby consolidated its position as No. 1 for windpower in the EU. At the end of 1999 the figures in megawatts were:

Germany	4444
Denmark	1700
Spain	1180
Netherlands	409
United Kingdom	343
Italy	281
Sweden	195
Greece	121
Ireland	68
Portugal	57
Austria	42
Finland	38
France	19
Luxembourg	10
Belgium	9

Source: European Wind Energy Association (www.ewea.org).

EU aviation strategy

A proposal for an environmental policy in the aviation sector was put forward by the Commission last December, expressing the view that the steady increase in emissions from aircraft is making it impossible to go on relying on technical standards only. An integrated approach will now be necessary, according to the Commission. One of the main items in the proposal would be environmental charges on air travel, corresponding to the emissions. While it would prefer to see such charges adopted on a world basis, the Commission is threatening to introduce them for the EU alone if no decision on global charges should be forthcoming from the ICAO at its next general assembly in 2001.

Press release from the EU Commission, December 1, 1999.

The problem of achieving reduction

European and Asian car makers have agreed with EU to cut down the emissions of CO₂ from new cars in the next few years, but it is doubtful whether they will be able to do it on their own.

According to a recent study, the car makers cannot fulfill the promises they have made to the EU Commission to reduce the emissions of carbon dioxide from new vehicles unless they get help from outside. The study, by environmental economist Per Kågeson, was made for T&E, the European Federation for Transport and Environment, and its Swedish member organisation Gröna Bilister (The Swedish Association of Green Motorists).

Kågeson has made a detailed analysis of the agreements made between the EU Commission and the manufacturers' trade associations in Europe, Japan, and Korea – ACEA, JAMA, and KAMA. In essence they mean that the makers have agreed that in 2008 the average new car sold in the EU will be emitting at the most 140 grams of carbon dioxide per kilometre – although the Asian companies would have until 2009. This corresponds approximately to a consumption of 5 litres per 100 kilometres for petrol-driven cars, and 4.5 litres for diesels – amounting to a drop of about 25 per cent from today's figures.

The average fuel consumption of new cars sold in the EU has remained unchanged since 1985. Kågeson proposes that the technical improvements made in the meantime should, by today, have brought a reduction of 15-20 per cent. But most of the car makers have, as Kågeson's analysis shows, simply used the improved technology to build heavier vehicles with more powerful engines. The average for new-car consumption would probably have been higher were it not for the increased proportion of diesel-driven vehicles that are being sold (which emit less CO₂ per km).

The question is then what the car makers can do to fulfill their commitments. The ACEA says they will not go in for smaller cars, one probable reason being that profit margins all the way from the factory to the salesroom are very much greater for large cars. The ACEA's solution lies in a great increase in the number of vehicles with engines that emit



© ANDRÉ MASLENNIKOV

less carbon dioxide per kilometre, hoping that 90 per cent of the new cars sold in 2008 will either be diesel-driven or have direct-injection engines. The Japanese are aiming at an increasing proportion of petrol-driven cars with direct injection engines and hybrids with part-electric propulsion.

But according to Kågeson's analysis, the car industry will, in this way, only get halfway towards fulfilling

Economic incentives needed to influence buyers' choice of cars

its commitments for 2008-09. He concludes that economic incentives will also be needed, to influence the buyers' choice of cars. That will be especially necessary in view of the present trend towards ever larger and more powerful cars.

The EU countries have moreover several reasons for turning to economic instruments for reducing the average fuel consumption of new cars. The Environment Council has set 120 grams per km as an objective for the average new car in 2010, and the EU has committed itself, in the Kyoto protocol, to reducing emissions of greenhouse gases by 8 per cent between 1990 and 2008.

After analyzing the various possible instruments for reducing the emissions of carbon dioxide from road traffic, Kågeson arrives at the following:

- The emissions from new cars could be kept down by a system of tradeable emission permits. A manufacturer that has reduced more than its permit requires can sell its surplus allowance to some other that has not; and *vice versa*, any failing to keep within the permit figure can save itself a fine by buying an extra allowance. In order to get down to the desired emission levels, the sum total of permits has to be successively reduced.

- An alternative to tradeable permits might be a combination of increased fuel taxes with a differentiated sales tax on new cars. So as not to hinder the turning in of old cars for new, the sales taxes should be so scaled as not to affect the average price of new cars. If it is to have any effect, though, the differentiation should be well marked.

- Because the tax on diesel is lower than that for petrol in all the EU countries except Britain, there is a tendency for the gain from having more diesel cars to be offset by people driving longer distances because it is cheaper. Petrol and diesel fuel should be taxed according to carbon content, which would mean that the tax on diesel should be 13 per cent higher than that on petrol.

- The tax on petrol and diesel fuel should be increased every year by an amount equal to 20-30 per cent of the saving that can be got from the decline in cars' fuel consumption. Otherwise the gain will be offset by people driving longer distances, since it would cost less.

- Speed limits and changed driving habits could bring about a marked reduction in the emissions of carbon dioxide from road traffic.

- Reducing cars' emissions of carbon dioxide to 120 grams per km would cause no social hardships. It would not cost much, and smaller cars with less powerful engines would actually result in a gain to society. Failure to grasp the possibilities would force the EU to take measures in other sectors that would be more costly.

- If the 120-gram aim is to be attained by 2010, the EU Commission will have to start deciding on suitable economic instruments without delay.

It is worth noting that one of the measures taken by the Commission, as a means of reducing the fuel consumption of new cars, by requiring a declaration of fuel economy, is unlikely to have much effect. Systems similar to that now being introduced in the EU have been applied in Britain and Sweden during at least two decades. But it is precisely in these two countries that the engine power of new cars has increased most of all, and today Sweden's cars are the heaviest and thirstiest in all Europe.

PER ELVINGSON

The drive for less fuel. Will the motor industry be able to honour its commitment to the European Union? By Per Kågeson. T&E Report 00/1. Available from the European Federation for Transport and Environment, Bd de Waterloo 34, B-1000 Brussels, Belgium. E-mail: t+e@arcadis.be.

T&E Online

T&E, the European Federation for Transport and Environment, which is celebrating its ten-year anniversary this month, can now be found on internet:

www.t-e.nu

– with its monthly newsletter, the T&E Bulletin, press releases, a complete list of its publications, and links to the member organizations.

LCPs

Split on existing plants

DESPITE LONG-DRAWN-OUT negotiations and a number of compromise proposals, the EU Environment Council failed in December to arrive at a so-called Common Position on a proposed revision of the LCP directive. This is a directive to control the emissions of SO₂, NO_x, and particles from combustion plants with a capacity of more than 50 megawatt (see AN 2/99, pp.6-7). The big question has been whether the member countries would be willing to accept the Parliament's proposal to set emission

limit values for existing plants as well as new ones. In this the Parliament has the support of most of the member countries, but a group consisting of Spain, Portugal, Greece, Britain, and Ireland is now blocking such a move. Italy, France, and the Netherlands have been undecided, but unlike the last group appear ready to accept a compromise solution. The matter has now been shelved for the time being. It will be up to Portugal to try and find a solution when in the EU chair this spring.

NECs

Support for new directive

ON JANUARY 10 the rapporteurs to the EU Parliament's environment committee presented their ideas for adjustments to the Commission's proposals for a new directive on national emission ceilings and a new daughter-directive on ground-level ozone (see AN 3/99, pp.6-7). The rapporteur from the Socialist Party, Riitta Myller (Finland), and Chris Davies (UK) for the Liberals called the Commission's proposals "challenging but attainable." They were also agreed that the cost of reducing the emissions had been greatly overestimated.

The rapporteurs agreed, too, that a date for attainment of the long-term aim of the directives – no exceeding of critical loads anywhere – should be written into them right away, and that it should be the year 2020. They

also noted that if the EU really does fulfill its commitments under the Kyoto protocol to reduce its emissions of greenhouse gases, the aims of the two directives will be easier and much less expensive to attain than would appear from the estimates.

The proposals were debated in the environment committee on February 23-24, when it was decided to reject a motion by the industry committee, as well as by some conservative (EPP) and liberal (ELDR) MEPs, to substitute the much weaker ceilings of the Gothenburg Protocol to the Convention on Long-Range Transboundary Air Pollution (CLRTAP) for the NECs proposed by the Commission.

The directives are coming before a plenary session of the Parliament in March.

Removing an obstruction

Considering the high sulphur contents allowed for petrol and diesel fuels under EU rules to be a brake on the introduction of new technology for engines and gas cleaning, the German government is pressing for a limit of 10 ppm as from 2007.

The present EU fuel standards date from 1998, when a directive was adopted for limiting the sulphur content of petrol and diesel oil to 350 and 150 ppm respectively by 2000, with a further re-

duction for both to 50 ppm by 2005.

The German government would like to see a tightening of the directive when it comes up for revision in 2007. It has in any case decided on a tax reduction from November 2001 in Germany for motor fuels with a sulphur content of 50 ppm, and to screw the level down to 10 ppm in January 2003.

In January the EU Commission said it would agree to a tax reduction for fuels with a 50 ppm sulphur content, but wanted more time to consider the environmental and free-trade aspects of a 10 ppm limit.

EU setting limits for emissions

Much cleaner vehicles can be expected as a result of standards agreed upon for diesels.

LAST NOVEMBER the EU Parliament approved the compromise proposal for a directive on emission standards for heavy-duty vehicles that the Council of Ministers had presented in December of the previous year. It was the Parliament's second reading of the directive and all that is now needed is formal adoption by the Council.

The directive sets limits for the emissions of carbon monoxide, hydrocarbons, nitrogen oxides, and particulates from the diesel engines of trucks and buses. New are special requirements for gas-driven buses and what are known as Enhanced Environmentally Friendly Vehicles. But it is the requirements for emissions of particulates and nitrogen oxides from diesel engines that have attracted most attention.

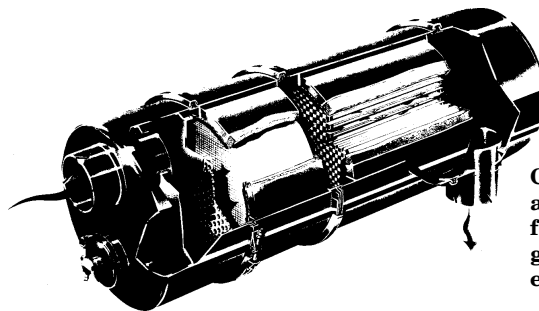
Much stricter for particles

The requirements for particulates will be applied in two stages. The first, Euro 3, applies to new types of engine next October and for all new vehicles that are registered in October 2001, to bring emissions down by 30 per cent from present requirements.

In 2005, when Euro 4 comes into force, particle emissions will have to be 80 per cent lower than permitted under present standards. That will mean, in effect, that all new heavy vehicles will need to have particle traps. The technique is well established, and probably could have been made a requirement already in Euro 3, but it will not be until 2005, when the sulphur content of diesel fuel has been limited to 50 ppm, that general application will be possible.

Conflict of aim

The requirements for nitrogen oxides will be tightened in three stages, first by 30 per cent this year (alternatively next, as above). From 2005, when Euro 4 comes into play, the limit will be 3.5 grams NOx/kWh, half of what is now permitted. It will probably be possible to



Combined particle trap and oxidizing catalyzer for cleaning the exhaust gases from heavy diesel engines (cut open).

get down to these levels by modifying the engines. There is however a conflict of aim between low emissions of nitrogen oxides and low fuel consumption in diesel engines. Engine modification to reduce emissions can lead to lowered energy efficiency for the fuel. A possible solution is to install EGR, exhaust-gas recirculation (see AN 4/99, p.19).

The third stage, cutting down the emissions to 2.0 grams/kWh, will give engine makers a very tough challenge. To get down to such a low level will most probably require some kind of after-treatment of the exhaust gases, with selective catalytic reduction (SCR) as a possible solution.

Other ways sought

The SCR technique calls for a reducing agent, ammonia or urea, to be added to the gases before they pass

through the catalyzer. The necessary installation is expensive and has moreover certain disadvantages. Neglect to fill up with reducing agent will for instance result in greatly worsened emissions.

The vehicle makers are therefore trying out other types of fuel and completely new engine concepts as means of controlling the emissions of nitrogen oxides. Volvo, for instance, is deeply involved in idea of using dimethyl ether (DME) as a fuel.

Following requests from several of the EU member countries, the Commission is, at the end of 2005, to "consider the available technology with a view to confirming the mandatory NOx standards for 2008 in a report to the Council and the Parliament, accompanied, if necessary, by appropriate proposals."

The emissions of carbon monoxide and hydrocarbons are relatively low from diesel engines.

They will nevertheless be lowered by 30 per cent under the new standards in 2000/01, from the levels of the present standards.

The new directive will in addition require all vehicles to carry on-board diagnostic systems to warn drivers if the gas cleaning should not be functioning properly. There are also to be new test cycles, intended to better reflect real driving conditions.

PER ELVINGSON

Note. The Council's compromise proposal was described in Acid News 1/99, p.8.

Emission standards for diesel engines. Grams per kWh as measured by ESC and ELR test cycles.

	CO	HC	NOx	PM
2000/2001	2.1	0.66	5.0	0.10
2005/06	1.5	0.46	3.5	0.02
2008/09	1.5	0.46	2.0	0.02

Emission standards for diesel and gas engines. Grams per kWh as measured by ETC test cycle.

	CO	NMHC ¹	Methane ²	NOx	PM ³
2000/2001	5.45	0.78	1.6	5.0	0.10
2005/06	4.0	0.55	1.1	3.5	0.02
2008/09	4.0	0.55	1.1	2.0	0.02

¹ Non-methane hydrocarbons. ² For natural-gas engines only.

³ For diesel engines only.

High levels ignored further south

Surprising that southern European governments should be turning a blind eye to the damage that pollutants such as ground-level ozone can cause to health and crops in their countries.

SCIENTIFIC STUDIES of the effects of ground-level ozone in the countries surrounding the Mediterranean and in southern Europe generally have usually been confined to particular phenomena in particular places. But when gathered together in a wide survey, the volume of evidence can leave no doubt that ozone is a serious problem in this part of Europe, affecting both agriculture and human health.

Ozone is formed under the influence of sunlight in air masses that have become polluted with nitrogen oxides and volatile organic compounds. Concentrations near ground level have been rising steadily all over Europe during the last century, and are now dangerously high over most of the continent. As with many types of air pollution, the problem they pose is transboundary.

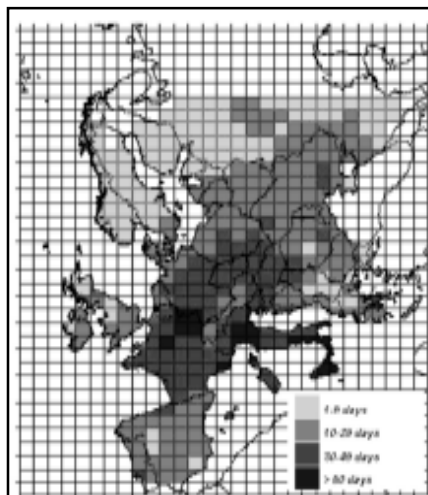
Since most of the broad studies have hitherto concentrated on northern and central Europe, the Swedish NGO Secretariat on Acid Rain commissioned Håkan Pleijel, ozone expert at the Swedish Environmental Research Institute, to assemble all the pertinent information in a single report on the concentrations and effects of ozone along the southern fringe of the European continent.

Pleijel notes that the climate in southern Europe is favourable to the formation of ozone. Moreover marked episodes – short periods with extremely high concentrations – often occur there, especially during the summer months. The level at which, according to an EU directive, member countries are obliged to inform their citizens of the situation is 90 ppb,¹ which in southern Europe is exceeded many times every year.

Concentrations which are so high as to be definitely injurious to health occur regularly in several thickly populated regions along the coasts of southern Europe. Areas that are

notably so exposed include Athens and its surroundings, some of the coastal parts of eastern Spain, and the Po valley in north Italy, where concentrations will sometimes reach 150 to 250 ppb. Many of the highest levels have been recorded in areas that are most attractive for tourists.

The levels at which ozone is now occurring in southern Europe are also damaging vegetation. It is true that in dry weather – such as often prevails in those parts where concentrations are highest – plants usually keep their leaf openings (stomata) closed, thus keeping down the uptake of ozone. But that does not happen when crops are irrigated, as they often have to be in southern Europe. The stomata then remain open. Studies made recently in Spain, Italy, Greece, and elsewhere indicate considerable damage from ozone. Although the risks have yet to be fully evaluated, there is evidence that the



Number of days on which ozone concentrations exceeded 60 ppb as an 8-hour floating value. The underlying data, based on the emissions of air pollutants in 1990, represents floating average values from five years of meteorological observations.

effects may be greater than has been supposed. Pleijel thinks in any case that further research would be justified in order to get a better estimate of the size of the problem and its economic consequences.

Pleijel lists the various limit and guide values for ozone concentrations, as well as the measures that have either already been decided upon or are now proposed for reducing the emissions of substances that cause the formation of ozone. He finds it surprising, in view of the evident situation in southern Europe, that reluctance to take the necessary measures in that direction should be greater there than in central and northern Europe. So does Christer Ågren, director of the Secretariat, who comments:

“Spain, Portugal, Italy, France, and Greece are among the countries that are most energetically opposing EU directives for reducing emissions of transboundary, ozone-forming pollutants. One of these is for national ceilings on emissions, the other for controlling emissions from large combustion plants, which is being revised.

“High concentrations do not only affect crop yield, and the health and well-being of the inhabitants of those parts, but are also a potential threat to their tourist industries, and might lead to serious consequences for their economies.

“It is, to say the least, surprising that southern European governments should be turning a blind eye to the damage that pollutants such as ground-level ozone can cause in their countries. It is surprising, too, that the inhabitants of these countries should not be rising up and protesting against the environmentally unfriendly line that their governments are pursuing in the EU.”

One reason for voters not protesting may of course be a general lack of knowledge and information. In that case Pleijel’s study may help to bring about a change.

PER ELVINGSON

The study – **Ground-level ozone. A neglected problem for southern Europe** – can be obtained free of charge from the Swedish NGO Secretariat on Acid Rain. Also available in pdf format on internet: www.acidrain.org (choose heading “Publications”).

¹ ppb = parts per billion. Sometimes the measure used instead is micrograms per cubic metre ($\mu\text{g}/\text{m}^3$). In the case of ozone $1 \text{ ppb} = 2 \mu\text{g}/\text{m}^3$.

More dangerous than supposed

Air-borne particles, causing thousands of deaths, are a problem that knows no frontiers

IT APPEARS from research carried out during the last decade that very small airborne particles are more dangerous to health than had previously been thought. Moreover attention is no longer centring solely on local sources. Concentrations have been found to be largely a result of transboundary air pollution.

An extensive survey of the state of knowledge concerning the effects of particulates on health has recently been made by researchers at the National Institute of Environmental Medicine (or IMM, the acronym for its Swedish title). They concluded as a result that much stricter standards would be necessary for controlling this kind of pollution.

What is proposed

"In view of the latest findings, we are proposing 30 micrograms per cubic metre of air as the highest 24-hour average for PM_{10} ," says Professor Göran Pershagen at IMM. The present guide value in Sweden is 100 micrograms per cubic metre.

There is as yet less scientific basis for limits to long-term exposure to small particles. According to Pershagen, however, effects on health have been recorded at levels of about $15 \mu\text{g}/\text{m}^3$. The half-year guide value in Sweden is now $20 \mu\text{g}/\text{m}^3$.

The limit values that IMM is proposing are much lower than those in the EU standards that will begin to take effect in 2005, and lower too than the indicative EU standards for 2010 (see table). In its guidelines for air quality, the World Health Organization has refrained from setting any definite values, having come to the conclusion that there is no threshold under which there would be no effects.

Greatest sources of emissions

The very small particles can be divided in two types: the primary type, those that are emitted directly as particles, and the secondary ones that are formed by chemical reaction in the atmosphere.

There is great uncertainty as to the amount of primary particle emissions. From the only estimate so far

made at the European level it would appear that power generation is responsible for about a third of the emissions (calculated as PM_{10}). Road traffic was also found to account for a considerable amount, but as emissions occur in places where many people gather, its contribution to the overall exposure will probably be greater than its share of the emissions would indicate. It was found in



Britain, for instance, that whereas road traffic accounted for 25 per cent of all the country's emissions of PM_{10} , in London the figure was 77 per cent.¹

Other outstanding sources include small-scale combustion, and industrial processes. Particles loosened from roads and other surfaces also contribute. They are however for the most part larger and so less inimical to health than those from combustion.

Thousands of premature deaths

Of late, attention has turned more and more to the contribution of the

secondary formed particles. Thus a task force was set up jointly by the European Centre for Environment and Health (WHO) and the Convention on Long-Range Transboundary Air Pollution to investigate the matter. It has now presented a report² on the current state of knowledge in this respect.

The secondary particles are formed in the air from various gaseous substances, such as sulphur and nitrogen oxides. They are very small and can remain floating in the atmosphere for weeks. According to preliminary estimates, 40-60 per cent of the concentrations of PM_{10} over most of Europe are made up of particles moving across national borders, a great part of which are of the secondary type. This is particularly so where there are no local emission sources. And secondary particles dominate the concentrations almost everywhere.

Starting from estimates of the concentrations over Europe and current knowledge of the dose-response connection, the authors of the report have calculated that something between 95,000 and 382,000 premature deaths occur every year as a result of exposure to long-range transports of particles, and that 75 per cent of them are due to exposure to the secondary type. They emphasize however that the estimates are uncertain, it not being clear to what

Limit values, guide values, and actual concentrations of PM_{10}

	24-hour average	Yearly average
WHO guide value (1999)	exposure-response	exposure-response
EU limit value 2005	$50 \mu\text{g}/\text{m}^3$ (35 ¹)	$40 \mu\text{g}/\text{m}^3$
EU limit value 2010 ²	$50 \mu\text{g}/\text{m}^3$ (7 ¹)	$20 \mu\text{g}/\text{m}^3$
Guide value proposed by IMM	$30 \mu\text{g}/\text{m}^3$	$15 \mu\text{g}/\text{m}^3$
Actual urban concentrations, Sweden ³	$50-100 \mu\text{g}/\text{m}^3$	$10-20$ (20-40) $\mu\text{g}/\text{m}^3$
Urban concentrations, Central & W. Europe		$40-60 \mu\text{g}/\text{m}^3$

¹ Figure in parenthesis shows the number of times the limit value has been exceeded. Can also be expressed as a percentile: 35 exceedings = 90 percentile, 7 = 98 percentile.

² Figures for 2010 are only indicative. The directive is to be revised in 2003.

³ Roof-level concentrations. Street levels in parenthesis.

extent the different composition and low concentration of the particles from long range transports will have the same effects as exposure to urban air pollution on which the dose-response connection rests.

Improvements likely

It seems that the concentrations of secondary particles in the air over Europe are likely to drop markedly over the next ten years as a result of international agreements to reduce the emissions of acidifying, eutrophying, and ozone-forming substances. Population exposure to secondary particles may be expected to have become halved by 2010 (as from 1990). The emissions of primary particles are also expected to be lower, perhaps by as much as a third – in part as a result of flue-gas cleaning and conversion to low-sulphur fuels in power generation.

A disturbing tendency is that the proportion of diesel-driven vehicles, which emit far more small particles than the petrol-driven types, is on the

increase in many European countries.

“The EU emission standards will have to be made technically neutral. There is no reason for allowing emissions to be higher from diesels than from petrol-driven vehicles,” says Magnus Nilsson, board member of



T&E, the European Federation for Transport and Environment.

Nilsson also urges all buyers of transport services to require environmental compliance of the carriers, not least in respect of emissions of noxious substances. Buses and other heavy vehicles would have

to be equipped with particle traps, especially if operating in urban environments.

Quite a lot of uncertainty remains as to the origins and effects of particles. Nevertheless there would appear to be every reason, in view of the known health effects, to do everything possible now both to control their secondary formation – in other words, to reduce the emissions of sulphur and nitrogen oxides, which is also what is needed to curb acidification, and to attack the sources for direct emissions, which often are diesel-driven vehicles and all kinds of combustion.

PER ELVINGSON

¹ Source Appointment of Particulate Matter in the United Kingdom. In Car Lines 99-2, March 1999.

² Health Risk of Particulate Matter from Long Range Transboundary Air Pollution. Preliminary Assessment. WHO Regional Office for Europe and Executive Body for the Convention on Long-Range Transboundary Air Pollution. 1999.

Effects on health

Short-term exposure. Several studies have shown a definite connection between daily variations in the volume of breathable particles in the air and effects on the respiratory system and even mortality. The connection has been noted at concentrations down to 30 $\mu\text{g}/\text{m}^3$, in terms of PM_{10} . The concentrations now current are believed to have considerable effects on health.

Long-term exposure. Scientific evidence for the effects is limited. Some studies suggest that there will be a risk of respiratory infections and heart and coronary diseases at concentrations even as low as 15 $\mu\text{g}/\text{m}^3$. There are indications that long-term exposure can also cause lung cancer.

How they act. Although it is not altogether clear *how* particles affect health, it has been proved by voluntary tests on individuals as well as epidemiological studies that they *do* have an effect. In epidemiological studies the concentration records are compared, say, with the number of deaths or hospital admissions on account of respiratory symptoms.

It has been proved on the other hand that the size of the particles is important. While the larger ones become transported away in the upper parts of the respiratory tract, the very smallest (less than 2 μm across) can penetrate even into the alveoli, causing inflamma-

tion of the lung tissue. The particles' chemical composition may also have something to do with the health effects, although there is as yet no proof.

Size is important

The particles known as PM_{10} are those with a diameter of 10 micrometres or less (or, more strictly, particles which pass through a size-selective inlet with 50 per cent efficiency at 10 μm aerodynamic diameter). Formerly it was soot, consisting mainly of the largest and most visible particles, that was measured. Measuring PM_{10} is certainly an improvement, but it does not tell the whole story. It only records weight, and scientists are coming more and more to the conclusion that it is the *number* of particles that is important, not the weight. The most dangerous are the smallest particles, which weigh practically nothing. A single particle with a diameter of 3 μm weighs as much as a million with a diameter of 0.03 μm . It will probably be $\text{PM}_{2.5}$ that is measured in future – that is, particles with a diameter of less than 2.5 micrometres (or, more strictly, particles which pass through a size-selective inlet with 50 per cent efficiency at 2.5 μm aerodynamic diameter).

PARTICLES

Motor vehicles

Diesel-driven vehicles especially emit large amounts of particles – the emissions from diesel cars being 10-30 times greater than those from petrol-driven. In this respect the fuel-efficient types of petrol-driven cars with direct-injection engines seem to fall about halfway between an ordinary diesel and a petrol-driven vehicle, according to several tests.

For heavy diesel vehicles there are already well-proven traps which remove 90 per cent or more of the particles in the exhaust gases, capturing all sizes. They can be fitted to old as well as new vehicles, at a cost of about 6000 euros. As from 2005 the exhaust standards will be so strict that particle traps will in effect be needed on all heavy diesels (see article, p. 14). The French PSA concern claims to have developed a method of solving the particle problem for light vehicles too (AN 3/99, p.15).

It can be said in general that the amounts of particle emitted will be lower in line with better quality of fuel, the sulphur content being especially important. With gas propulsion the emissions will be very small.

Particle emissions can be kept down, too, by proper maintenance and careful driving. Sudden accelerations and high speeds increase the emissions of particles.

Review of the power sector

There will now be tighter rules for the control of emissions from the oil and coal-fired British power plants, but a new flexibility in the system should encourage flue-gas desulphurization.

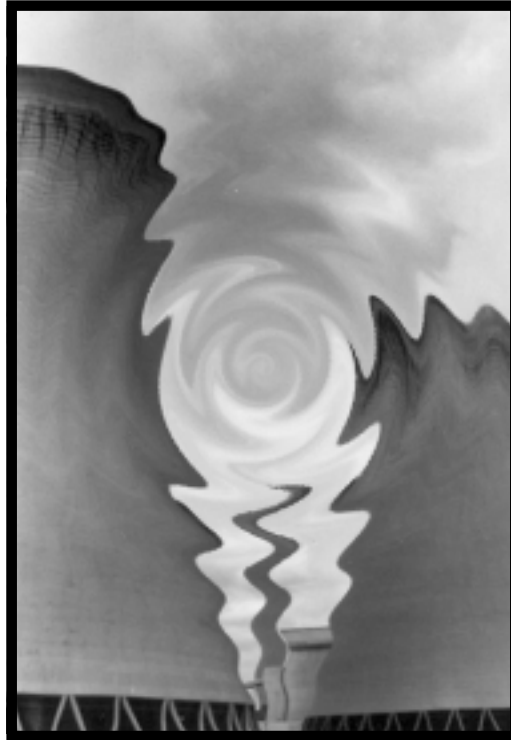
ENVIRONMENTALISTS have given a cautious welcome to changes in the control of emissions from the UK's 19 large coal and oil-fired power stations. These stations are responsible for about 62 per cent of the sulphur dioxide emissions, 20 per cent of the nitrogen oxides, and 12 per cent of the particulate emissions in the UK.

The changes are a result of a review undertaken by the UK Environment Agency in response to technical and market developments in the electricity supply industry (see AN 4/99, pp.8-9).

It is mostly a matter of the A and B emission limits for each power company. To recapitulate: the A-limits apply to emissions from each of the company's generating units, and take account of their effects on the local environment. The B-limit controls the total amount of sulphur dioxide that may be released from all of the company's power plants, and is designed to cover their combined effect. The sum of a company's A limits will exceed the B limit, but any individual plant can be operated up to its A limit, provided emissions from the others are adjusted so as to ensure compliance with the overall B limit.

The new arrangements that were presented in December will allow a certain amount of flexibility. Companies that manage to increase their share of the electricity market will be able to obtain temporary increases in their B limits, provided they operate plants that are equipped for flue-gas desulphurization at double the average load factor of those that are not. A new limit on the amount of sulphur dioxide released per unit of electricity generated would prevent a "losing" company from using its excess B limit to burn a dirty fuel. Temporary increases in B limits may also be granted to companies undertaking to retrofit for FGD.

The success of this proposal can only be tested in the marketplace, but Eastern Generation and Edison



Mission Energy have already cited it as contributing to their decisions to fit FGD at their West Burton, Fid-

Emphasis on individual units welcomed as reflecting the realities of power generation

dlers Ferry, and Ferrybridge power stations.

Friends of the Earth are delighted that, whether or not the generators take advantage of these inducements, the Environment Agency is now *requiring* them to run their FGD-equipped stations ahead of their non-FGD plant. It has long been a source of frustration to environmentalists that despite a £1 billion public investment in FGD equipment at the Drax and Ratcliffe stations, there has been no requirement to use these ahead of cheaper, non-FGD stations.

Friends of the Earth have also welcomed the Environment Agency's review of the A limits. They have

been pressing the Agency to carry out these reviews, not least because of evidence that some plants are likely to be operated after the end of their previously assumed life span in 2010.

The A limits are set by BATNEEC assessments (Best Available Techniques Not Entailing Excessive Costs). These balance what is technically possible (BAT) against the costs involved (NEEC). The projected lifespan of a station is therefore crucially important for the feasibility of retrofitting capital-intensive technologies such as FGD. There has been evidence of extended lifespans emerging shortly after the previous BATNEEC assessments had determined against extensive retrofitting of FGD equipment, on the grounds that by 2010 most stations would have come to an end of their lifespan.

The Environment Agency is now requiring operators to provide a written statement of the expected lifespans of each of their generating units. Should a company continue to run a plant after the stated time limit, it would have to ensure that releases did not exceed a level consistent with the application of FGD or other appropriate technique.

Although the revised A limits allow increases for a few power stations, the overall level of emissions will be reduced. Unfortunately, though, the reductions are timed for 2004, and it is just the stations getting the largest increases that have the greatest effect on their local environment.

The Agency is also requiring all generating units that are expected to operate at a load factor above 40 per cent after September 2001 to be subject to BATNEEC assessments to see whether it is practicable to fit FGD. Any operator wishing to run a non-abated unit at a higher load factor will have to present a reasoned justification for doing so. Since each power station usually has several units, this emphasis on individual units is welcomed as reflecting the

realities of power generation. It remains however to be seen how easy or difficult it will be for operators to justify unabated operation above a 40-per-cent load factor.

Operators will in any case be required to justify the use of high-sulphur coal in any unabated unit after September 2001. The idea is that high-sulphur coal should be burned in plants equipped for FGD, and low-sulphur coal in those not so equipped. The generators have acknowledged that this is attractive in principle, but then put up a long list of reasons why nothing could be done in practice.

It is a relief to see that the Environment Agency has not allowed the UK's international treaty agreements to be used as a brake on emission controls at home. The generators had been arguing that no further action was needed, because emission controls were already on target to meet the country's international obligations. The Agency has however upheld its view that BATNEEC assessments are distinct from treaty agreements and must therefore be pursued independently.

The effects of the Environment Agency's review could include some short-term environmental detriment, due to the granting of additional B limit allowances during the construction of new FGD plants. The Agency claims however that these effects are likely to be fairly small, and to be strongly outweighed by the longer-term benefits of new FGD capacity.

By September 2005, sulphur dioxide emissions from coal- and oil-fired stations in England and Wales will have come under 398,000 tons, a reduction of 60 per cent compared with 1996-97 levels. This will reduce the 3.3 million hectares of UK ecosystems that are now at risk from acid deposition by 25-35 per cent. And the Environment Agency expects to see significant further reductions in the emissions of sulphur dioxide as a result of the new flexibility in the system. Friends of the Earth in turn hope to see these translated into equally significant improvements in the bids for sulphur dioxide made by the UK for the EU directive on national emission ceilings.

LESLEY JAMES

Acid Rain Campaigner, Friends of the Earth (England, Wales and N. Ireland).



Compensation for pollution

The Kobe District Court in Japan has awarded 210 million yen in compensation to the residents of Amagasaki (Hyogo) Prefecture for pollution caused by vehicle exhaust emissions. The Japanese central government and the Hanshin Expressway Public Corporation will both pay, the court having ruled that the two are responsible for failing to keep the daily level of exposure to suspended particulate matter to the permissible maximum of 0.15 mg/m³.

Car Lines, January 2000.

Better done abroad

The Japanese government is to offer China a loan of 16 billion yen – equal to about 120 million euro – to help reduce air pollution. It is intended that the money shall first be used to clean up in three of the country's most polluted (and polluting) cities – Dalian, Chongqing, and Guiyang – but if the results are good there, the program can be extended. The Japanese hope that low-interest loans will enable the Chinese to develop alternatives to coal firing, mainly through increased use of the country's gas reserves. Japan is the recipient of a great amount of air pollution from China.

Ny Teknik, 2000:6 (February, 2000).



Road charging for heavy vehicles

Germany is continuing to make preparations for the introduction of a new system of road charging for heavy vehicles. The Ministry of Transport has started to negotiate a contract for a satellite-based system which will make it possible to charge according to the use of the highways. An independent commission has recommended a charge of DM 0.25 (0.13 euro) per kilometre, to be

applicable in 2002 or 2003, and that the income should be used for investments in the road infrastructure. The Ministry also wants the emissions of air pollutants to be reflected in the charges, if that should be technically possible. But tariff rates have in any case still to be fixed.

If such a charging system should be adopted, Germany will be the third country in Europe to take the step. Switzerland and Austria have already prepared systems for 2001 and 2002 respectively. If Germany does it, it will mean leaving the Eurovignette system, in which eight EU countries are now participating. In that system the charges are differentiated according to the vehicle's environmental characteristics, varying between 750 and 1550 euro a year, but no account is taken of the distance travelled.

The EU is itself preparing for abandonment of the Eurovignette system and going over to road charging on the German lines. A report giving the details is expected next year.

ENDS Daily, February 3 and 14, 2000.



European investment bank criticized

A network of environmentalist organizations in central and eastern Europe – CEE Bankwatch – is keeping an eye on the activities of the international investment banks in the area. In February, for instance, it criticized the European Investment Bank, EIB. While its lending has so far been mainly to present EU members, the EIB is now expected to be increasingly active in the candidate countries. But the NGOs claim that some of the projects it has financed are in breach of national environmental laws – naming specifically the Budapest ring road, for which the bank has lent 72 million euro even though projections have shown that the pollution would be higher than permitted either in Hungarian or EU law.

CEE Bankwatch asserts that the bank operates in a manner “largely exempt from the overall policy direction of the EU” and that it “disregards environmental considerations.” Underlying these problems, the NGOs say, is the bank's secretive manner of operating, which prevents it being held publicly to account for its actions.

Further information: www.bankwatch.org.

The cost of reducing emissions

After taking a close look at the situation in the EU, researchers find it to be profitable

An ordinary view is that reducing the emissions of carbon dioxide will be expensive and difficult. But IPSEP, a Californian research group, now maintains that by laying emphasis on productivity-enhancing technologies in climate policies, a shifting of investments in order to cut carbon will result in substantial economic gains – even without counting the benefits of avoiding the risks and damage of climate change.¹

According to IPSEP, the myth about emission reductions being expensive has arisen because the computer models used for the calculations are “grossly incomplete presentations of technology menus, policy options, and technological change,” and are therefore “ill-suited for simulating innovative productivity-enhancing energy policy options.”

The possibilities

The IPSEP has therefore set up its own computer model and applied it for the fifteen EU member countries. The base here has been the Commission’s scenarios for future economic developments, use of energy, etc. From that basis it has made a careful study of the possibilities of making energy use more efficient and reducing dependence on fossil carbon. The conclusion was that the EU has sufficient low-carbon energy resources and technological options to reduce its emissions of carbon dioxide by 25 per cent by 2010, and 50 per cent by 2020, from the levels of 1990.

So much can however hardly be achieved. But if done to 50-65 per cent, the result would be a cut in EU emissions to 8 per cent below 1990 levels by 2010, thus fulfilling the commitment under the Kyoto protocol (assuming the other gases named in the protocol are reduced to a like extent). With a more complete turnover of buildings, vehicles, plant, and other energy-using capital stocks the reduction by 2020 could be 17 per cent.

The IPSEP claims that these successively larger reductions of emissions will be possible while gross

domestic product is being more than doubled, and the EU’s requirements for natural gas become significantly lower than current projections would indicate. Moreover these reduction percentages also assume that an accelerated phase-out of nuclear power will have taken place by 2020. This all shows that the EU has a tech-



nological choice for meeting global environmental goals without having to trade off nuclear against climate risks.

Explaining why, contrary to current opinion, it will pay to reduce emissions, the IPSEP makes the following points:

- Productivity will gain from investment in energy efficiency.
- Technology costs will be reduced.
- As will the import prices for fossil fuels.
- There will be cheaper mixes in the electricity supply.
- Externality costs will be lower.

Productivity gains from investments in energy efficiency

What is most important is to invest in better energy productivity on the supply side, for instance in cogeneration of heat and power, and on the demand side in more efficient vehicles, buildings, appliances and other equipment. The IPSEP believes there could be at least a doubling or even a fourfold improvement in the energy efficiency of present EU capital stocks.

Such investments can for the most part be highly profitable. The trouble is that the gains are often relatively small in comparison with a company’s or a household’s total costs, and so they pass unobserved. The tendency is strengthened by other pervasive market barriers, such as split incentives between renters, builders, and owners, and by organizational

processes within companies.

Innovative but proven market-enhancing policies, such as demand-side management programs, standards for energy efficiency, and government-sponsored voluntary agreements, can overcome these barriers at small administrative expense while yielding major net economic savings. A partial (50-65 per cent) implementation of the potentials of increased energy productivity would, according to the IPSEP, save European consumers and companies about 40 billion euro a year in 2020 – even without taking into account the feedback effects on technology costs, fuel prices, and the electricity mix. This would amount to a 7-per-cent reduction in the total EU outlay on energy services in that year.

Analyses by conventional modelling fail to capture these productivity savings. By using fixed historical coefficients when deriving future energy demand both for policy and reference cases they project existing market barriers into the future.

Reductions in technology costs

A determined effort to bring down the emissions of carbon dioxide will lead to a distinctly lowered cost of investing in energy efficiency and technologies for renewable energy, in part because of the advantages of scale from the change to mass production, and because of the technical improvements resulting from “learning by doing.” This feedback will on the one hand reduce the cost of a changeover to renewables, and on the other yield greater cost advantages from energy-efficiency technologies. In the IPSEP estimate, the result would be additional savings to the EU of about 50 billion euro a year in 2020. Analyses by conventional modelling, they say, completely overlook these feedback effects on the demand side, and in most cases on the supply side as well.

Reduced import prices for fossil fuels

If the climate strategy should lead to a lower demand for fossil fuels,

their prices will fall. In combination with other factors that should bring savings to the EU in fuel prices of about 80 billion euro a year in 2020.

A cheaper mix in the electricity supply

Greater efficiency in the final uses of electricity will result in a lower-cost mix of generating sources. When demand is lower, cheap hydropower and other low-cost plant will answer for a greater share of the total generating requirements. The effect would add another 10 billion euro to the savings in fuel costs.

Lower externality costs

A significant side-effect of a reduced burning of fossil fuels will be lower emissions of sulphur dioxide and nitrogen oxides. A doubling of the EU's Kyoto target for 2010, to cut carbon dioxide emissions 17 per cent below 1990 levels by 2020, would reduce sulphur dioxide emissions by 60 per cent below baseline projections (mainly as a result of burning less coal). More hybrid vehicles, less combustion, and so forth would cause emissions of nitrogen oxides to drop by 50 per cent. The economic benefits of these and other reductions in the effects of pollutants could be assessed at anything between 10 and 50 billion euro a year in 2020.

Monetary estimates of the damage from climate change that would be avoided proved so highly uncertain that they have been left out, although even partial estimates could easily multiply the economic benefit of reduced externalities.

Combined economic effect

The IPSEP comes to the conclusion that if the EU countries should decide to reduce their emissions of carbon dioxide by 17 per cent between 1990 and 2020, and do so through a strategy of investment-led productivity growth, by 2020 the yearly cost of energy services in the EU could be reduced by about 30 per cent – leaving aside any consideration of the additional benefit from the avoidance of environmental externalities. If the externality costs are included, the total direct benefit for the EU rises to 190-240 billion euro.

The gains from a well designed (but realistically imperfect) strategy for climate protection could however be still greater. About 2 per cent of

the projected gross domestic product for the year 2020 could be set free and used to stimulate economic growth. How much that might be has however not been estimated.

What to do

Although current liberalization of the EU energy market may result to some extent in improved efficiency on the supply side, it will, according to the IPSEP, have no effect on the demand-side barriers. It therefore makes the following proposals:

□ Carry out targeted programs to eliminate the high transaction costs that block investments in energy productivity on the demand side. Suitable and proven instruments are voluntary agreements, utilities' incentive programs, fee rebates, man-



datory standards for minimum efficiency, and a range of activities, including information, labelling, training and extension services, to build and strengthen the institutional foundations of a functional energy-service industry.

□ To ensure high reduction of carbon emissions, these demand-side efforts would have to be complemented by regulatory reforms for utilities, such as fair buy-back rates for on-site electricity production, and market-creation programs on the supply side, such as standards for cogeneration and renewable power. □ Such policies for enhancement and transformation of the electricity market can be given added effectiveness through a reform of energy subsidies and a reorientation of the programs for research and development. Only a moderate energy or carbon tax would be needed to finance

these policies and the requisite incentives for investment. They could also be backed up by an EU regime for emissions trading.

A multi-faceted policy of this kind could make carbon abatement profitable for society. With present policy only a small part of the feasible carbon reductions and economic benefits will be realized, according to the IPSEP. This vacuum will mean that the total costs of energy services in the EU will remain a third above least-cost levels in 2020, even after some price reductions resulting from liberalization of the energy market have been accounted for.

Warning against flexible mechanisms

The IPSEP warns against the so-called flexible mechanisms of the Kyoto protocol, enabling one country to buy an emission allowance from another. If carried out on a large scale it would mean that the gain from an offensive climate policy was not being taken, and countries that do make cuts will simply increase their competitiveness. The IPSEP estimates that "elsewhere" flexibility will only be economically advantageous in respect of about 10 per cent of the EU's commitments, the rest having to be profitably realized through productivity measures within the Union itself.

"Outdated economic modelling studies have severely distorted the international policy debate on climate protection. With a productivity-oriented climate strategy, the European Union could garner significant GDP, employment, and competitiveness benefits from implementing its Kyoto commitment for 2010. Reductions below 1990 levels could be more than doubled by 2020, at an even greater net economic benefit," is the conclusion of the Californian group.

PER ELVINGSON

¹ **Cutting Carbon Emissions While Making Money. Climate Saving Energy Strategies for the European Union.** Energy Policy in the Greenhouse: Volume II, Part 2 (1999). By F. Krause, J. Koomey, and D. Olivier. International Project for Sustainable Energy Paths (IPSEP), 7627 Leviston Ave, El Cerrito, California 94530, USA. Available free of charge on internet: www.ipsep.org.

Effects on fish stocks

Areas where fish stocks have either been eradicated or become markedly depleted as a result of acidification.

ACIDIFICATION has hit the fish stocks throughout a quarter of Norway's land area. Stocks have been wiped out in almost 10,000 places, as well as being damaged in in some 5000 others as a result of acid deposition, say Norwegian scientists.

It is mostly brown trout (*Salmo trutta*) that are affected. As can be seen from the maps – based on close reporting from local fishermen, lake

and river wardens – the damage had steadily increased from 1940 up to 1990, the latest year for which figures are available.

The government's environmental survey has revealed on the other hand a distinct improvement in general water quality during the nineties, mainly in consequence of reduced depositions of sulphur. The effects can be seen in the recovery both of the

bottom fauna and the fish stocks in many lakes. But there is still a great absence of sensitive fish species in many parts of South Norway, where acid depositions are greatest and the critical levels are low. It is thought that in order to counteract the effects of acidification, liming will have to be kept up for many years to come.

Source: **pH-status**. No. 3, 1999.

EU INITIATIVE

“In town without my car”

EARLY IN FEBRUARY, amid increasing evidence that banning cars from cities can greatly improve the quality of urban air, the EU environment commissioner Margot Wallström formally launched preparations for the first car-free day all over Europe.

As Wallström was giving the signal for an “In town without my car” day on September 22, many of Italy's major cities were already setting out now on voluntary programs to keep cars out of the city centres once a week.

Starting in February, fourteen cities, including Rome, Florence, and Milan, will be banning cars every Sunday in an effort to combat the photochemical smog that kills thousands of people every year and severely damages cultural objects.

The scheme officially started on February 6, but Como and Milan had already set off January 10 and 11, allowing only cars with catalytic converters (except for emergency vehicles and taxis) into city centres between 8 o'clock in the morning and 8 in the evening. A week later they

repeated the ban, extending it to all privately-owned vehicles with combustion engines.

The result was a drop in air-borne particulates from 170 micrograms per cubic metre in early January to 90 $\mu\text{g}/\text{m}^3$ on January 12 and to 35 $\mu\text{g}/\text{m}^3$ after the second ban. Adherence to the scheme is voluntary, but the Italian government is offering



nearly 500 million lire to cities that sign up. The money is expected to be used to pay for more trains, trams, and buses to run on Sundays, to make it easier for residents to leave their cars at home.

The World Health Organization estimates that over 15,000 Italians die from smog-related illnesses every year (for Europe the figure is 80,000). Italy also loses 16 million

working days a year from the same cause. The smog readings would appear to dismiss the arguments of those who have said traffic intensity was irrelevant.

In her invitation to government ministers and representatives of local authorities and NGOs, Wallström said, “It is my belief that technological development alone will not deliver sufficient benefits, and behavioural change is necessary to prevent further deterioration of the urban environment and to achieve more sustainable development. However, translating this awareness into a change in habits requires decisive action to demonstrate the sustainable way forward.

“Europe's cities have a great deal to offer to their citizens, to each other and to the development of a better quality of life. I believe the European Car Free Day is an excellent tool to raise European citizens' awareness of their important role to help us achieve a more sustainable future.”

Adapted from T&E Bulletin, February 2000.

Recent publications

The effects of acidification (1999)

A twenty-minute videofilm describing the ecological effects of air pollution on forests, small freshwater lakes, and grasslands. In English. Produced by the Dutch Ministry of Environment. Available free of charge from the publisher: Distribution Centre of the Ministry of Housing, Spatial Planning and the Environment, Box 2727, 3430 GC Nieuwegein, the Netherlands. Fax: +31 70 3391568.

Controlling Traffic Pollution and the Auto-Oil Programme (1999)

By F. Goodwin, the European Federation for Transport and Environment (T&E). A comprehensive evaluation of the two Auto-Oil programs, examining the applicability of the Auto-Oil model for other legislative initiatives, and looking into the future of controlling emissions from traffic. T&E 99/8. Available from T&E, Boulevard de Waterloo 34, B-1000 Brussels, Belgium. Fax. +32 2 5029908. E-mail: t+e@arcadis.be.

Aviation and its Impact on the Environment (1999)

Comprehensive and easy-to-read, up-to-date information on aviation and its effects on the environment at the turn of the century. Update of a German publication from 1997. T&E 99/10. Available from the T&E, address as above.

Ecologically-viable Alpine transport

Pamphlet published by Federal Ministry of the Environment, Youth and Family, Stubenbastei 5, 1010 Vienna, Austria.

The environmental and social costs of mobility in Italy, second report: Executive Summary

By Amici della Terra (Friends of the Earth, Italy). This 44-page English-language executive summary describes the current situation in Italy. Can be ordered by e-mail: amiterr@amicidellaterra.it.

Air Pollution from the Transport Sector – A Scenario Study for Europe (1999)

62 pp., 81 kronor. Report 5023. Published by the Swedish Environmental Protection Agency, 106 48 Stockholm, Sweden. E-mail: kundtjanst@environ.se.

European Directory of Sustainable and Energy Efficient Building (1999)

Presenting buildings with low energy consumption and/or using systems for renewable energy. Includes both new and refurbished buildings, and lists individuals to contact, suppliers, etc.

Published by James & James Ltd, 35-37 William Road, London NW1 3ER, England. E-mail: edseeb@jxj.com

Ground-Level Ozone – A Threat to Vegetation (1999)

Edited by H. Pleijel. A general survey of the problem of ground-level ozone, especially in regard to its effects on crops, forest trees, and natural vegetation. Report 4970. Obtainable from the Swedish Environmental Protection Agency, address as above.

Ozone Position Paper (1999)

Underlying material for the EU Commission's proposal for the directive on ozone, prepared by the Ad hoc Working Group on Ozone Directive and Reduction Strategy Development.

171 pp. 26.50 euros. Published by the Office for Official Publications of the EC. Available from all national outlets for EU publications. Also available on internet: europa.eu.int/comm/environment/docum/99125sm.htm.

Voluntary Approaches for Environmental Policy: An Assessment (2000)

The use of voluntary approaches in environmental policy (e.g. negotiated agreements between government and industry) is spreading and attracting growing interest in OECD countries. This book provides a systematic analysis of the different types of voluntary approaches, their economic characteristics, their role and effectiveness.

144 pp. 180 francs. Can be ordered from OECD, 2, rue André-Pascal, 75775 Paris Cedex 16, France. E-mail: bookshop@oecd.org.

OECD Environmental Data: Compendium 1999 Edition

A compendium presenting data that link pollution and natural resources with activity in such economic sectors as energy, transport, industry and agriculture. 332 pp. 370 francs. Bilingual (English/French). Obtainable from OECD, address as above.

Environmental Performance Reviews: Turkey (1999)

This book is part of the OECD Environmental Performance Review Program, which conducts peer reviews of environmental conditions and progress in each member country. 188 pp. 180 francs. Available from OECD, address as above.

Road Congestion in Europe (1999)

This publication, the results of the 110th Roundtable of the European Conference of Ministers of Transport 1998, defines congestion, determines the scale of the problem and considers possible solutions. 240 pp. 320 francs. Can be ordered from OECD, address as above. Contents

and conclusions are also available from the website www.oecd.org/cem/events/justRT110.htm

Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (1999)

Pamphlet, 12 pp., describing the Convention on Long-Range Transboundary Air Pollution and the development and content of the new protocol. Available from the UN ECE, Environment and Human Settlements Division, Palais des Nations, CH-1211 Geneva, Switzerland. E-mail: air.env@unece.org. Internet: www.unece.org/env/lrtap.

The Göteborg Protocol clears the air

Newsletter from the Ministry of Environment, Sweden, describing the new Protocol to Abate Acidification, Eutrophication and Ground-level Ozone.

4 pp. Article No. M99.017. Can be ordered from Ministry of Environment, att. Anna Larsson, 103 33 Stockholm, Sweden. Also available on internet: www.miljo.regeringen.se/english/public.htm.

Facts about Swedish Policy: Acid Rain (1999)

Eight-page pamphlet available from the Ministry of Environment, 103 33 Stockholm, Sweden. Tel. +46-8-405 10 00.

Something in the Air (1999)

Pamphlet from the regional authorities of western Sweden, highlighting the problems of acidification. 8 pp. Can be ordered from Länsstyrelsen Västra Götalands län, 462 82 Vänersborg, Sweden. Tel. +46-521-60 50 00.

Green Taxes. Economic Theory and Empirical Evidence from Scandinavia (1999)

Edited by R. Brännlund and I-M. Gren. Examines the possibility of a green tax reform in the Scandinavian countries. 176 pp. £39.95. Published by Edward Elgar Publishing, Glensanda House, Montpellier Parade, Cheltenham Glos GL50 1UA, England. Internet: www.elgar.co.uk.

Guide to Research Databases of Acid Rain Assessment and Policy Literature (1999)

By W.F. Dietrich. ENRP Discussion Paper E-99-04. Available from Belfer Center for Science and International Affairs, Kennedy School of Government, Harvard University, 79 JFK Street, Cambridge, MA 02138, USA. Internet: <http://environment.harvard.edu/gea>.



SHIPS' EMISSIONS

Far from small in Mediterranean

THE EMISSIONS of sulphur and nitrogen oxides from shipping in the Mediterranean and Black Seas are far from negligible – as a survey made by Lloyd's Register, the first ever, has now shown. Taking the registered movements of shipping in those seas during a number of weeks in 1990 as a base, they have calculated the extent of one year's traffic and the amount of pollution it must have caused. It turned out to be 1,725,000 tons of nitrogen oxides and 1,246,000 tons of sulphur dioxide – or almost as much as has been

estimated for traffic in the north-eastern Atlantic, and equal to all the emissions from land in France in 1990.

The figures do not include emissions from naval vessels, fishing boats, and small craft generally. The most-trafficked routes can be seen from maps with emissions distributed over 50x50 km squares. These show traffic to be heaviest along the Atlantic-Suez corridor, in the Bosphorus-Volga transit, the coastal routes around the Gulfs of Valencia and Lion, and the Ligurian, Tyrrhenian, and Adriatic Seas.

Marine Exhaust Emissions Quantification Study – Mediterranean Sea. Lloyd's Register. Report No. 99/EE/7044. December 1999. Made for the Environment directorate of the EU Commission.

Emissions, 000 tons, 1990	NOx	SO ₂
Mediterranean & Black Seas	1725	1246
NE Atlantic Region	1935	1371
France	1590	1300

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Coming events

2000 Future Car Congress. Arlington, Virginia, USA, April 2-6, 2000. *Information:* SAE International, Meetings Division, 400 Commonwealth Drive, Warrendale, PA 15096, USA. Internet: www.sae.org.

16th European PV Energy Conference and Exhibition. Glasgow, UK, May 1-5, 2000. *Information:* WIP, Sylvensteinerstrasse 2. 81369 München, Germany. Internet: www.wip.tnet.de.

4th European conference on mobility management, ECOMM 2000. Bregenz, Austria, May 17-19, 2000. Organized by Austrian Mobility Research. *Information:* Tibor Naphegyi. Fax +43-5522 79232. Internet: www.ecomm2000.at.

EUROSUN. Copenhagen, Denmark, June 19-22, 2000. *Information:* Danish Solar Energy Society, DANVAK, Örholmsvej 40B, 2800 Lyngby, Denmark. Tel. +45-45-877611. E-mail: info@danvak.dk.

Removing market barriers to zero and low emission mobility. Stockholm, Sweden, June 20-21, 2000. *Information:* The ZEUS Project, City of Stockholm, Box 38024, 100 64 Stockholm, Sweden. Internet: www.zeus-europe.org.

Mobility: Challenge of the 21st century. Car-free cities conference. Bremen, Germany, June 24-27, 2000. Internet: www.agenda21.bremen.de/conference2000

WREC-2000. Brighton, England, July 1-7, 2000. World Renewable Energy Congress. *Information:* Ali Sayigh, World Renewable Energy Network, 147 Hilman-ton, Lower Early, Reading RG64 HN, England. Internet: www.wrenuk.co.uk

COP6. Sixth Conference of the Parties to the UN Framework Convention on Climate Change. Hague, The Netherlands, November 13-24, 2000.

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, Chiyoda-ku, Tokyo 102-8646, Japan. E-mail: acid2000@ics-inc.co.jp.