

Acid News

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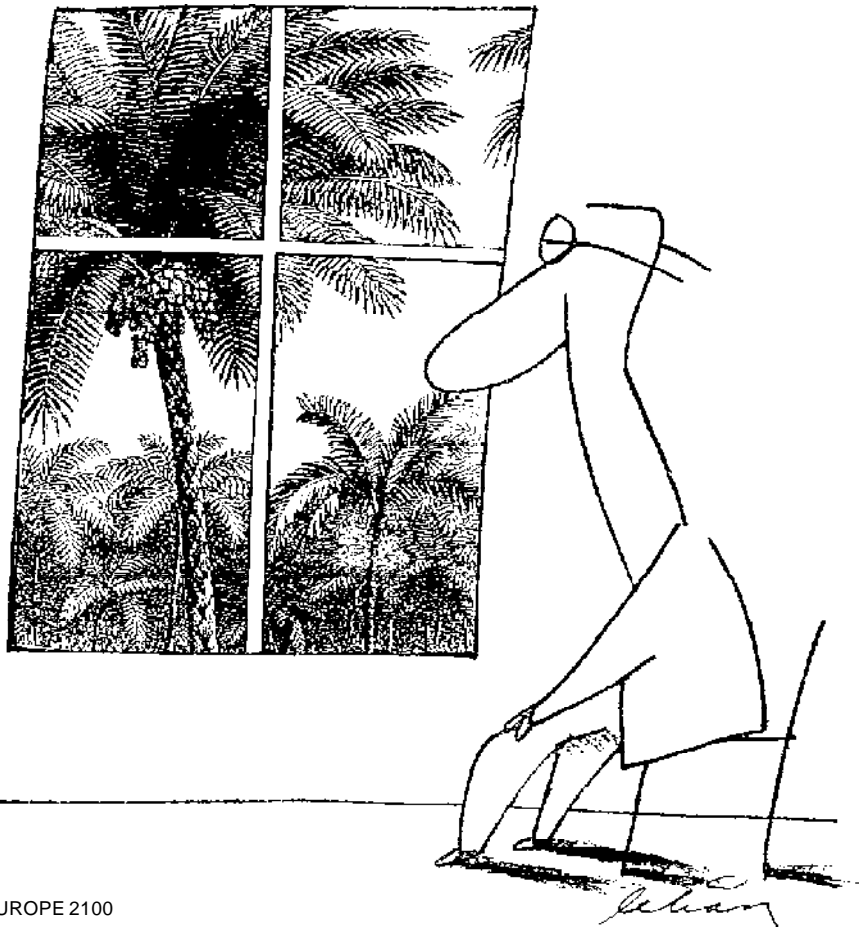
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EUROPE 2100

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A warmer world

Desert-like climate in Spain and shrinking areas of bare mountainside in Europe's far north are likely developments over the next hundred years, according to recent Swedish research.

The latest report from the Intergovernmental Panel on Climate Change (IPCC) indicates a rise of 1.4-5.8°C in average global temperature between 1990 and 2100. This spread is the outcome of a study of twenty or so climate models and some forty scenarios of likely emissions, all of which were deemed equally probable.

The global models give relatively little information however as to the regional effects, and to remedy this, researchers in the Swedish climate study SWECLIM have developed a

model for Europe giving much higher resolution.

This regional one rests on two global models, which have been run with different assumptions as to coming emissions of greenhouse gases – with the outcome that the average global temperature may increase by something between 2.3 and 3.4°C, depending on which model is used and which emission scenario (see box p.4).

But it appears from the regional scenario that the changes will be

Continued on page 4

Acid News

is a newsletter from the Swedish NGO Secretariat on Acid Rain, whose primary aim is to provide information on the subjects of acid rain and the acidification of the environment.

Anyone interested in these problems is invited to contact the secretariat. All requests for information or material will be dealt with to the best of our ability. Acid News is distributed free of charge.

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

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THE SECRETARIAT

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

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

In furtherance of these aims, the secretariat operates by

- Keeping under observation political trends and scientific developments.
- Acting as an information centre, primarily for European environmentalist organizations, but also for the media, authorities, and researchers.
- Producing information material.
- Supporting environmentalist bodies in other countries in their work towards common ends.
- Acting as coordinator of the international activities, including lobbying, of European environmentalist organizations, as for instance in connection with the meetings of the Convention on Long Range Transboundary Air Pollution and policy initiatives in the European Union.
- Acting as an observer at the proceedings involving international agreements for reducing the emissions of greenhouse gases.

EDITORIAL

Dragging its feet

ON JUNE 4 the European parliament voted almost unanimously in support of greatly strengthened measures to reduce the emissions of sulphur dioxide from shipping in European waters. A reduction of 80 per cent was to be achieved in the first place by gradually extending to southern waters the areas of sea where the sulphur content of the bunker fuels that are being used is to be limited, and then by lowering the maximum permitted content to 0.5 per cent. No haste was demanded. Not until 2013 was the limit to apply in all European waters.

From the viewpoint of health and the environment it would be highly unsatisfactory if ships were to be allowed to spew out great quantities of air pollutants for another ten years. But the background to the parliament's attitude is to be found in a well-nigh scandalously weak proposal from the Commission, which would only require the emissions of sulphur from ships to be cut down by one-tenth from their level in 2000.

The fact that parliament was so unanimous in voting for stricter measures shows that the Commission had completely underestimated the need for dealing with ships' emissions. It also shows that the parliament will be sticking to its view at the approaching second reading of the new directive.

Despite all this, in its reply to the outcome of the first reading the Commission chose to ignore the two most important elements in the parliament's list, which were: adding the Mediterranean and the north Atlantic to the seas covered, and later lowering the sulphur limit from 1.5 to 0.5 per cent. As a reason for rejecting these moves, the Commission said it "believes [them] to be premature, as the added benefits and costs were not presented."

That can only be regarded as a badly chosen excuse. Normally it is the business of the Commission to analyse proposals for EU legislation. But actually the Commission has, during the last few years, had three

extensive studies made by consultants concerning the possibilities and consequences of various measures to cut down the emissions of pollutants from ships. It has however only had analyses made of the benefits and costs of its own proposal. The criticism therefore rebounds on the Commission itself.

In the Commission's proposal the economic benefits were said to amount to three times the costs – despite a great likelihood of the cost being overestimated, and the benefits definitely undercalculated (see AN 1/03, p.16). There is no reason to believe that an extension of the sea area, together with lowered limits, should yield such an enormously different result, with costs exceeding the benefits – especially if the latter mainly concern less damage to people's health.

It would be appropriate for the Commission to adopt a more constructive attitude when the matter comes up before the Council of Ministers. It ought therefore to hurry on with its homework, making a proper analysis of the benefits and costs of the parliament's proposals, and this time taking a more realistic view of the costs of measures to bring about an improvement.

Then, too, both the member countries and the Commission should follow parliament's example by finally ceasing to shuffle decision on this matter onto the International Maritime Organization (IMO), a forum dominated by shipping interests flying the flags of countries such as Panama, Liberia, and the Bahamas.

It is the EU that must decide on measures to protect the population and the environment of the member countries – although without of course ceasing to keep up pressure on the IMO to adopt decent global rules for shipping in respect of the environment.

CHRISTER ÅGREN

Developments on wrong course

During the last two years EU emissions have started to rise, putting Kyoto goals at risk.

IN 1999 the situation seemed under control. Since 1990 the overall emissions of greenhouse gases had dropped by 3.6 per cent in the EU. The target under the Kyoto protocol, to have reduced emissions by 8 per cent, seemed within reach.

But during the last two years the trend has been broken. Instead of continuing to go down, emissions have again increased. According to the latest figures from the European Environment Agency, in 2001 they were only 2.3 per cent under their 1990 level.

The increases of the last two years are due to a variety of factors, among which have been the cold winters together with a lower availability of hydropower. Road transport has also continued to increase – emissions of carbon dioxide from transportation went up by almost 20 per cent between 1990 and 2001.

Although the overall figure for emissions of greenhouse gases was somewhat lower in 2001 than in 1990, that for carbon dioxide, the leading greenhouse gas, had risen by 1.6 per cent during the period. This was offset however by reductions in methane and nitrous oxide, which had gone down by 20 and 16 per cent. The effect of six gases on the climate is balanced out in the final figure.

There are marked differences in the EU countries' commitments under the Kyoto protocol, some having to reduce a great deal, others very little. A minority are even allowed to increase their emissions. See table.

According to the latest figures, ten of the fifteen EU member states are on their way to overshooting their agreed share of the emissions by a wide margin. The ten are Austria, Belgium, Denmark, Finland, Greece, Ireland, Italy, the Netherlands, Portugal and Spain.

Farest away from sticking to their commitments are Ireland, Spain and Portugal. Ireland's emissions were 31 per cent higher in 2001 than they had been in 1990 – well over double the 13 per cent increase

actually allowed for the period from 1990 to 2008-2012.

In Spain greater hydropower output, reducing the need to use fossil fuels for the production of power and heat, brought a drop in emissions of 1.1 per cent from 2000 to 2001 – for the first time in five years. Emissions are however still 33 per cent higher than in 1990. Under the EU

burden-sharing agreement the country is only allowed an increase of 15 per cent from 1990 to 2008-2012.

PER ELVINGSON

¹ Annual European Community Greenhouse Gas Inventory 1990-2001 and Inventory Report 2003. EEA Technical Report No 95. Available in pdf format at www.eea.eu.int

Emissions of greenhouse gases in the base year and in 2001, with the percentage of change up to 2001 and commitment under the EU burden-sharing agreement.

	Base year ¹ (mill. tons)	2001 (million tons)	Change base year -2001	Target base year -2008/12
Austria	78.3	85.9	9.6%	-13.0%
Belgium	141.2	150.2	6.3%	-7.5%
Denmark	69.5	69.4	-0.2%	-21.0%
Finland	77.2	80.9	4.7%	0.0%
France	558.4	560.8	0.4%	0.0%
Germany	1216.2	993.5	-18.3%	-21.0%
Greece	107.0	132.2	23.5%	25.0%
Ireland	53.4	70.0	31.1%	13.0%
Italy	509.3	545.4	7.1%	-6.5%
Luxembourg	10.9	6.1	-44.2%	-28.0%
Netherlands	211.1	219.7	4.1%	-6.0%
Portugal	61.4	83.8	36.4%	27.0%
Spain	289.9	382.8	32.1%	15.0%
Sweden	72.9	70.5	-3.3%	4.0%
UK	747.2	657.2	-12.0%	-12.5%
EU-15	4204.0	4108.3	-2.3%	-8.0%

¹ Base year for carbon dioxide, methane and nitrous oxide is 1990. For fluorinated gases 1995 is used as the base year, as allowed for under the Kyoto Protocol. This reflects the preference of most member states.

Could well drop by 16 per cent

It will be fully possible for the EU to reduce its emissions of greenhouse gases by 8 per cent between 1990 and 2010. The actual potential is at least twice as great, according to a progress report under the Commission's European Climate Change Programme (ECCP).

The ECCP was started in 2000 to iden-

tify the most environmentally beneficial and cost-effective additional measures as a means of enabling the EU to meet its target under the Kyoto protocol, complementing the efforts of member states.

The full ECCP report as well as a summary can be found at www.europa.eu.int/comm/environment/climat/eccp.htm

greater in Europe than the global average.

The maps in Figure 1 show the increases in average temperature as derived from each model (average values for 2071-2100 compared with what they were in 1961-1990).

Marked as it is, the average annual temperature rise gives no indication however of the still greater changes that are likely to occur in winter in northern Europe and in summer in the southwest.

The difference in winter in the north (December to February) is due to the fact that less of the incoming radiation will be reflected back into space when the snow and ice cover shrinks both in time and extent. In Finland, the Baltic states, Belarus and further east the average winter temperature may rise as much as 5-6°C over its present level, with an accompanying great decrease in the number of very cold days.

It appears from both models that the average summer temperature (June-August) may rise by 7-8°C in Spain and central France. Since it is difficult to explain the reason for this, the researchers prefer however to remain reticent.

The general warming will mean that climate zones will move northwards. Temperatures in southern Scandinavia will be more like those now prevailing in central France, while central Spain will suffer desert heat as now in Morocco, with average summer temperature approaching 30°C, and it will be almost as warm eastwards in the Mediterranean region. In both cases there will be a great increase in the number of very hot days.

Besides a great increase in temperature, the Mediterranean region may also suffer less rainfall (Figure 2). This will be especially noticeable in summer (June-August), when the already small amounts could be halved. The increased drought in summertime may cause problems as far north as the UK and southern Scandinavia. There may however be a slight increase in the annual rainfall in the north, and the rain may generally be heavier in the northern and central parts of the continent.

If these changes should actually occur, the effects on humans and the natural environment could be very far-reaching. Those on agriculture

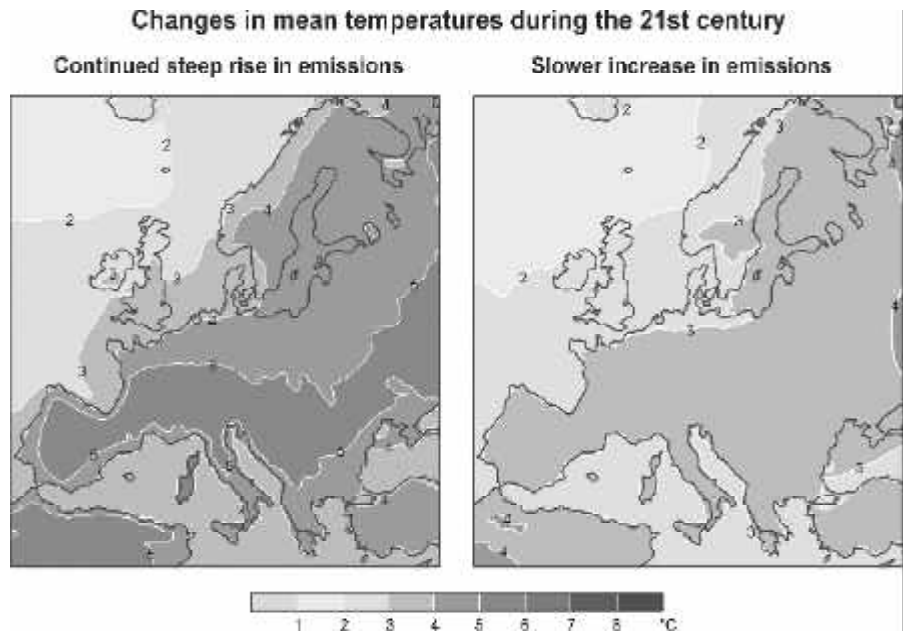


Figure 1. Changes in average annual temperature (°C) 2000-2100. The map on the left shows what would come from a continued rapid increase in emissions (Scenario A2), that on the right the result of a slower rate of increase (Scenario B2).

and forestry might be favourable in northern Europe, but mainly the opposite in the south – due primarily to a diminished supply of water there. Excessively high temperatures may lead to a drop in the numbers of summer tourists around the Mediterranean, and insufficient snow may do the same for winter tourism in the Alps. And heavier winter rains will increase the risk of flooding in central and northern Europe.

The effects on European ecosys-

tems are also likely to be considerable. The climate zones in Scandinavia may for instance advance northwards at a rate of 500 km per hundred years, or by one metre per hour. Numerous plant species would fail to keep up, and there is a further complication in the lack of uninterrupted areas for the spread of many species that are already hard pressed.

The treeline in Swedish mountain parts is estimated to move upwards by 150 meters with every degree of

Models and scenarios

The SWECLIM model for Europe rests on two separate global models – one from the Hadley Centre in the UK (HadAM₃) and the other from the Max Planck Institute in Germany (ECHAM₄/OPYC₃).

For emission scenarios it has taken two of the six so-called illustrative ones used by the IPCC in its third assessment report (2001). These are:

- A2, in which emissions of carbon dioxide are doubled between 2000 and 2100. The atmospheric concentration in 2100 would then be 850 ppm.
- B2, assuming an increase of 50 per cent during the same period, making the atmospheric concentration 600 ppm.

The changes in average global temperature arising from the two models between 1961-1990 and 2071-2100 (°C):

	Hadley	Max Planck
A2	+3.2	+3.4
B2	+2.3	+2.6

Note that there will be no full effect of the temperature rises before the climate system has reached a state of equilibrium, which may take several hundred years, by which time the temperature may have risen by several degrees compared with the figures in the table.

Emissions tending to increase

DURING THE NINETIES the industrialized countries total emissions of greenhouse gases fell off slightly, due for the most part to the slackening of the economies in eastern Europe, where emissions declined by good third. But with recovery now taking place in the east, the emissions total is on the way up again.

From information assembled by the climate convention's secretariat,¹ it appears that the combined emissions of western Europe, Japan, the United States and other highly industrialized countries could grow by 8 per cent from 2000 to 2010, bring them to about 17 per cent over their 1990 level. And that despite measures to limit them.

But with emissions from the so-called transition countries of Central and Eastern Europe now starting to increase again, those of the developed world as a whole (highly industrialized plus transition countries) are likely to increase by 11 per cent from 2000 to 2010, making them 10 per cent over their 1990 level. Much of this trend can be laid to the continued increase in emissions that is expected in the US.

During the nineties several other highly industrialized countries allowed their emissions to increase. Australia let them go up by 18 per cent, Canada by 20 per cent, the US by 14 per cent, and New Zealand and Japan by 5 and 11 per cent respectively. With no more than 20 per cent of global population, the industrialized countries account for 60 per cent of the annual emissions of carbon dioxide.

PER ELVINGSON

¹ **Communications from Parties included in Annex I to the Convention: Compilation and Synthesis of Third National Communications.** UN Framework Convention on Climate Change. June 2003. Available in pdf format: www.unfccc.int/resource/docs/2003/sbi/07.pdf.

Precipitation changes during the 21st century

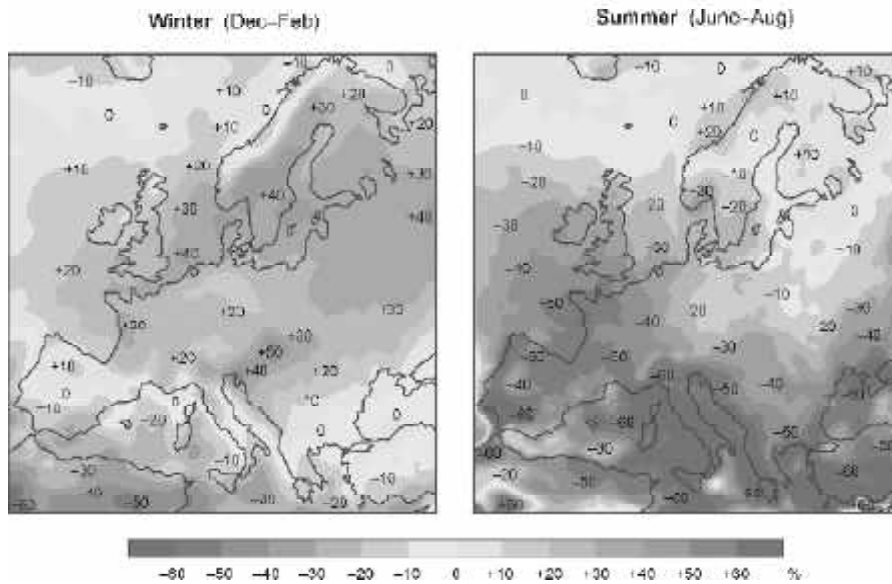


Figure 2. Changes (in per cent) in winter and summer precipitation, 2000-2100. During the winter period (December-February) the precipitation increases over most of the continent. The rainfall may also be heavier. In summer the climate will be noticeably drier, especially in southern Europe.

temperature increase. This may mean that only a fraction of bare mountain above the treeline will remain if the temperature rises by 3-4 degrees C.

Biological diversity will be at great risk in southern Europe as well, where heat and drought will kill off much of the present fauna and flora. Since there will be few species that can withstand desert-like conditions, any invasion of new ones from the south seems likely to be limited.

It should be worth noting that the extensive effects so far described might occur even if the global average temperature had only risen by barely 3°C in 2100, from its present level (Scenario A2).

If on the other hand the global

temperature should have risen by about 6°C in 2100 (which the IPCC considers within the range of possibility), or if we move the date onwards by some further hundred years (when emissions will have had their full effect), the effects on Europe will be far, far greater than here described.

PER ELVINGSON

The SWECLIM scenarios are described in detail in **A Warmer World**, which also includes a thorough but easily readable account of the conclusions drawn in IPCC's third assessment report. Published by the Swedish Environmental Protection Agency, S-106 48 Stockholm, Sweden. 166 pp. SEK 225. E-mail order: natur@cm.se.

Breaking records

The world's weather is rapidly breaking away from existing patterns with an increasing number of extremes and climate crises, is the content of a press release issued by the World Meteorological Organisation on July 2.

It states for instance that southern France recorded temperatures in June that were 5-7 degrees C above average, Switzerland had its hottest June in at least 250 years, there were 562 tornadoes in the USA in May, breaking the previous record for one month of 399 from 1992,

and the pre-monsoon heatwave in India saw temperatures 2-5 degrees above average, which caused 1400 deaths.

The year 2003 is set to become the hottest ever. The ten hottest years in 143 years of monitoring have all been since 1990, with a top three of 1998, 2002, and 2001.

Normally the WMO only issues detailed scientific reports and statistics after the end of each year, so the July release came unexpectedly.

Further reading: www.wmo.ch

Strong call for tougher action

The EU parliament is urging tougher measures than proposed by the Commission.

ON JUNE 4 the European Parliament voted almost unanimously to demand greatly reduced emissions of sulphur dioxide from ships. If its proposal should be accepted by the Council of Ministers and the Commission, within ten years the emissions from shipping in European waters could have come down by about 80 per cent.

A Commission proposal for revision of Directive 99/32/EC concerning the sulphur content of marine fuels had been put forward in November last year (reported in AN 1/03, pp. 4-5). It was not especially far-reaching, being confined in the main to securing the 1.5-per-cent limit for sulphur in the fuel of ships plying in the North Sea and the Baltic – as had in fact already been laid down in Annex VI under the IMO MARPOL Convention.

The Commission was however proposing to extend this limit to ferries in regular service to or from any Community port, and to ordain that the sulphur content of fuel used by vessels lying in port should not exceed 0.2 per cent. But even if fully implemented, the combined effect of these measures would only be to reduce the emissions of sulphur by 10 per cent, from their level in 2000.

There was quite evidently strong support for stronger measures when the matter came up at the meeting of the parliament's environment committee last April (AN 2/03, p. 4), so in May the parliamentary rapporteur, Alexander de Roo of the Greens, set going talks with the other parties in the parliament, with the aim of arriving at a compromise that would have the support of a broad majority when it came to voting at the plenary session in June. The intention was to bring about a reduction of 80 per cent in ships' emissions.

The strategy worked. The agreed text got the support of all the chief parties. Of the 520 members who were present at the vote on June 4, between 505 and 510 declared themselves in favour of it. Put briefly, this means that the parliament is urging the introduction of gradually tighter



measures, as follows:

STAGE 1. The introduction of the limit of 1.5 per cent sulphur in marine fuels is to be brought forward to

six months after the entry into force of the directive for northern European sea areas (the Baltic and the North Sea with the inclusion of the

The Commission's attitude

ON AUGUST 1 the Commission presented its views on the amendments that had been passed by the European parliament in June, together with the changes it was proposing in its new directive. Of the parliament's 40 or so amendments, the Commission is willing to agree, by and large, with all but six.

Among those that the Commission does not accept are some that would further lower the sulphur content (from 1.5 to 0.5 per cent) in a second stage, and also extend the region in which these requirements shall apply to the southern sea areas (the Mediterranean and the northeastern Atlantic).

Nor does the Commission agree to bringing forward the date at

which it is to report and present a revision by two years (making it December 2008 instead of 2010).

It does on the other hand agree to changing the deadline for making the directive law from 12 months to 6 after its entry into force. It also agrees to somewhat stricter procedures for sampling and monitoring, yet without accepting all the proposed amendments. It accepts, too, the introduction of a new article on trials for abatement technologies, even if its proposal for a text is shorter and less detailed than the parliament's.

The new version of the directive can be found on internet; www.europa.eu.int/comm/environment/air/transport.htm#3

English Channel), and the limit is also to apply to ferries in all EU waters. As from December 31, 2010, it is to apply, too, in southern sea areas (the Mediterranean and the north-eastern Atlantic).

STAGE 2. Lowering the limit, from December 31, 2008, to 0.5 per cent sulphur for all ships in northern European waters and for ferries in all EU sea areas, and from December 31, 2012, in the remaining European sea areas. These limits would apply to ships registered anywhere in the world, regardless of what port they start off from.

At the request of the Conservative party (PPE), the text also allows the possibility of carrying out pilot trials to assess and eventually develop new technologies for abatement (such as sea-water scrubbing of the exhausts). There would be no requirement to use low-sulphur fuels during the trials. The Commission shall then consider which, if any, of the abatement methods might be permissible as an alternative or complement to low-sulphur fuels.

If any of these abatement methods are shown to be successful and acceptable, the Commission should, before December 31, 2007, make proposals for a further revision of the directive, with the possible inclusion of economic instruments.

Comments Melissa Shinn, clean-air coordinator at the European Environmental Bureau: "This is a very satisfactory result. The European Parliament gave absolutely unequivocal support to the implementation of the necessary measures to enable the Community to achieve its health and ecosystem protection objectives concerning particles and sulphur dioxide. Strictly speaking the required 80-per-cent emission reductions should have been brought in much earlier in order to meet the 2010 objectives; however, the timeline set should allow the shipping industry to have a clear road-map and more than enough time with which to adapt."

The next step will now be for the EU environment ministers to arrive at their common position. The fact that the parliament has reached such a high degree of unanimity on the matter must surely be a strong signal that it will maintain its attitude at the second reading of the proposal.

CHRISTER ÅGREN

SHIPS

Far worse polluters than road vehicles

A REPORT that has just been published on the use of chemicals in the shipping industry¹ states that the emissions of polycyclic aromatic hydrocarbons (PAH) are ten times higher per unit of energy from the burning of heavy oil (marine residual fuel) than from marine gas oil.

The aim of the report, which has been made as part of a project called "Grön Kemi" (Green Chemistry) has been to indicate ways in which the situation as regards health and the environment can be improved on ships and also to some extent in ports.

It starts by noting that world shipping handles and consumes 150 million tons of bunker fuel (mostly marine residual) a year. Because of its high content of polycyclic aromatics, this type of oil is classified as carcinogenic and harmful to the environment.

The PAH emissions from a ship using marine residual fuel are about 30 times higher per unit of energy than those from a heavy diesel-driven vehicle. This means that if the output of a ship's engine is say, 40 times that of a diesel vehicle, the emissions from a fairly large vessel entering port will correspond to those from about 1200 heavy diesels.

Many ships now burn heavy oil even in port areas, and as a result of

engine improvements, even more are using it for their auxiliary engines, say for generating electricity, while berthed. The consequent emissions of sulphur dioxide and PAH must be contributing considerably to the worsened quality of the air in the surrounding urban areas.

The authors of the report think that this problem could be simply and easily dealt with by switching to the sole use of low-sulphur marine gas oils (with less than 0.2 per cent sulphur) in and around ports. A further advantage would lie in the fact that such fuels have much lower contents of PAH.

They also observe that the emissions of sulphur dioxide and particulates from ships are markedly higher, per ton-kilometre, than from road transport, and suggest switching to low-sulphur marine residual fuels (with at most 1 per cent sulphur). The emissions of nitrogen oxides could be reduced by installing nitrogen cleaning, say, by the HAM (humid air motor) method or selective catalytic reduction (SCR), both of which can cut down NO_x emissions by more than three-quarters.

CHRISTER ÅGREN

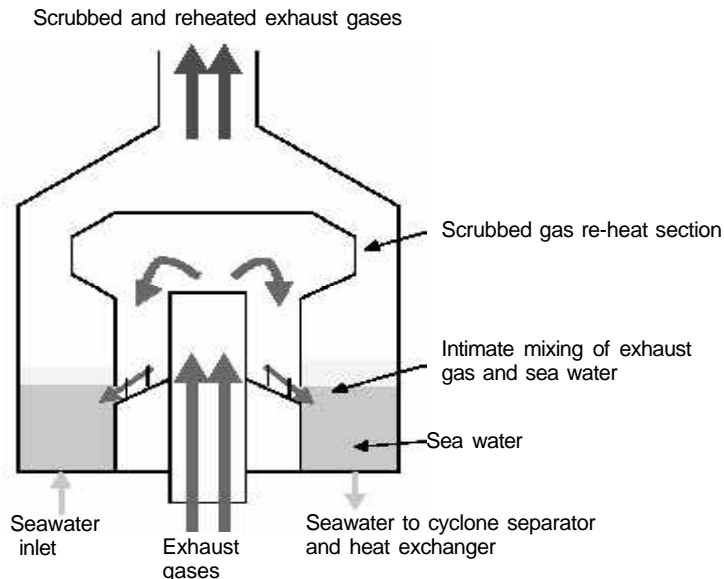
¹ *Rent skepp kommer lastat*. May 2003. By Jan Ahlbom and Ulf Duus. In Swedish. An English abstract is available in pdf format at www.gronkemi.nu/skepp.html

MARPOL ANNEX VI

Some likelihood of it soon coming into force

IT WAS ANNOUNCED at the meeting of IMO's Marine and Environment Protection Committee (MEPC) in July that MARPOL Annex VI had been ratified by 11 states representing well over 50 per cent of the gross tonnage of the world's merchant shipping. Consequently, to satisfy the conditions for its entry into force, ratifi-

cation is now only required from four more states. The Annex enters into force twelve months after it has been ratified by at least 15 states representing not less than 50 per cent of world merchant shipping tonnage. It was announced that Cyprus, Italy, Japan, and Spain expected to ratify before the end of this year.



SHIPS' EMISSIONS

Instead of low-sulphur fuel

Trials with seawater as a means of cleaning ships' exhaust gases from sulphur.

A TEST OF seawater scrubbing as a means of cutting down the emissions of air pollutants from ships has started this summer. It is being carried out jointly by the P&O shipping line and BP Marine, who believe it will provide evidence of the benefits of shipboard solutions for improving the environmental performance of shipping.

This spring two of the P&O's ferries underwent major refits. One of them, the *Pride of Kent*, was provided with a new technology, called Eco-Silencer, for removing sulphur and other pollutants from the funnel exhausts. Altogether eight Eco-Silencers were installed – one at each of its four main engines, and another four at the auxiliary engines (generators), at a total cost of about £1.5 million. A sister ship, the *Pride of Canterbury*, sailing the same route and using the same fuel, but without Eco-Silencers, will provide a reference.

Eco-Silencers bring seawater into close contact with the ship's exhaust gases so as to transfer the oxides of sulphur from the gas to the water in a process known as scrubbing. After scrubbing the seawater is filtered to remove particulates, which are trapped and collected for disposal. The seawater is recirculated back into the sea, where the sulphur dioxide goes into solution as sulphate,

which is a natural component of seawater.

Peter Smith, P&O director with responsibility for environmental issues, said: "We decided to invest in this technology as we believe it is the most effective and efficient way to clean up exhaust gases. We expect to be able to cut sulphur emissions by 95 and particulates by 80 per cent."

Don Gregory, BP Marine's Environment and Clean Fuels Manager, announced: "We expect to complete

the trials by summer 2004, and then we will make the results available to the [shipping] industry and legislative authorities."

CHRISTER ÅGREN

More information on the Eco-Silencer: www.dmeinternational.com/marineexhaust/faq

Note. This test of seawater scrubbing is coincident with the EU Commission's proposal for a directive to reduce the emissions of air pollutants from shipping. See page 6.

Seawater scrubbing

Seawater scrubbing as a means of reducing the emissions of sulphur from ships is by no means new – it had been given a trial in Norway more than ten years ago. For various reasons however it has never come into general use – mainly, it seems, because there have been no requirements to bring about a reduction of emissions, but also because of uncertainty as to the possible negative effects on the sea of releasing waste water containing sulphate from the scrubbers.

According to the rules for SO_x Emission Control Areas (SECAs), as set down in MARPOL Annex VI, which were agreed in 1997 but have not yet come into force, ships traversing SECAs must

either use fuel with no more than 1.5 per cent sulphur or employ some exhaust-gas cleaning system that confines emissions to 6.0 grams SO₂/kWh.

The cleaning system must be approved, and "waste streams from the use of such equipment shall not be discharged into enclosed ports, harbours and estuaries unless it can be thoroughly documented by the ship that such waste streams have no adverse impact on the ecosystems of such enclosed ports, harbours and estuaries based upon criteria provided by the authorities of the port state."

As far as is known, such criteria has as yet not been developed.

Compromise will enable a start by 2005

But proposal to allow companies credits for projects outside the EU is frowned down.

AT SECOND READING in July the European parliament voted to accept a compromise with the Council of Ministers which means that emissions trading with carbon dioxide will be able to start throughout the extended EU in 2005.¹ Each country will have to inform the Commission of the way in which it intends to distribute its emission quotas at the latest by March 2004.

The proposal for an emissions-trading directive was put forward as an important component of EU climate policy in 2001. The compromise that has now been reached concerns such matters as the size of the emission rights that are to be granted to participating companies, whether they should be distributed free or auctioned off, and whether further industrial activities and other greenhouse gases should be included than the Commission had proposed (see box).

The compromise version was welcomed by several representatives of industrial associations because of the possibility it allows of reducing emissions where the cost is lowest. There were however also warnings of harder competition from countries such as the US, India, and China where there are no corresponding requirements for cutting down emissions.

Calling it an important step forward, five leading environmentalist organizations commented in a joint press release: "What is needed now are strict national caps on carbon-dioxide emissions. Weak caps would punish those businesses that are already investing in clean technologies, while rewarding laggards, thus destroying an important driver for European innovation."

A further proposal from the Commission to make the trading scheme compatible with the flexible mechanisms of the Kyoto protocol² was all the more criticized. "Commission shoots its own emission-trading system full of holes" was the heading of a press release from the Climate Action Network Europe.

The Commission's new proposal had amounted briefly to this: An EU company could take action to reduce emissions in some other part of the world and count the gain as credit in the EU scheme. Such projects would however have to fulfill the requirements of the Kyoto protocol.³ Among

"Commission shoots its own emission-trading system full of holes"

the projects that would not qualify are those involving carbon sinks (planting forests, etc.) and nuclear power.

While not wishing to directly limit the proportion deriving from projects in other parts of the world, the Commission does envisage an automatic review of the situation as soon as that proportion exceeds 6 per cent of all the emission rights allotted in the EU between 2008 and 2012.

The Climate Action Network is also critical of the Commission's

proposal as being likely to weaken the incentive to reduce emissions in the industrialized countries, saying: "Rather than using the trading system to add financial value to emission cuts, companies are likely to be faced with a flood of available credits from cheap and often damaging projects, including hydroelectric dams and projects that would have happened in any case."

PER ELVINGSON

¹ Directive establishing a scheme for greenhouse gas emissions trading within the Community (2003/.../EC).

² Proposal for a Directive amending the Directive establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms. COM (2003)403.

³ This concerns the Joint Implementation and Clean Development Mechanism. JI projects must be undertaken in countries with targets for quantitative emission reductions under the Kyoto protocol. CDM projects are to be hosted by developing countries with no quantitative targets. More information on the Kyoto protocol and its flexible mechanisms can be obtained from environmental factsheet No. 12, a supplement to Acid News 1/03.

The emissions-trading compromise

Emissions trading is to be put into practice at first within the EU during 2005-07. After that international trading is to start in accordance with the rules of the Kyoto protocol, provided that protocol has by then entered into force.

During the first period trading will only be in emissions of carbon dioxide from parts of the energy and manufacturing sectors, comprising approximately 10,000 plants that are estimated to be responsible for nearly half of the Community's emissions of carbon dioxide. The Commission is however to consider the possibility of including other greenhouse gases and

other industrial activities, such as chemical manufacturing and transportation.

While there is no limit to the number of emission rights any country may allocate to its industries, allocations must accord with commitments under the Kyoto protocol.

To begin with, most of the emission rights are to be allocated free of charge. No more than 5 per cent may be auctioned off in any country. The European parliament, as well as many environmentalist organizations, had wanted it to be obligatory for countries to auction off at least part of the rights.

CO₂ emissions can be halved

Measures to cut the demand for electricity and promote the use of renewables are key elements.

IF WE ARE TO AVOID disastrous climate change, worldwide emissions of greenhouse gases will have to be turned downwards within a couple of decades. And it means changes will have to be made in particular in the power sector, which currently is responsible for 37 per cent of global emissions. The potential is great, according to an EU-wide study¹ by Ecofys consultants.

If nothing is done, electricity demand in the EU is likely to be up by 50 per cent in 2020. The power sector's emissions of carbon dioxide might then be 23 per cent over their 1995 levels.

The consultants have estimated the possibilities of getting down under the level of such a "business-as-usual" scenario. While it is difficult to calculate exactly how much of the potential for reduction can be realized, they have nevertheless made a cautious estimate of what could be done.

They came to the conclusion that, on the basis of "real-life" experience in progressive countries, carbon-dioxide emissions from the EU power sector could have been brought down by 20 per cent by 2010, and 61 per cent by 2020, from the levels that would have prevailed under business as usual. In actual figures that would amount to something like a halving of current emissions (see chart). If the trend should then continue, the result could be a wholly "carbon-neutral" power sector around 2040.

The main difference between the outcome of this so-called Power Switch scenario and a business-as-usual one is that under the former there would also be numerous measures to ensure a slower growth in the demand for electricity, making it 27 per cent lower in 2020 than under business as usual.

Seen from the input side, the big reductions in the emissions of carbon dioxide would come from an increased use of renewable energy and an expansion of combined heat-and-power, together with a switch from

coal to natural gas.

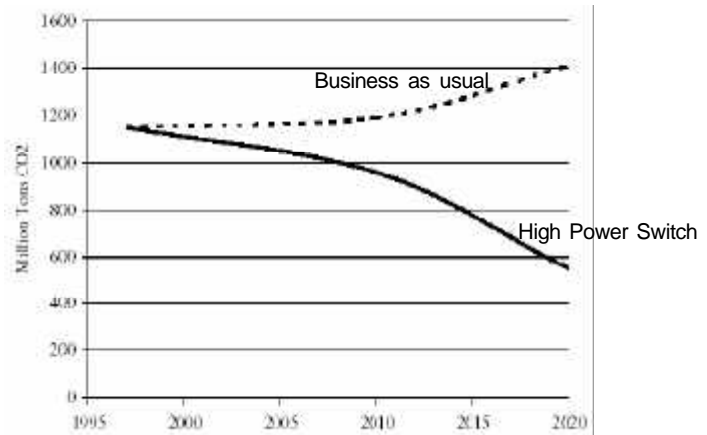
In the Power Switch scenario the share of renewable energy in the fuel mix would rise to 50-60 per cent, while wind capacity would attain 60 GW in 2010 and 150 GW in 2020 – equalling in other words the whole UK generating capacity in 2010, and that for the UK, Germany, and Belgium combined in 2020.

Ecofys says the social cost of such a relatively large and rapid re-arrangement of the power sector

*The share of renewables
in the fuel mix would
rise to 50-60 per cent*

need not be very great. Measures taken on the consumer side to cut down demand could actually pay in terms of money.

Fuel switching would be likely to cost 10-60 euros per ton of carbon dioxide eliminated (at social discount rates), tending to be at the higher end of the scale in 2010 but at the lower in 2020 as technology improves and costs fall. The increased cost per capita should be around 10 euros in 2010 and 30 euros in 2020. Although the gains



With measures to reduce the increase in demand for electricity, combined with an increased use of combined heat-and-power as well as renewables, the power sector's emissions of carbon dioxide could be halved by 2020.

from reducing the emissions of air pollutants that would affect health and the environment have not been calculated, they can be assumed to be considerable.

The study had been commissioned by the Worldwide Fund for Nature as part of a new campaign going under the name of Power Switch. It is noted that the power sector is due for extensive reshaping. As the WWF points out, half of the German plants will soon have to be replaced.

Revamping the power sector is said to require substantial changes in energy policies and taxes on energy, as well as market incentives. The WWF is also addressing the big generators directly. Says Jennifer Morgan, director of WWF's Climate Change Programme:

"The onus is on the power producers of the world, such as RWE, Vattenfall and E.ON in Germany. We challenge these companies to make a firm commitment to be a part of the solution to global warming. The technical solutions exist and are cost-effective. What we need to see now is responsible leadership amongst the biggest polluters."

PER ELVINGSON

¹ Low Carbon Electricity Systems in the European Union. information can be had from www.panda.org/climate.

Effects of ozone underestimated

Of late particulates have been predominant in debate on the effects of air pollutants on health, but research is now revealing ground-level ozone as the cause of numerous premature deaths.

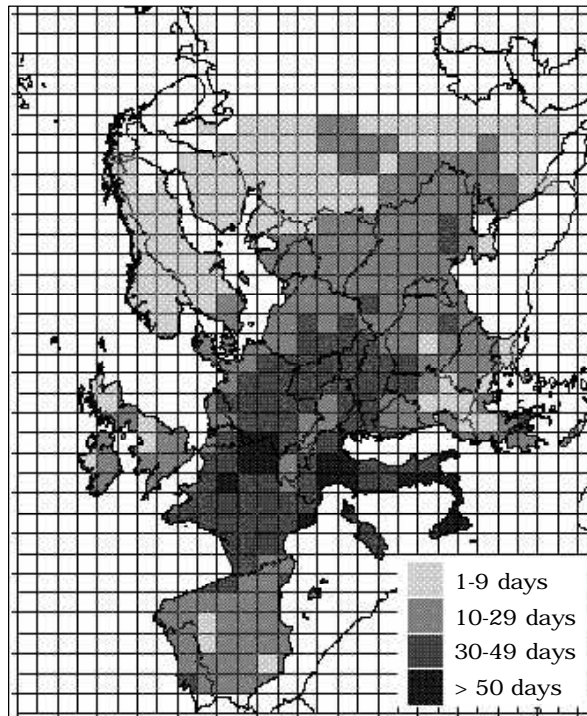
THE EFFECTS of ground-level ozone on health are probably much more extensive than has previously been assumed. That at any rate is what appears from modelling of two aspects of short-term exposure that has been made in Sweden – where concentrations are, by European standards, actually quite low.

The number of extra cases of hospitalization resulting from exposure to ozone in Sweden are now estimated to be 2800 a year, as against 90-360 from a previous study. The great difference comes from the fact that there is not believed to be any threshold value below which no effects will occur. Previous estimates were confined to episodes with high concentrations.

Ozone has moreover an adverse effect on lung functioning, clearly leading to increased mortality in the long term. Recent Swedish figures show at least 1700 premature deaths per year to have been due to ozone exposure. The extent to which this have shortened life expectancy can however not be estimated on the basis of available data.

The two effects of exposure quantified in the study only show, according to the researchers, “the tip of the iceberg.” There are numerous others, which are however difficult to assess for lack of data. Among them are the effects of exposure to low concentrations over a long period of time, and respiratory complaints that were insufficient for hospitalization. It was however found from a study made in New York that the acute intakes due to ozone were seven times greater than for cases of respiratory disease, and the number of asthma cases from ozone was 350 times greater.

There can also be synergetic effects where ozone adds to those from other pollutants. It was found for instance in the all-European study APHEA2 that the part played by particles in cases of hospitalization of older people due to difficulties in



In comparison with the central parts of Europe, ozone concentrations are low in Sweden – but are still calculated to cause 2800 extra cases of hospitalization and at least 1700 premature deaths every year.

Map shows the number of days on which ozone concentrations exceeded $120 \mu\text{g}/\text{m}^3$ as an 8-hour floating value. The underlying data, based on emissions of air pollutants in 1990, represents floating average values from five years of meteorological observations.

Source: IIASA, 1999.

breathing increased in step with the rise in ozone concentrations.

The Swedish calculations show that it will pay to hold ozone levels down. By not exceeding a concentration of $60 \mu\text{g}/\text{m}^3$ (8-hour average) 1800 hospital cases and 1160 premature deaths could be avoided – a reduction of two-thirds for each. The interim EU target value, due to come into effect in 2010, is $120 \mu\text{g}/\text{m}^3$ as 8-hour mean, which may not be

exceeded more than 25 times a year.

The principal air pollutants causing the formation of ground-level ozone are nitrogen oxides and volatile organic compounds.

PER ELVINGSON

Source: *Hälsokonsekvenser av ozon – en kvantifiering av det marknära ozonets korttidseffekter på antalet sjukhusinläggningar och dödsfall i Sverige* (in Swedish only). Bertil Forsberg et al. Umeå University, 2003. Available at www.fhi.se.

Dose-response relationship in the Swedish study

Deaths. Daily increase (excluding violent deaths) is assumed to be 0.4 per cent for every $10 \mu\text{g}/\text{m}^3$ increase of the maximum 8-hour mean value, with a statistical uncertainty interval of 0.2-0.5 per cent.

Hospitalization. Daily increase in the number of admittances for respiratory illness is assumed to be 0.7 per cent for every $10 \mu\text{g}/\text{m}^3$ ozone increase. Uncertainty interval: 0.3-1.0 per cent.

The effect of ozone is deemed in general to be greater in cases of deaths from respiratory causes than of those from heart-artery disease. Although there seems to be no lower threshold, according to some studies the risks are greater for every unit of concentration increase ($\mu\text{g}/\text{m}^3$) at higher concentrations than at lower ones.

Hybrid vehicles could be just as good

Fuel cells are not the solution to all environmental problems that carmakers with government support would like them to be.

SEVERAL OF the big carmakers are intending to start mass producing fuel-cell cars in a matter of a few years, and some already have prototype vehicles equipped with them. Billions of dollars are being spent every year on research and development. But whether there will be any real environmental gain from them will depend on the prime energy source that is used to produce the hydrogen and on the overall efficiency of the system.

The argument most often put forward for fuel cells is that they don't give rise to any harmful emissions in the form either of substances inimical to health or the environment, or of the greenhouse gas carbon dioxide. It is also claimed that fuel-cell cars operate more efficiently than conventional types, by getting more out of the fuel.

For a true comparison, fuel-cell cars ought to be judged against internal combustion-engine types that will be on the market in five to ten years. The requirements that will then prevail in Europe will have made for such clean ordinary cars that it will hardly be possible to point to any special advantage in respect of air quality for those powered by fuel cells.

What then about energy efficiency and carbon dioxide emissions?

The fuel cell that is most likely to be used for cars (PEM, see factfile) has a high efficiency, and converts – at least in continuous running – 50 to 60 per cent of the applied chemical energy to electricity, which is then converted into movement in electric motors. Compared with an internal combustion-engined car, the total vehicle efficiency is very good – the energy being converted to propulsion almost doubly effectively. But for a comparison of total effect, one must look at the whole energy chain.



Honda Civic, an energy-efficient hybrid car.



Neocar 5 from DaimlerChrysler, a fuel-cell car prototype.

Fuel cells run on hydrogen and oxygen (the latter being taken from the air) and hydrogen has to be stored in the vehicle. This is now usually being done in the form of liquid hydrogen or gas in pressure tanks. Since hydrogen does not contain so much energy per unit of volume as, say, petrol or natural gas, it needs tanks capable of withstanding very high pressure. Liquid hydrogen must

For a comparison of total effect, one must look at the whole energy chain

be kept at temperatures around -250 °C. The tanks must thus either be able to withstand very high pressure or be very well insulated.

A considerable amount of energy is needed to cool down hydrogen in order to make it liquid at -253°C. In fact as much as corresponds to 30 per cent of its own energy content. Compressing it also uses energy – about 5-10 per cent of that in the gas to reach 300 bar.

Further losses occur during transport to the tank stations. Moving petrol or diesel costs at the most a

few per cent of the fuel's energy content. But taking hydrogen 100 kilometres by truck requires more than 15 per cent, and almost 40 per cent if the distance is 200 kilometres.

The cost in terms of energy is lower if the hydrogen is moved by pipeline; but it is still much greater than that for natural gas, for example, since a greater volume of hydrogen must be transported to deliver the same amount of energy.

Since there are no great accumulations of hydrogen anywhere on earth, it has to be produced by using energy from other sources. The two most usual ways of making hydrogen today are to split it off from hydrocarbon compounds, such as natural gas, or to split water into hydrogen and oxygen by using electricity.

Producing hydrogen by splitting water with electricity is an energy-consuming process involving a loss of 15-25 per cent in the form of heat. How it relates to the climate problem will depend on the way the electricity is generated. In the scenarios it is often assumed that hydrogen will be made with electricity from windmills or solar panels – which have a very low environmental effect.

But in real life and globally, electricity is still mostly generated by burning fossil fuels – coal, natural

gas, and oil. Since it is hardly likely that the whole generating apparatus will be converted to the use of renewables in any near future, it cannot be assumed that hydrogen will only be produced from renewable sources.

Therefore to sum up:

- ❑ A fuel-cell car uses energy at least twice as efficiently as one with an internal combustion engine.
- ❑ Obtaining one unit of energy for a fuel-cell car requires, at a low estimate, three units of primary energy – at least two-thirds vanishing in processing and transport losses in the power-plant-electricity distribution-electrolysis-hydrogen storage-and-transport chain.
- ❑ In the case of conventional fossil fuels it can be assumed that losses in production, storage and distribution will amount to 10 per cent of the internal energy, or perhaps less.
- ❑ If fossil fuels are used for the generation of the electricity needed for the production of hydrogen, the energy used and the emissions of carbon dioxide from a fuel-cell car will in all probability be *higher* than those from a conventional one. In other words, as long as global electricity production remains largely based on fossil fuels, there will be a risk of fuel-

cell cars increasing the emissions of carbon dioxide rather than diminishing them.

Hydrogen can also be made from hydrocarbon substances such as methane or methanol by subjecting them to high temperatures in so-called reformers. The extent of the

*Electricity is still
mostly generated by
burning fossil fuels*

climate effect will again depend on the required energy – whether it is fossil or renewable.

One way of facilitating distribution of the fuel would be to install reformers in the vehicles. Then they would only need to carry a hydrocarbon fuel such as methanol or petrol. As in a stationary plant the reformer would split off hydrogen from the fuel and let the fuel cells be fuelled directly. The carbon dioxide produced in the process would be let off into the air.

Compared with the direct use of the fuel in an internal combustion engine, the route via a fuel cell may in the above case be somewhat more

efficient. It appears from a number of studies, however, that the emissions of carbon dioxide will not, in total, be less than from a hybrid car with an internal combustion engine using the fuel efficiently. A fuel-cell vehicle will moreover usually be heavier than a conventional one giving equal performance, thus reducing the overall energy efficiency.

Many of those who have considered the matter think it doubtful whether fuel-cell cars will really lead to significant environmental improvement, compared with those with internal combustion engines in hybrid solutions – in any case not while electricity continues to be generated for the most part from fossil fuels and no new way of producing hydrogen on a large scale is in sight.

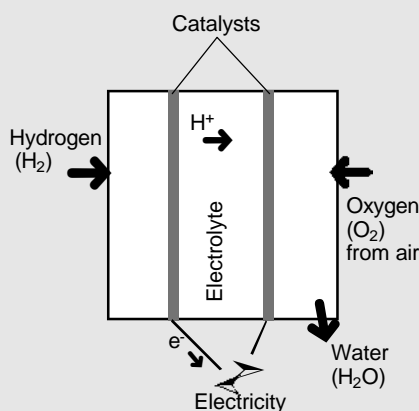
The German Federal Environment Agency (Umweltbundesamt) has compared the respective environmental gains from fuel-cell vehicles and those with improved conventional technique and fuels, and found little to support the carmakers' optimism:¹

“While the industry unreservedly supports the introduction of fuel cells in transport applications, the Federal Environmental Agency analysis – which even used manufactur-

How it works

IN A FUEL CELL electric current is produced by introducing two substances, such as hydrogen and oxygen, which easily react with each other. But instead of allowing them to mix and react directly, as in a combustion process, they are let in on each side of a membrane that is intended to keep them separate. The membrane allows one of the substances to pass through, but only after it has released electrons, which are forced to take a way around to the other side in a conductor. These “wandering” electrons constitute usable electric current. A fuel cell is thus in effect a battery that can deliver current as long as it is given a supply of fresh fuel.

For most of the current types of fuel cell the “energizer” is hydrogen together with oxygen from the air. What makes them differ is the type of membrane and the working temperature. The most upheld technique at the moment is that used for the PEM cell (Pro-



ton Exchange Membrane), which operates at a relatively low temperature (around 80°C or lower). The PEM cell converts 50-60 per cent of the chemical energy into electricity. Its disadvantage is that it needs expensive platinum as catalyzer. In current development practices the PEM is the type of cell most

favoured for cars – not least on account of the low operating temperature and consequent short starting time, with relatively quick response to a “touch of the accelerator.”

There are a number of other types of fuel cell, with differing characteristics in regard to operating temperature, efficiency, and sensitivity to pollution in the fuel. There are also types that use methanol directly, without the need of hydrogen.

An interesting idea is the so-called reversible cell. It can not only produce electricity in the regular way when fed with hydrogen and oxygen, but also turn the process around – producing hydrogen and oxygen by electrolysis when electric current is passed through the cell and the water is split back into hydrogen and oxygen. Thus part of the electrical energy can be stored in the form of hydrogen when there is a surplus of electricity. When there is again a need for electricity, the same hydrogen can be returned to the cell to produce it.

China to start sulphur trading

Following the good results of emissions trading in sulphur dioxide in some Chinese provinces, a nationwide system will now be introduced, said Xie Zhenhua, director of the State Environment Protection Agency when China's National People's Congress met in annual session in March.

He added, however, that there was still a great deal of preparatory work to be done. "First, we must implement a total emissions control regime; and second, we must implement a pollution discharge permitting system," he said. "And to turn those permits into resources, we must have an inspection and monitoring system."

China amended its laws on air and water pollution in 2000 to incorporate "total emissions control" concepts, but the inspection and monitoring systems needed to enforce the control regime at provincial and local levels are still far from comprehensive.

Xie also mentioned a number of areas where China is eager for foreign investment, for desulphurization at power plants and in manufacturing industry.

Source: *Car Lines*, April 2003.

More than expected

Particulate matter from non-road diesel engines in tractors, bulldozers, trains and ships accounts for almost 50 per cent of all such matter emitted from mobile sources in the US. The emissions of nitrogen oxides from these sources are also considerable. The figures are from a study made by the Union of Concerned Scientists.¹

They note that non-road vehicles have been allowed to get off much more lightly in this respect than road vehicles, despite the engines in both cases being essentially similar. Particulate pollution from highway vehicles has been cut over the last two decades, while emissions from non-road engines have increased by 23 per cent.

The Concerned Scientists welcome a proposal from the EPA that should reduce emissions from non-road vehicles by 90 per cent (see AN 2/03, p.19), calling it "one of the few environmentally sound actions of the Bush administration," but emphasize that so far it is only a proposal.

¹ **Cleaning up Diesel Pollution: Emissions from Off-highway Engines by State.** Available at www.ucsusa.org.

Fuels cells Continued from previous page
ers' optimistic assumptions – suggests that fuel cell vehicles are not a cost-effective option from the environmental viewpoint."

It does on the other hand recommend using fuel cells in stationary installations, where they can contribute to considerable environmental improvement and yield greater efficiency even in their present state, saying:

"... It makes sense even today to use fuel cells in stationary power supply operations, e.g. in cogeneration plants. In some areas fuel cells can convert fossil fuels, such as natural gas, into electricity much more efficiently than conventional power stations and heating plants."

In a recent report² on the subject, the Massachusetts's Institute of Technology comes to similar conclusions regarding fuel cells, and criticizes the Bush administration's unquestioning support for their devel-

opment. The dream of the fuel cell as a solution for the climate-change problem is vain, according to the MIT. The production and distribution of the hydrogen alone gives rise to as great emissions of carbon dioxide as are avoided by running cars on fuel cells.

While it does not entirely write off the use of fuel cells in vehicles, it considers it likely to be impractical during the next fifty years or so. For the meantime it recommends continuing to develop energy-efficient hybrids.

MICHAEL KOUCKY

¹ **Technical Options for Abating Road Traffic Impacts. Comparative study of fuel cell vehicles and vehicles with internal combustion engines.** Available at www.umweltbundesamt.de/uba-info-daten-e/daten-e/brennstoffzelle.htm

² **On the Road in 2020.** Available at: <http://lfee.mit.edu/publications>, under the heading Reports.

Commission issues warnings to member countries

ALL FIFTEEN EU member countries have been reprimanded by the Commission for failure in implementing legislation to improve air quality in Europe. This is a matter of 42 proceedings concerning eight different directives.

Large combustion plants

A final warning has been issued to Belgium, the Netherlands, Austria, Ireland, Italy, Denmark, Greece, Spain, Portugal and France for not having transposed directive 2001/80/EC for large combustion plants into national legislation, as they should have done by November 27, 2002.

National emission ceilings

Nothing has been done by France, Belgium (for the Brussels region only), the Netherlands, Germany, Ireland, Italy, Greece, Spain and Portugal about the directive on national emission ceilings for certain air pollutants (2001/81/EC). All have been given a final written warning.

Countries had to report to the Commission, at the latest by December 31, 2002, saying what they had done to meet the directive's require-

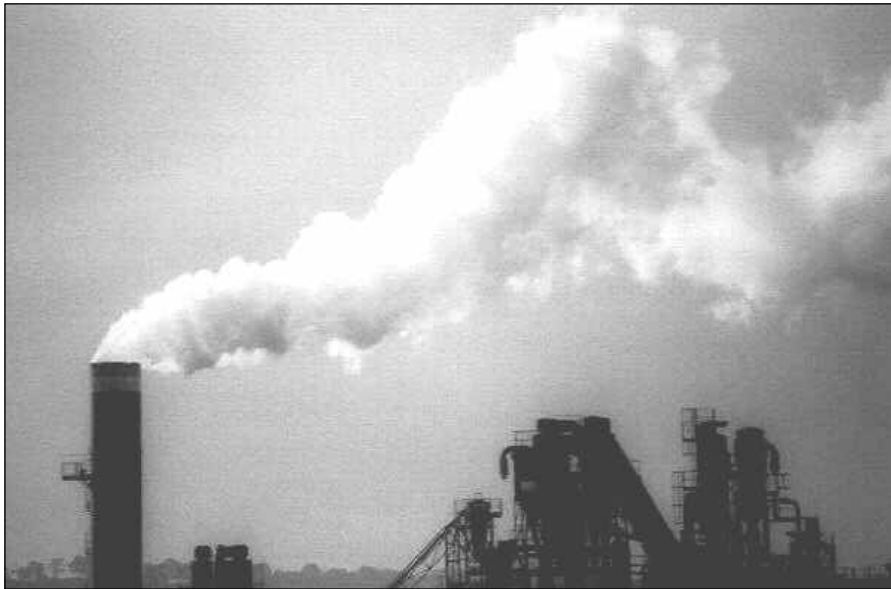
ments. Emission inventories and projections for the year 2010 should also be reported to the Commission every year. Since Belgium, Greece, Spain, France, Ireland, Italy and Luxembourg had failed to comply in this respect, the Commission has sent each of them a first written warning.

The legal process

A country has two months, after receiving a first written warning, in which either to fulfill the requirements of the directive or give an explanation for not having done so. If it does neither, the Commission can issue a final written warning giving the country a certain period, usually two months, in which to comply. If it still does not, the Commission has the right to bring the case before the European Court of Justice.

Cases of failure to implement in time include, besides those mentioned, the incineration of waste and air-quality limit values for benzene and carbon monoxide.

Further information: http://europa.eu.int/comm/secretariat_general/sgb/droit_com/index_en.htm#infractions



PAH AND HEAVY METALS IN THE AIR

No mandatory limits

THERE ARE TO BE no mandatory limit values in the EU for polyaromatic hydrocarbons and heavy metals in the air if the Commission gets its way. A proposed directive,¹ published in mid-July would merely require increased monitoring and reporting.

The Commission would make monitoring compulsory for heavy metals when concentrations exceeded certain thresholds, which would be most likely to occur at large point sources such as smelters.

Emissions of polyaromatic hydrocarbons (PAH) derive primarily from combustion processes, especially in small boilers with often poor combustion. Road traffic is also a contributor. Since PAHs are a large group of pollutants, the Commission is picking out benzo(a)pyrene (BaP) as the one to be measured. It is also proposing a target value of max. 1 nanogram BaP/m³ (annual average of the PM₁₀ particle fraction) which must, "as far as possible and without entailing excessive costs," be kept under.

Member states would be required to inform the Commission and the public of any exceeding of the target value, saying why it has occurred and what may have been done about it. After 2007 any industrial plant contributing to the exceeding of the target value would have to install the best available technique (BAT).

The proposed directive is intended

to be the fourth daughter directive to the air-quality framework one,² for which binding limit values are foreseen. The fact that no such values have been proposed this time is explained by the Commission, saying "there are no cost-effective measures to attain everywhere the concentration levels that would not give rise to harmful effects on human health."

This absence of binding values has been sharply criticized by the European Environmental Bureau (EEB), the environmentalist umbrella organization, which sees it as succumbing to industry pressure. "Binding limit values for 2010 and indicative long-term values are the only tools which will move the polluters from business as usual," declares Melissa Shinn, clean-air coordinator. The EEB is also critical of the cost-benefit analyses, which it says overlook some important secondary benefits, such as reduced emissions of particulates.

PER ELVINGSON

¹ Proposal for a directive relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air. COM(2003)423. The full text of the Commission's proposal can be found at: <http://europa.eu.int:8082/comm/environment/law/>

² Directive 96/62/EC on ambient air quality assessment and management. The three daughter directives cover SO₂, NO_x, particulates, and lead (1999/30/EC), carbon monoxide and benzene (2000/69/EC) and ozone (2002/3/EC).

Biofuel directive coming into force

Having been published in the EC Official Journal, the directive to increase the use of biofuels in the transportation sector has now become law (2002/30/EC). It requires each country to ensure that biofuels will have replaced 2 per cent of the diesel and petrol by December 2005, and 5.75 per cent by December 2010. Exemption may be granted in cases where there is little potential for producing biofuel or it is already being used for other purposes. Governments will have to report annually on their progress.

¹ OJ L 123, Volume 46, 17 May 2003.



Fluorinated gases

The use of HFC-134a in vehicles' air conditioning equipment will have to cease. Such is the message of a proposed EU directive for cutting down the emissions of fluorinated gases.

The three groups of these gases covered by the Kyoto protocol are hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride. The main sources of emissions are refrigeration and air conditioning (also in cars) and industry. Use has increased of late as a result of their being substituted for forbidden ozone-depleting substances.

At present emissions are relatively limited, amounting to 65 million tons of carbon dioxide equivalents, or about 2 per cent of the EU total for greenhouse gases. But the Commission estimates this figure will have increased by 58 per cent, to 98 million tons, by 2010.

The proposed measures are calculated to reduce emissions by 23 million tons of CO₂ equivalents by 2010, from what they would have been otherwise. The key element in the Commission proposal is the stepwise phasing out of HFC-134a in the air conditioning equipment of new cars between 2009 and 2013. Better inspection of plant where the gases are being used, along with restrictions against their use where there are reasonable alternatives, are also on the Commission's list.

For more information, visit the Commission's "Climate" website at: <http://europa.eu.int/comm/environment/climat/eccp.htm>

Recent publications

Towards Sustainable Aviation (2003)

By Paul Upham et al. Aviation is integral to the global economy but also one of the main obstacles to environmentally sustainable development. What can be done to retain the economic and other benefits it brings, without the associated pollution, noise, congestion and loss of countryside? In this volume, industry, policy and research experts examine how to address the problems, and what it would take to achieve genuinely sustainable aviation.

240 pp. £17.95. Published by Earthscan, 120 Pentonville Road, London, N1 9BR, UK. Internet: www.earthscan.co.uk.

Health aspects of air pollution with particulate matter, ozone and nitrogen dioxide (2003)

Report from a WHO working group that was convened to support the EU Clean Air For Europe program, providing a review of the most recent scientific evidence on the adverse health effects of PM, O₃, and NO₂.

94 pp. Published by WHO Regional Office for Europe, Copenhagen, Denmark. Available on www.euro.who.int/document/e78992.pdf

Empirical critical loads for nitrogen

Eds. B. Achermann and R. Bobbink. Proceedings from an experts workshop, held under the Convention on Long-range Transboundary Air Pollution, in Berne, Switzerland, November 11-13, 2002.

327 pp. 24 franc. Available from the Swiss Environment Agency, Documentation, 3003 Bern, Switzerland. Order number: SRU-164-E. Internet: www.buwalshop.ch. A summary is available at www.umwelt-schweiz.ch/buwal/shop/files/pdf/phpDQvvMp.pdf

Voluntary Approaches for Environmental Policy: Effectiveness, Efficiency and Usage in Policy Mixes (2003)

Voluntary approaches in environmental policy are increasingly popular in a number of countries, but this OECD report questions their environmental effectiveness and economic efficiency. The report notes that there are few cases where such approaches have improved the environment beyond a business-as-usual baseline.

Published by the OECD, 2, Rue André Pascal, 75775 Paris Cedex 16, France (www.oecd.org/bookshop)

Proposal for reducing emissions of VOCs

THIS AUTUMN the European parliament will be debating a proposal for a directive¹ aimed at reducing the Union's emissions of volatile organic compounds by limiting the amount of solvents in paints, varnishes, and vehicle coatings.

It is proposed to make the new limits applicable in two stages: first from 2007, and then from 2010 (see AN 1/03, p. 7). The directive rests on Article 95 of the EU treaty aiming at harmonization of the market, under which member states that want to apply still tougher standards have to provide justification for taking such a step.

Proposals for changes in the directive brought up by the parliament's Italian rapporteur, Giorgio Lisi (Conservative), would allow easier limits for several kinds of solvent-borne products. But early in July various other changes were proposed by members of the parliament's environment committee.

Several of these would, in contrast to Lisi's, strengthen the limits on the amounts of solvent and advance the date for introduction of new limits.

Some members would even like to see a complete phasing out of some solvent-borne products. The aim of several of the proposals is moreover to have the limits regarded as maximum values, thus allowing member countries every possibility of retaining or introducing even stricter requirements than those set down in the directive.

Lisi was to have presented his report to the parliament's environment Committee before the summer recess, but has had to postpone it until September. Voting is expected to take place in the environment committee in late September, and at the parliament's plenary session in October.

CHRISTER ÅGREN

¹ Proposal for a Directive of the European Parliament and of the Council on the limitation of emissions of volatile organic compounds due to the use of organic solvents in decorative paints and varnishes and vehicle refinishing products and amending Directive 1999/13/EC. COM (2002)750 final. Available on Internet: http://europa.eu.int/eur-lex/en/com/pdf/2002/com2002_0750en01.pdf

VOC emissions in the EU

It is important to bring down the emissions of volatile organic compounds in order on the one hand to reduce the concentrations of ground-level ozone in Europe, and so curtail damage to health and the environment, and on the other to protect people from the damaging effects of direct exposure to the volatile organic compounds in paints and varnishes.

The total of VOC emissions in the present EU is expected to amount to 6.5 million tons in 2010, provided the member countries stay under their ceilings stipulated in directive 2001/81. If that directive's interim aim for ground-level ozone is to be achieved

by 2010, emissions will have to be reduced by an extra million tons. The Commission estimates that they will have been reduced by about 280,000 tons a year in 2010 as a result of the new solvents directive.

The measures for reducing the emissions of VOCs from the products in question will be very cost-effective – with the gains according to the Commission's estimate amounting to four times the cost of the measures – despite the fact that the Commission has not included in its analysis either the reduced damage to the ecosystems or the fewer direct effects on health from volatile organic compounds.

Using income for road building

A fresh proposal from the Commission could open the way for an entirely new system for taxing road use. The question is however whether they really aim at improving the present situation.

Taxation of road traffic is now based in most countries on an annual vehicle tax and a tax on fuel – giving great possibilities for evasion, especially by hauliers serving several EU countries. The smart ones register their vehicles where the vehicle tax is lowest and fill up where the tax on diesel is lowest.

The Eurovignette directive, adopted in 1999, represented a first attempt to correct this situation by regulating the taxation on trucks of more than 12 tons. It sets minimum levels on the one hand for the annual vehicle tax, and maximum levels on the other for the charges EU countries may exact for the use of their roads.

The Eurovignette system applies only to trunk roads and for a certain time, no matter how long the distance travelled. The charge is differentiated according to the number of axles and the vehicle's environmental classification.

It was in any case only regarded as provisional. The Commission has long been enjoined to produce a proposal for a way of arriving at a coordinated transition to a kilometre tax. The EU parliament and many member states have been especially eager for a tax based on the external marginal costs – meaning the extra costs in the way of additional road wear, noise, exhaust fumes, and increased accident risk falling on society when a vehicle uses the road network.

The changes in the Eurovignette directive as now proposed¹ only partially meet what has been asked. In some respect they actually go contrary to previous policy.

They would indeed enable countries to start imposing a kilometre tax for heavy vehicles. The Commission also wanted the directive to apply to trucks down to 3.5 tons. As a general principle charging would be restricted to those roads that form the Transeuropean Transport Network (TEN-T), although countries would be free to ask permission to charge on all roads.



A main, and highly controversial departure from the present system is the proposal to have the income earmarked for road building generally, and especially for roads in the TEN-T network. The Commission would moreover like the charge level to be determined by the total sum any country is paying out for road building and maintenance, not by the external marginal costs.

There is a gigantic TEN-T plan for railway, airport, canal and port expansion to the tune of 350 billion euros. But few countries have shown any desire to join in and pay for all this. Only three of the 14 TEN-T mega-projects decided in 1996 have as yet been carried out, all the others are still at the planning stage. But the Commission calculates that with a coordinated system for hauling in

money from road traffic, construction could soon get going again.

So far however the Commission's ideas are no more than proposals, which will doubtless have to be thoroughly worked over before they can be acceptable to the governments of the member countries and to the European parliament. One aspect of them that many governments are likely to reject is earmarking of the income for road building.

Environmentalists have been harshly critical of the whole thing. The European Federation for Transport and Environment (T&E) considers the proposed directive so faulty that it ought to be withdrawn.

"Requiring most money from road pricing to be used for roads is against all economic and environmental logic. It will mean a huge influx of cash for road transport, and with it, great environmental and possibly economic harm. It also goes against the subsidiarity principle," says T&E in a press release.

Another proposal for a directive, which the Commission put forward in April, should also be of interest.² It outlines a system by which all road users could be provided with equipment that would make it possible to have road charges based on distance travelled – the idea being that it should have become harmonized for heavy vehicles all over the EU by 2005, and for light ones by 2010.

MAGNUS NILSSON

German road-user charge postponed

Germany has postponed the introduction of its road-user charge (see AN 1/03) until the end of October after delaying tactics by trucker lobby groups. Their calls for compensation led the government to offer hauliers 600 million euros a year in compensation, which threatened to undermine the whole charge and caused the Commission to investigate whether the compensation amounted to illegal state aid. The two-month delay is likely to cost 326 million euros in lost revenue.

Source: T&E Bulletin No. 121, August 2003.

¹ Proposal for a directive amending directive 1999/62/EC on the charging of heavy goods vehicles for the use of certain infrastructures. COM(2003)448. Available at http://europa.eu.int/comm/transport/infr-charging/library/dir_com_2003_448_en.pdf

² Developing the trans-European transport network: Innovative funding solutions, Interoperability of electronic toll collection systems. Proposal for a Directive on the widespread introduction and interoperability of electronic road toll systems in the Community. COM (2003)132 final. Available at http://europa.eu.int/comm/ten/transport/revision/doc/com_2003_0132_en.pdf

Great possibilities of reducing greenhouse gases from transportation

Light-duty fuel economy could be increased by one-fourth to one-third at less than the cost of the fuel saved over the vehicle's lifetime.

TODAY transportation is answerable for 70 per cent of the oil consumed in the United States, and a good quarter of the country's greenhouse-gas emissions. And the latter are increasing more rapidly from transportation than from any other sector.

These emissions could however be reduced by 20 per cent up to 2015, and almost 50 per cent by 2030 even with existing technology, according to a report issued by the Pew Center on Global Climate Change.¹ The measures proposed would hold the absolute US emissions constant at today's levels. But, says the report, greater reductions could be achieved either through more aggressive control of carbon or policies to slow the growth of travel.

Three main paths are put forward as means of reducing emissions:

1. Improve vehicle efficiency. Fuel economy for new cars and light trucks could be improved by 25-33 per cent over the next 10-15 years through the use of market-ready technologies. This would cost less than the petrol so saved. Emerging technologies, including advanced diesel engines and hybrid-electric vehicles, are said to be likely to bring about fuel savings of 50-100 per cent by 2030 – and could be adopted without reducing either the size or the performance of the vehicles. But enforced requirements will be needed to push forward developments. Fuel economy in the US has deteriorated for lack of policy, not of technology.

2. Substitute low-carbon for carbon-intensive fuels. There are many alternative fuels producing less carbon dioxide per unit of energy than petroleum. Requiring ethanol to be used as a petrol additive could lead to a 3-per-cent reduction of greenhouse-gas emissions in the near future, and 10 per cent in the long term, without any change in the current fuel-supply system. Work to lay

the ground for longer-term solutions, such as a hydrogen-based transportation system, should be set going immediately.

3. Increase the efficiency of the transportation system. This would mean improving accessibility to the various modes of transportation as well as putting more efficient ones to use. Which mode is the most efficient will depend both on distance travelled and population density. The policy options would include public funding of mass transportation, building an infrastructure that would ease the transfer of passengers and freight between modes, supporting "intelligent transportation" policies, and promoting integrated land-use and transportation planning to minimize sprawl.

The Pew Center asserts that a cost-effective portfolio of policy options to deal with the transportation system's emissions of greenhouse gases already exists, but on account of the long lead-time needed to convert an entire fleet of vehicles as well as the supporting infrastructure, policies will have to be implemented straight-

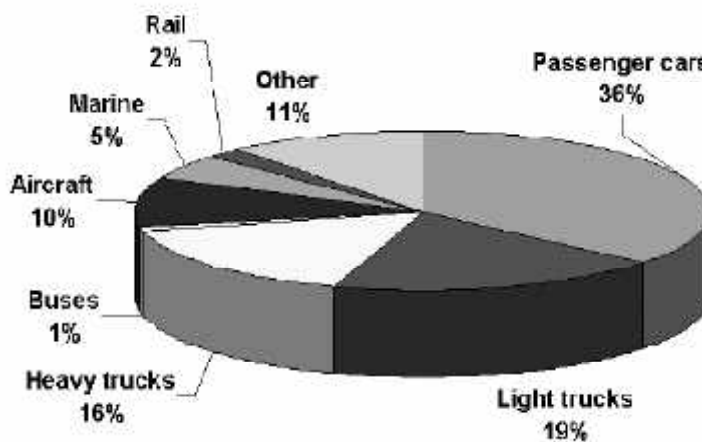
away in order to create the impetus for change.

"The transportation sector in the US offers a myriad of choices for near-term gains in efficiency, and since many are affordable and available, it is inexcusable that we are not taking advantage of them. Action needs to begin today in order to start us down the path to a low-carbon transportation future," says Eileen Clausen, president of the Pew Center.

A reduced consumption of oil in transportation, it says in its report, will not only constitute a gain for the climate, but will also help address other national priorities, such as to reduce the country's dependence on imported oil, as well as spurring technological advances and increasing the competitiveness of the US vehicle industry.

PER ELVINGSON

¹ **Reducing Greenhouse Gas Emissions from U.S. Transportation.** By David L. Greene, Oak Ridge National Laboratory, and Andreas Schafer, Massachusetts Institute of Technology. Published by the Pew Center on Global Climate Change. Internet: www.pewclimate.org



Greenhouse-gas emissions from the transportation sector in the US 2000. Transportation alone stands for 27 per cent of total US emissions.

Heavily subsidized in many ways

THERE IS REASON to believe that around 20 per cent of three leading European airlines' revenue derives from subsidies.

Umweltbundesamt, the German environment agency, had asked some Dutch and German consultants to propose a model for defining aviation subsidies, and from that calculate the benefits accruing to Air France and the Dutch and German airlines KLM and Lufthansa.

While acknowledging that the model includes assumptions that might be challenged, the consultants concluded that all three airlines were receiving subsidies to the extent indicated. These come in the form of exemptions from value-added tax on international tickets, from fuel tax, and from duty on sales aboard aircraft.

The consultants had also considered airports and the aircraft industry. They found Amsterdam's Schipol airport to be enjoying indirect subsidies amounting to about 9 per cent of its income, and 11-13 per cent of the top European aircraft maker Airbus' turnover has been in the form of subsidies over the past 30 years.

Commented the UBA president Andreas Troge: "It is regrettable that the transport mode producing most pollution should be the most highly subsidized." He called for an end to subsidies to aviation, and for landing charges to be related to pollution and emissions of greenhouse gases.

Beatrice Schell, director of the environmentalist organization T&E, adds: "The study estimates that the impact of the subsidies on ticket and freight prices is not great, about 1.5 per cent. That really makes the point that ending the subsidies is not even half the issue - subsidies need to end, in conjunction with a new pricing scheme which takes environmental damage from aircraft into account."

Source: **T&E Bulletin**, May 2003. The report is entitled "Financial support to the aviation sector." See press release (in German) at www.umweltbundesamt.de/uba-info-presse/presse-informationen/pd03303.htm.



UNITED KINGDOM

Emissions from aviation could annul CO₂ target

THE UK GOVERNMENT will be unable to meet its climate targets if it fails to enact measures to control emissions from aircraft, says the Institute for Public Policy Research (ippr) in a report issued in May.¹ Building new runways to accommodate more flights would only make things worse.

The government has set an ambitious target to cut the country's overall emissions of carbon dioxide by 60 per cent by 2050. But by then the expected emissions from aviation alone would effectively breach that target (see chart). The number of people flying in and out of UK airports is forecast to have almost trebled by 2030, and freight to have grown at an even faster rate.

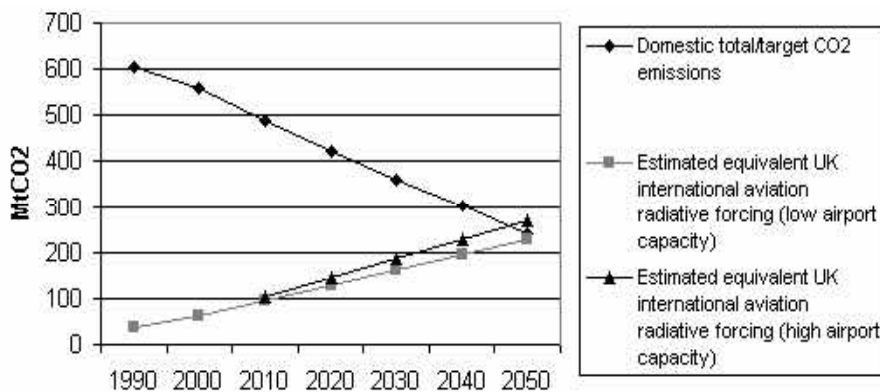
Emissions from international flights do not call for any action under the Kyoto protocol. In its report

the ippr recommends including the carbon-dioxide emissions from aircraft in an international system for emissions trading, with a global cap on the total level of emissions. As a start, the proposed European emissions-trading regime could be made to include emissions from aircraft.

Other recommendations:

- ❖ Auctioning take-off and landing slots at airports, and earmarking the money so raised for improvements in public transportation, including airport links and high-speed rail.
- ❖ Congestion charging on roads in the vicinity of major airports such as Heathrow, and again earmarking the income for improvements in public transportation.

¹ **The sky's the limit: policies for sustainable aviation.** By Simon Bishop and Tony Grayling. For details see www.ippr.org.uk





UK coal-fired power plants rated

The 36-year-old Cockenzie power station in Scotland is the coal-fired generator that lets out the most carbon dioxide in the UK, in relation to electricity produced. That places it first in the ranking of "Carbon Dinosaurs" published by Friends of the Earth in August. Second came Ferrybridge in England, followed by another Scottish plant, Longannet.

The UK's 16 coal fired power stations, all more than 30 years old, generate 35 per cent of the country's electricity. Friends of the Earth is using the table to launch a campaign which aims to shame coal-fired utilities into reducing their emissions.

For information, see www.foe.co.uk

Environment in 52 European countries

An Internet database of state-of-the-environment reports on 52 European countries has been launched by the European environment agency. The system, named Seris, references 230 reports published since 1997. Each entry includes bibliographic information and links to full texts of reports posted on the Internet.

Address: <http://countries.eea.eu.int/SERIS>

Environmental progress risked

The state of the environment across Europe has improved in several respects over the past decade, but much of the progress is likely to be wiped out by economic growth because governments have yet to make significant strides towards

decoupling environmental pressures from economic activity.

This is one of the key messages from the European Environment Agency's latest assessment of the environment in Europe,¹ prepared for the 'Environment for Europe' ministerial conference that was taking place in Kiev, Ukraine, in May.

The new report covers a total of 52 countries, including for the first time the whole of the Russian Federation and the eleven other Eastern European, Caucasus and Central Asian states.

¹ **Europe's environment: the third assessment.** Environmental assessment report No. 10. Available in pdf format at http://reports.eea.eu.int/environmental_assessment_report_2003_10

Traffic pollution and asthma attacks

By far the greatest number of asthma attacks are due to viral infections. But researchers at St Mary's Hospital in Portsmouth, southern England, have discovered that exposure to nitrogen dioxide exacerbates the attacks.

"It drops the lung function and increases the symptoms after a virus infection. It can increase symptoms by as much as 200 per cent," said Dr Anoop Chauhan, pulmonologist at the hospital.

"These effects are occurring at levels (of pollution) that are currently considered to be safe by international quality standards. So it has an important bearing on what we should set as targets for air quality," Chauhan said in an interview.

Dr Chauhan and his team measured the personal exposures of 114 asthmatic children between the ages of 8-11 from non-smoking families over almost a whole year. The study has been published in *The Lancet*.

Road traffic is one of the outstanding sources of nitrogen dioxide in the air. Indoors, gas stoves are a far from negligible source.

Source: Reuters (www.planetark.org), June 9, 2003



Coming events

For the latest news and direct links, please visit www.acidrain.org (choose "Coming events" in the lefthand column).

Air quality – assessment and policy at local, regional and global scales. IUAPPA 14th International Conference. Dubrovnik, Croatia. October 6-10, 2003. *Internet:* www.imi.hr/cappa2003.html

EU Environment Council. October 27, 2003.

16th international symposium on theory and practice in transport economics. Budapest, Hungary. October 29-31, 2003. Organized by the European Conference of Ministers of Transport (ECMT). *Information:* www.cemt-symp.hu

European Biofuels Forum. Berlin, Germany, November 24-26, 2003. *Information:* Europoint, tel. +31 30 6933 489 or www.europoint-bv.com.

UN Framework Convention on Climate Change, 9th Conference of the Parties (COP9). Milan, Italy. December 1-12, 2003. *Information:* www.minambiente.it/cop9/

Executive Body for the LRTAP Convention. Geneva, Switzerland. December 9-12, 2003. *Information:* www.unece.org/env/lrtap/

EU Environment Council. December 22, 2003.

World Sustainable Energy Days 2004. Wels, Austria. March 3-5, 2004. *Information:* O.Ö. Energiesparverband, tel. +43-732-7720-14380, www.esv.or.at/wsed04

ECOMM 2004: Transition strategies for sustainable mobility in an urban area – Review and prospects based on European experiences. Lyon, France. May 5-7, 2004. *Information:* www.epomm.org

Fourth Ministerial Conference on Environment and Health. Budapest, Hungary. June 23-25, 2004. Theme: The future for our children. *Information:* www.euro.who.int/budapest2004

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