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Acid News

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Clean Air for Europe and the thematic strategy on air pollution

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CLEAN AIR FOR EUROPE

Strategy with low level of ambition

ON 21 SEPTEMBER the European Commission presented its proposal for improving air quality in the EU. The Thematic Strategy on Air Pollution[1] is the first of seven thematic strategies outlined in the EU's Sixth Environmental Action Programme (6EAP)[2], and by establishing interim environmental objectives for 2020, the Commission also sets the level of ambition regarding air quality in the EU until that year.

Originally due out before the summer, the strategy was delayed after complaints by industry interests, and eventually the Commission decided to opt for an ambition level between the "low" and "medium" of the policy scenarios analysed under the Clean Air For Europe (CAFE) programme. Earlier drafts aimed at a higher level of ambition, but were watered down under pressure from EU commissioners for industry, agriculture and internal market.

Environment Commissioner Stavros Dimas said: "The air strategy will substantially improve Europe's air quality. It will prevent thousands of premature deaths from pollution-related illnesses and drastically reduce

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Acid News

A newsletter from the Swedish NGO Secretariat on Acid Rain, the primary aim of which is to provide information on air pollution and its effects on health and the environment.

Anyone interested in these matters 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 available free of charge.

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

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THE SWEDISH NGO SECRETARIAT ON ACID RAIN

The Secretariat has a board consisting of 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

- Keeps up observation of political trends and scientific developments.
- Acts as an information centre, primarily for European environmentalist organizations, but also for the media, authorities, and researchers.
- Produces information material.
- Supports environmentalist bodies in other countries in their work towards common ends.
- Participates in the lobbying and campaigning activities of European environmentalist organizations concerning European policy relating to air quality and climate change, as well as in meetings of the Convention on Long-range Transboundary Air Pollution and the UN Framework Convention on Climate Change.

Overestimated costs

THE OPPOSITION to more ambitious EU air quality policies – most recently regarding the Thematic Strategy on Air Pollution – has so far come mainly from various industry groups, primarily those with direct or indirect links to fossil fuel use, such as the oil, coal, electricity and road vehicle industries, and UNICE, the Union of Industrial and Employers' Confederations of Europe. Voices of concern have also been raised by some member states.

A common focus for the criticism relates to the high estimated costs of implementing more ambitious environmental policies. However, very rarely, if ever, do these industry groups or member states recognize the fact that the costs are highly overestimated. (Nor do they seem to pay any attention to the very significant benefits that would result from more ambitious policies.)

Current estimates of the costs for implementing EU air quality policies are based primarily on technical "end-of-pipe" abatement measures.

This means that a number of so-called structural measures are not included, in spite of the fact that some of these measures can reduce emissions at zero or low net cost, and many of them will also reduce emissions of greenhouse gases.

Examples of such structural measures include those aimed at improving energy and transport efficiency, fuel switching, and increased use of renewables.

Moreover, the baseline energy scenario employed for making the Commission's analysis stands in total contradiction to commitments made by the EU and its member states to reduce emissions of the greenhouse gas carbon dioxide. This is of major importance since the energy scenario largely determines the levels of emissions of air pollutants such as sulphur dioxide, nitrogen oxides and fine particles.

If the total energy used – and especially the share generated from fossil fuels – is overestimated, the estimated cost of reducing emissions to a certain level will also be exaggerated. An overestimation of future energy use will also result in an underestimation of the potential to reduce emissions of air pollutants, thus weakening the setting of interim environmental quality targets. Inflated cost estimates are also likely to lower political acceptance of the more ambitious initiatives concerned.

Consequently, if the EU and its member countries take action that is necessary to reduce emissions of carbon dioxide, the costs of reducing emissions of "traditional" air pollutants will be significantly lower.

Currently there are separate EU programmes for controlling "traditional" air pollutants and for controlling greenhouse gases. To date these various programmes have largely been considered separately, despite the fact that there are strong links between them. This lack of integration, and the focus on "end-of-pipe" measures, means that the estimated costs of meeting the separate objectives are generally too high.

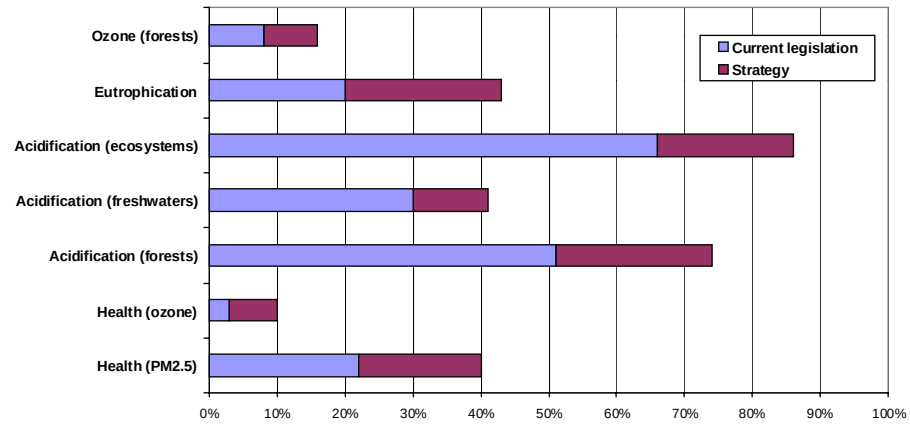
By linking the development of abatement strategies for the five air pollutants under the Thematic Strategy with those needed to reduce emissions of greenhouse gases, estimated abatement costs can be substantially reduced.

Those cost savings should be used to further improve the protection of human health and the environment from the damaging impacts of air pollution. This would mean aiming for a higher level of environmental ambition, as compared to that proposed by the Commission in the Thematic Strategy.

It is clear that analyses, such as that done for the Thematic Strategy, should be based on more politically as well as environmentally sound energy scenarios. This would not only result in more accurate cost estimates, but also in strategies that provide the double benefits of reducing local as well as European air pollution and related environmental problems, while at the same time reducing emissions of the primary greenhouse gas, carbon dioxide.

CHRISTER ÅGREN

Estimated improvement of health and environmental indicators resulting from the baseline scenario (CLE) and additional improvements from the strategy.



Note: The figure shows per cent gap-closure towards the no-effect level from the base year 2000 to the target year 2020. Figures on health impacts are based on change in the number of premature deaths, while figures on ecosystem impacts are based on change in exceedance of critical loads and levels.

Continued from front page

damage to crops, forests and other ecosystems. Although there will be costs involved in improving air quality, these will be offset at least five-fold by the benefits to society as a whole."

But the European Environmental Bureau (EEB) expressed great disappointment that the strategy does not go far enough in improving Europe's air quality.

John Hontelez, secretary general of the EEB, said: "The 6EAP sets the objective to ensure that people and the environment are protected from the negative effects of air pollution. What we see here is a small step, a step too small to accept, given the still worsening state of the overall environment in Europe, and the particular health risks of air pollution."

According to the Commission's analysis, it is estimated that by the target year 2020 the strategy will deliver annual health benefits worth at least 42 billion euro through fewer premature deaths, less sickness, fewer hospital admissions, improved labour productivity, etc.

This is more than five times higher than the cost of implementing the strategy, which is estimated at around 7.1 billion euro per annum, or about 0.05 per cent of EU GDP, in 2020.

Although there is no agreed way to express damage to ecosystems in monetary terms, the environmental benefits of reduced air pollution are also significant. Table 1 shows the estimated costs and benefits of the strategy, compared to the situation in the base year 2000 and the baseline scenario for 2020.

The strategy will deliver annual health benefits worth at least 42 billion euro

The wider economic and social impacts were also investigated by CAFE. The overall impact on employment was found to be negligible, and EU competitiveness relative to other industrialised countries such as the USA and Japan was unlikely to be affected. It should be noted that the positive impacts of reduced mortality and better health were not taken into account in this analysis.

As regards specific legislative proposals, the strategy is accompanied by a proposal to combine the existing air quality framework directive and three so-called daughter directives containing minimum requirements for air quality (see pp. 4–5). The proposed new directive aims to clarify and simplify provisions, and to modernize and streamline monitoring and reporting requirements. It also introduces new provisions for fine particles ($PM_{2.5}$).

When it comes to the emission abatement measures required for attaining the interim objectives of the strategy, no specific proposals for new or revised EU legislation were presented with the strategy.

The Commission did however announce that it will review the national emission ceilings (NEC) directive, and in 2006 propose revised emission ceilings that will be based on the level of ambition set out in the strategy.

In addition, the strategy outlines a range of other possible measures to be examined, such as the introduction of strengthened emission standards for new road vehicles; revision of the directive on integrated pollution prevention and control (IPPC), including expanding it to include smaller combustion plants; a new directive to reduce VOC emissions from petrol stations; and measures to reduce NOx emissions from shipping.

The Commission also makes clear, however, that it has no plans to strengthen emission standards for installations already covered by the IPPC or the large combustion plants directive.

It is foreseen that the strategy will be reviewed in 2010, and that the

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Table 1. Summary of the CAFE analysis and the strategy.

		Human health			Natural environment (km^2)		
	Cost of reduction (euro bn)	Life years lost due to $PM_{2.5}$ (million)	Premature deaths due to $PM_{2.5}$ and O_3	Monetized health benefits (euro bn)	Acidification (forest area exceeded)	Eutrophication (ecosystem area exceeded)	Ozone (forest area exceeded)
Year 2000	-	3.62	370,000	-	243,000	733,000	827,000
Baseline 2020	-	2.47	293,000	-	119,000	590,000	764,000
Strategy 2020	7.1	1.91	230,000	42-135	63,000	416,000	699,000

Note: Costs and benefits are given as annual amounts for the year 2020, and only the costs and benefits of moving beyond the baseline scenario are included. Benefits to the natural environment and the cultural heritage have not been monetized.

Clean air strategy adopted ...

Continued from page 3

results will feed into the review of the 6EAP.

As the strategy was presented in the form of a communication from the Commission to the Council and the European Parliament, these two bodies are expected to provide comments – but they cannot change the strategy as such. A first discussion will take place in the Environment Council on 2 December.

CHRISTER ÅGREN

[1] More information on the CAFE programme and the strategy can be found in the factsheet on pp. 11-14 in this issue of Acid News. The main Commission documents are:

Communication from the Commission to the Council and the European Parliament: thematic strategy on air pollution. COM (2005) 446 final.

Commission staff working paper: Impact assessment of the thematic strategy on air pollution and the directive on "Ambient air quality and cleaner air for Europe". SEC (2005) 1133.

These two documents as well as reports produced by the CAFE programme are available from the website of the Commission's environment directorate: http://europa.eu.int/comm/environment/air/cafe/index.htm

[2] The seven thematic strategies cover air pollution; marine environment; pesticide use; urban environment; sustainable use of resources; waste prevention and recycling; and soil management. The Sixth Environment Action Programme was adopted by the Council and the Parliament on 22 July 2002, and the seven strategies were to be adopted within three years of that date.

New marine strategy presented

On 24 October the European Commission presented a thematic strategy on the protection and conservation of the marine environment. It aims to ensure that all EU marine waters are environmentally healthy by 2021. The thematic strategy was the second that the Commission adopted following the provisions of the 6th Environmental Action programme.

A group of environmental groups criticized the proposal as "desperately inadequate". They regret that it contains no binding commitment to protect Europe's seas and called on the other EU institutions to strengthen this work.

Further information: European Commission, http://europa.eu.int/comm/environment/water/marine.htm. NGO comments are available at www.eeb.org/press/press.htm

No stiffening of air quality standards

The European Commission proposes to combine four directives in one, introduce a new standard for fine particulates and permit a number of derogations from already agreed standards.

IN THE PROPOSED NEW air quality directive that was presented as part of the Thematic Strategy on Air Pollution, the Commission wishes to combine the framework objective on air quality that was adopted in 1996 with the three subsequent daughter directives. The stated aim is to simplify EU legislation, for example by facilitating monitoring and reporting by the member states.

The proposal also includes new standards for $PM_{2.5}$ and the possibility of up to five years postponement for member states to attain air pollution values in specified zones.

New $PM_{2.5}$ standards

In January standards came into force for PM_{10} (particulates smaller than 10 microns in diameter). Based on current research on the harmfulness of different particulates the Commission wants to add a new standard for fine particulates ($PM_{2.5}$), but at the same time keep the existing PM_{10} standard in place.

The proposed legally binding cap for $PM_{2.5}$ is an annual mean value of 25 $\mu g/m^3$. This must be met by 2010, but there is a margin of tolerance that allows the level to be exceeded by 20 per cent when the directive comes into force, dropping in stages to zero by the year 2010.

As a rule of thumb, levels of $PM_{2.5}$ are around 60–70 per cent of PM_{10} levels, so the proposal does not represent any stiffening of requirements in relation to the PM_{10} standard that is already in force. To put this in context, last year the US introduced a standard for $PM_{2.5}$ of 15 $\mu g/m^3$, and a staff paper from the Environmental Protection Agency recommends that this standard is stiffened (AN 3/05, p.22).

To complement the new EU standard it is proposed that member states should reduce average human exposure to urban background levels of $PM_{2.5}$ over the period 2010–2020. At this stage a general, non-binding 20-per-cent reduction is proposed.

The Commission shows that the benefit of reducing the average background concentration by 20–25 per cent between 2010 and 2020 is estimated to be between 37 and 119 billion euro per annum in 2020. These figures are between five and 24 times higher than the estimated costs, which range between five and eight billion euro per annum.

The Commission's aim is that the indicative 20-per-cent requirement should be converted into a legally binding exposure reduction obligation, differentiated for each country, when the directive is reviewed in five years' time. The measurement data that has been accumulated by then will provide a better basis for decision than is available today.

Kerstin Meyer, air pollution policy officer at the European Environmental Bureau (EEB) is strongly critical of the fact that the requirement is only indicative:

"The Commission's own analysis has shown that each year some 350,000 people die prematurely due to exposure to $PM_{2.5}$ alone. A legally binding requirement to make real reductions in particle emissions would have been the only right answer."

Removal of indicative standards

The proposal means that the existing standards for PM_{10} will remain unchanged. As a result the current directive's indicative standards for 2010 will no longer apply.

These indicative limit values would have meant a halving of the highest permissible annual mean value in comparison with 2005 (from 40 to 20 $\mu g/m^3$) and a reduction in the number

of days of permissible exceedances of the daily mean value from 35 to 7 per annum.

Softening of agreed standards

The Commission's proposal makes it possible for member states to exceed already agreed standards for PM_{10}, nitrogen dioxide, benzene and other pollutants for up to five years. Such a postponement would also include the new $PM_{2.5}$ standard.

If a country can show that it has taken all reasonable measures to implement the legislation but is nevertheless unable to comply with air quality standards in certain areas, it is proposed to allow it to request an extension to the compliance deadline by up to five years in the affected zones provided that certain criteria are met and plans are put in place to move towards compliance.

The Commission's resources for assessing whether countries have taken "all reasonable measures" are probably limited, however, and it is likely that this will effectively allow compliance with the standard to be postponed by five years in those areas where the problems are greatest.

Kerstin Meyer comments:

"In most cases member states have just not done enough and have not started early enough to meet the existing limits. Granting derogations simply rewards laggards."

The Commission also wants to make it possible to discount pollutant contributions from natural sources for compliance purposes. This means that where pollution arises from natural sources, such as wind-blown Saharan sand or sea spray, these will not count towards exceedances of limit values, since there is no way to control such natural contributions.

However, no research has been done to show that particles from natural sources should be any less harmful, so the ability to discount such sources will effectively mean that greater health risks are accepted for the population in certain areas.

The Commission's proposal will now go before Parliament and the Council of Ministers under the co-decision procedure.

PER ELVINGSON

Proposed Directive on Ambient Air Quality and Cleaner Air for Europe. COM(2005) 447. Can be downloaded at http://europa.eu.int/comm/environment/air/cafe/index.htm.

A bike demonstration in the Hungarian capital of Budapest during the annual car-free day on 22 September attracted between 20,000 and 30,000 participants. The main aim was the promotion of city biking, but it was also a demonstration for cleaner air and a more sustainable city.

The Clean Air Action Group, which co-organized the event, points to the fact that air pollution (PM_{10}) seriously damages Hungarian people's health and that the municipality of Budapest does not comply with existing air quality legislation.

HEALTH EFFECTS IN BRIEF

Air pollution a significant threat

The air pollution and health research and information programme Apheis[1] has released new findings in its ongoing assessment of the impact of particulate air pollution on health in 26 cities in 12 European countries.

The new evidence provided by the third phase of the programme confirmed earlier findings that air pollution continues to pose a significant threat to public health in urban environments in Europe.

For public health reasons Apheis recommends 15 $\mu g/m^3$ (yearly average) as the limit value for $PM_{2.5}$. However, because a significant health impact can be expected even at 15 $\mu g/m^3$, the advice is to reduce air pollution to levels even lower than 15 $\mu g/m^3$.

[1] Air Pollution and Health: A European Information System. Further information: www.apheis.net

Health effects could be underestimated

The contribution of particulate matter to chronic health problems may be as much as two to three times greater than current estimates, according to research presented in the November issue of the journal Epidemiology.

Michael Jerrett of the University of Southern California, Los Angeles, and his colleagues analyzed two decades of data collected from nearly 23,000 residents of 260 LA neighbourhoods. They found that as the concentration of particles less than 2.5 microns in diameter ($PM_{2.5}$) increased, so too did the risk of dying: each rise by 10 $\mu g/m^3$ corresponded to an 11 to 17 per cent increase in the risk of dying from any cause.

"By looking at the effects of pollution within communities, not only did we observe pollution's influence on overall mortality, but we saw specific links between particulate matter and death from ischemic heart disease, such as heart attack, as well as lung cancers," Jerrett says.

In the same issue of Epidemiology, a group of researchers from the Keck School of Medicine at the University of Southern California reports that living close to the freeway raises a child's risk of developing asthma. Tracking the respiratory health of 208 children in 10 cities, the scientists determined that those youngsters who lived closer to highways were more likely to develop asthma.

Source: **Car Lines**, 2005-5, October 2005.

Many cities reacting far too late

Late implementation and inadequate action plans mean that many cities will not meet the standards for PM_{10} that come into force in the EU this year, despite being aware of the problems for many years.

EXCESSIVELY HIGH LEVELS of particulates in the air of many European cities are in many cases the result of failure by the authorities responsible to draw up and implement effective programmes of measures in time, concludes a study from the European Environmental Bureau.

According to the EU air quality directives, the member states are obliged to monitor air quality in their territories and to draw up and implement air quality management plans if the levels are too high. These plans should reduce pollution concentration in order to meet the limit values once they enter into force.

However, by the beginning of 2005 it was already obvious that many member states would not be able to meet the standards for particulates (PM_{10}), which come into force this year but were agreed in 1999. In many cities the number of days when limit values were exceeded had already reached the full-year quota (35 days) by early spring (see AN 2/05).

The non-compliance is at least partly due to the fact that member states have been late in drawing up plans and programmes to improve air quality.

EEB has through its member organizations analyzed air quality data, plans and programmes and background information from 26 cities in 15 European countries, and highlights some key problems with the implementation of the directive.

Although it is not an exhaustive analysis and does not cover all aspects of implementation, it does give a snapshot of the current situation.

The first main conclusion is that the problem of high PM_{10} concentrations should have been fully apparent in the years leading up to 2005. Between 2002 and 2004, 24 out of 25 cities in the study recorded exceedances of the limit values, plus the margin of tolerance, in at least one year.

However, twelve out of the 24 cities did not make plans or introduce programmes before the year 2005. This is clearly against the requirements of the directive, which stipulates that plans and programmes have to be made in order to meet the legally binding limit values by 2005.

All of the 21 plans and draft plans analyzed by the EEB opt for a policy mix of a number of different measures.

The study by EEB shows considerable shortcomings

The most popular measure is charges for parking space and reduced car parking possibilities in the city.

This is followed by reorganizing the city to limit car use by providing better opportunities for walking and cycling, as well as for public transport.

In third place are measures such as promotion of car sharing, cycling and walking as well as providing more and better public transport.

But it is not sufficient simply to set up a plan – it also has to give results. In this respect the study by EEB shows considerable shortcomings; many of the measures set out in the plans will not affect the exceedances that are occurring today, but will only take effect in the long term.

The plans are also often vague in their aims. Only eight of the 21 plans give information about the expected effects of the measures on air quality.

Six of the plans contain no information at all about this and eight lack information about when limit values will be achieved.

Finance is another problem area. Fourteen out of 21 plans failed to make clear how the measures in the plan will be financed. Without finance, even the most detailed and ambitious plan is unlikely to achieve the necessary reductions.

PER ELVINGSON

Note. The study will be published within shortly. Take a look at www.eeb.org.

Cities in the study where the legally binding limit value for PM_{10}, plus margin of tolerance, were exceeded at least one of the year 2002–2005.

Plan or programme adopted before 2005			Plan or programme not adopted before 2005		
City	Country	Date of plan	City	Country	Date of plan
Padua	Italy	09/2002	Berlin	Germany	02/2005
Rome	Italy	09/2002	Vienna	Austria	03/2005
Milan	Italy	09/2002	Düsseldorf	Germany	04/2005
London	UK	09/2002	Dortmund	Germany	05/2005
Brussels	Belgium	11/2002	Lisbon	Portugal	
Stockholm	Sweden	/2003	Amsterdam	Netherlands	
Leige	France	12/2003	Prague	Czech Rep.	
Warsaw	Poland	12/2003	Budapest	Hungary	
Bristol	UK	04/2004	Paris	France	
Riga	Latvia	07/2004	Madrid	Spain	
Munich	Germany	09/2004	Naples	Italy	
Graz	Austria	10/2004	Valladolid	Spain	

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EUROPEAN UNION

Aviation to join emissions trading

IN A COMMUNICATION published in September the EU Commission proposes that carbon dioxide emissions by aviation should be included in the European greenhouse gas emissions trading scheme (ETS). If so, it would be the first legally binding framework in the EU for tackling the environmental impact of international aviation.

Aviation's share of overall EU greenhouse gas emissions is still modest, at about three per cent – if you look at carbon dioxide emissions alone. But this figure does not include indirect warming effects, such as those from emissions of nitrogen oxides and water vapour. If these are included in the calculations they increase the share by a factor of 2 to 4.

The Commission points out that the aviation sector is international and is best regulated at global level, but since initiatives within the International Civil Aviation Organization (ICAO) have been blocked so far it believes that bringing aviation into the trading scheme offers the most promising way to tackle emissions.

The ETS sets an overall cap on greenhouse gas emissions, within which participating operators can buy and sell emission allowances as needed. The Commission sees the market mechanism as a permanent incentive for airlines to minimize their emissions.

The ETS should cover all emissions from any flight departing from the EU, whether to another EU destination or a third country. EU and non-EU carriers would be treated equally.

Preliminary estimates based on modelling exercises suggest that the impact on ticket prices would be modest, aviation demand would simply grow at a slightly slower rate than otherwise. Any effect on tourism or peripheral regions relying on aviation is likely to be very limited.

In preparing the strategy the Commission also examined other types of market-based solutions, including airline ticket or departure taxes and emissions charges, but concluded that these would be either less effective in environmental terms or less cost-efficient.

The Commission makes no statement on when aviation could join the ETS, but does not rule out the possibility that this could take place during the second trading period, which starts in 2008. Whether emission rights would only be required for CO_2 emissions by airlines, or for their indirect effects on the climate as well, has yet to be examined, as does the question of how many emission rights should be made available.

The Commission also advocates continuing or strengthening a range of other activities that can help limit emissions from aviation, such as improving air traffic management and continuing efforts to remove legal obstacles to the taxation of jet fuel.

Jos Dings, director for the European umbrella organization for NGOs in the transport and environment sector, T&E, comments as follows:

"The Commission has taken six years to study this issue and it was high time to act. We welcome the communication as an important first step and urge the Commission to follow-up with a legislative proposal as soon as possible. It is also important that this measure is seen as the beginning not the end. Emissions trading alone will not be enough to combat the rapidly growing emissions of the aviation sector."

PER ELVINGSON

Further information: **Reducing the Climate Change Impact of Aviation.** COM(2005) 459 final. Available at http://europa.eu.int/comm/environment/climat/aviation_en.htm

Aviation and the environment

EU emissions from international flights grew by 73 per cent from 1990 to 2003. This increase could widen to 150 per cent by 2012 unless action is taken, the Commission estimates.

Such growth would cancel out more than a quarter of the eight-per-cent reduction in greenhouse gas emissions that the Kyoto Protocol requires the EU15 to achieve between 1990 and 2012. Emissions of carbon dioxide from domestic flights are subject to emission targets under the Kyoto Protocol, but international flights are not.

In 1999 the Intergovernmental Panel on Climate Change (IPCC) estimated that the total impact of aviation is currently about two to four times higher than the effect stemming from its CO_2 emissions alone. Recent research results indicate that this ratio may be somewhat smaller, around two times, according to the Commission.

NEWS IN BRIEF

Dutch speed limits to reduce emissions

The Dutch transport ministry has reduced the speed limit on four stretches of motorway, covering 15 kilometres in total, in an effort to improve air quality, greenhouse gas emissions, noise levels and traffic flow. The limit on the four roads has gone down from 100 to 80 km/hour. A fifth stretch has seen the limit reduced from 120 to 100 km/h.

Research into 80 km/h zones published in June 2003 calculated that NOx emissions went down by 15–25 per cent and PM_{10} emissions by 25–35 per cent.

Meanwhile the transport minister in the Belgian region of Flanders is calling for an 80 km/h limit for commercial vehicles. The Flemish Institute of Technical Research says this will reduce CO_2 emissions by around 15 per cent.

Source: **T&E Bulletin**, November 2005.

Consultation on common transport policy

The Commission will carry out a mid-term review of the White Paper on "European transport policy for 2010". This revision was envisaged in the White Paper adopted in 2001. To supplement its own analysis the Commission invites all stakeholders to submit their views, and in particular their responses to ten questions. The deadline for submissions is 31 December 2005.

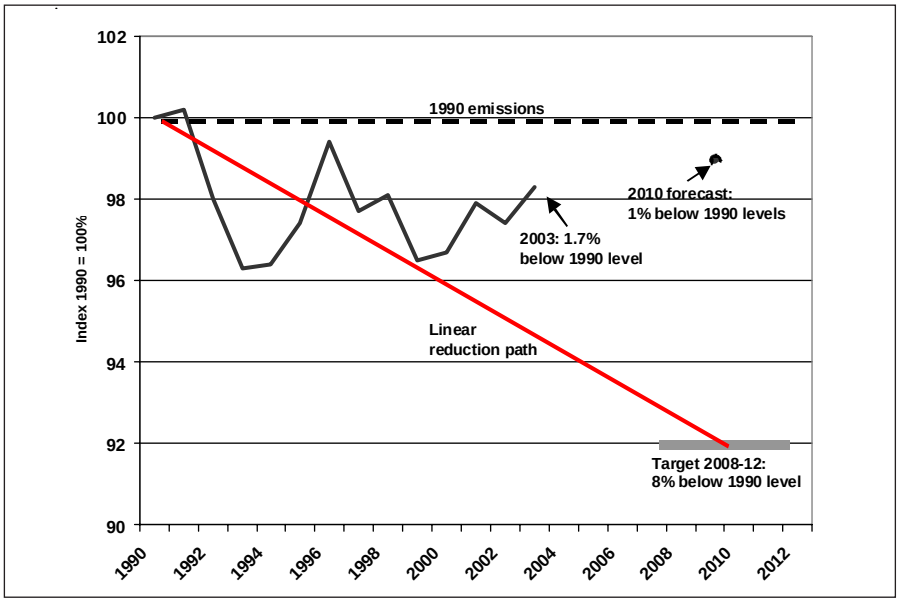
Information: European Commission DG TREN, http://europa.eu.int/comm/energy_transport/en/lb_en.html

Fluorinated gases in cars' air conditioning

The European Parliament has overruled its environment committee in voting against measures that would have eliminated fluorinated gases, which are used in car air conditioning systems and contribute to global warming.

The plenary vote in October means fluorinated gases can be used in cars until 2017, despite the gases contributing around 40 million tonnes of carbon dioxide equivalents each year. Greenpeace said MEPs conceded in the face of fierce lobbying by the chemicals industry. Alternatives are commercially available and already on the market, according to Greenpeace.

Source: **T&E Bulletin**, November 2005.



Second European Climate Change Programme launched

THE SECOND EUROPEAN Climate Change Programme, ECCP II, was launched by the European Commission at a conference in Brussels in October. The purpose of the new programme is to provide a new policy framework for EU climate change policy, with a scope and perspective beyond 2012.

Five working groups on specific issues have been formed under the programme and have been instructed to report to the Commission by the middle of next year.

Two of the groups will propose ways of reducing emissions from aviation and passenger road transport, respectively. A third group will draw up proposals for geological carbon capture and storage, while the fourth will examine the best ways to adapt to climate change.

The fifth group will analyze what has been achieved under the first European Climate Change Programme. This was launched in 2000 and resulted in a list of 40 recommended, cost-effective measures which were estimated to have a reduction potential of over 700 million tonnes of carbon dioxide, twice the reduction undertaken by the EU under Kyoto.

"The first experiences with emission trading have encouraged us to look at the potential of other market-based mechanisms. The EU believes that these should be a part of any future international climate change regime post-2012," said EU environment commissioner Stavros Dimas at the launch conference.

Commissioner Dimas also said that the EU would not meet its Kyoto undertaking with existing measures, and that this itself was just a first small step:

"Science indicates that we need much greater reductions if we want to limit the extent to which our climate will change. In March, the European Council mentioned possible reduction pathways for developed countries in the order of 15–30 per cent by 2020. That is where the second European Climate Change Programme comes in."

Under the framework of the ECCP II, the European Commission will present in mid-2006 a Communication on a revised strategy to reduce CO_2 emissions from cars. The work on aviation emissions is expected to result in a legislative proposal for aviation to be incorporated in the EU Emissions Trading Scheme.

PER ELVINGSON

Further information: http://europa.eu.int/comm/environment/climat/eccp.htm. See also position paper on ECCP II from environmental NGOs, available at www.climnet.org, and studies on potential reduction of emissions by Greenpeace and WWF Europe, pp. 22-23 in this issue.

Unable to meet targets with current measures

DESPITE SUCCESSES in some areas, the EU continues to face significant environmental challenges in terms of meeting its long-term environmental commitments. In particular, targets in respect of climate change and the use of renewable energy are in danger of being missed.

This is some of the conclusions of the European Environment Agency in a report[1] which was published in September. It assesses the environmental consequences of key socio-economic developments in Europe over the coming decades, particularly with regard to climate, air quality, water stress and water quality.

The climate change issue is identified as the most problematic and is intimately linked with a whole range of human activities, including energy use, transport and agriculture.

The report finds that it will be difficult to achieve the target of an eight-per-cent reduction in greenhouse gas emissions by 2010, to which EU countries are committed under the Kyoto Protocol. The actual reduction may be as little as three per cent. Further measures must be implemented if the target is to be met.

The prospects look even bleaker for the period after 2012, since emissions are expected to rise rather than fall. One important factor is an expected 20-per-cent rise in energy use by the year 2030. Expected growth is especially high in the transport sector, at 35 per cent.

The projected developments in the report are discussed in light of EU's current policy targets, as adopted in the Sustainable Development Strategy and the Sixth Environment Action Programme.

EEA highlights the fact that for many environmental problems, legislation has successfully addressed the "big polluters", but new concerns are likely to arise from individual consumption and diffuse sources of pollution associated with agriculture.

"Successful responses require policy-makers to continue to shift to more integrated approaches that provide a coherent response across key sectors. That means that policy makers in transport and agriculture, for example, must consider the combined environmental implications of their policies," says Jacqueline McGlade, EEA's executive director.

According to the report the EU seems to be on track to meet the targets set for a number of other issues, particularly for air pollution, although large differences across Europe are expected to prevail. In particular, negative health effects in highly populated areas of the EU are expected to remain significant.

[1] **European Environment Outlook**. Available at http://reports.eea.eu.int/eea_report_2005_4

Energy transformation programme needed

The European Parliament's environment committee has responded to the Commission's proposals for a post-2012 EU climate strategy by proposing a radical "energy transformation" programme.

Europe should become the most energy efficient economy in the world by setting targets to cut energy intensity by 2.5–3 per cent per year, the committee said. Average emissions of carbon dioxide from new cars should be slashed to 80–100 g/km "in the medium term", enforced through an emissions trading system.

The committee agreed that cuts of 60–80 per cent should be achieved by 2050 and recommended EU-wide road speed limits, traffic charges, tax incentives, and "severe reduction targets" for aviation emissions. The full Parliament will finalize the resolution in December.

Source: **T&E Bulletin**, November 2005.

NEWS IN BRIEF

2005 one of the hottest years globally

2005 will be the second or third warmest year on record globally, according to the Met Office, Britain's national weather service. After 1998, the four hottest years globally have been the last four years, according to Met Office data going back to 1861. The second hottest year was 2002, followed by 2003, 2004 and 2001.

Source: **Planet Ark**, 17 October 2005.

Stronger hurricanes more numerous

Were New Orleans and coastal Mississippi victims of global warming? Until recently, most scientists would have answered no. Now, however, a connection is emerging between warming oceans and severe tropical cyclones. In the 16 September issue of Science, meteorologists report an 80-per-cent increase worldwide in the abundance of the most powerful tropical cyclones during the past 35 years. At the same time, the tropical oceans have been warming, driven, most researchers agree, by rising greenhouse gases.

Further information: Is Katrina a Harbinger of Still More Powerful Hurricanes? Science, Vol. 309, Issue 5742, 1807, 16 September 2005.

Russia to match EU emission standards

Russia's government plans to impose progressively stricter emissions standards for new cars with a view to matching current EU standards by 2010. The emissions rules will cover a range of pollutants and will be modelled on the EU's Euro standards. Under the plan, Russia will match Euro 2 standards next year, Euro 3 in 2008, Euro 4 in 2010, and Euro 5 in 2014. The EU implemented Euro 2 in 1996, Euro 3 in 2000, and Euro 4 this year.

Source: **Car Lines**, 2005-5, October 2005.

Climate change a major threat

Under the assumption of no migration, more than half of European plant species could be vulnerable or face extinction by 2080.

RESEARCHERS have investigated the future of 1,350 species of European plants that can be regarded as representative of the flora on the continent, looking ahead to 2080. Their conclusion is that more than half of them are under threat as a consequence of expected climate changes.

Seven different climate scenarios were examined in the study, with mean global temperature rising by between 1.8 and 3.6 degrees Celsius between now and 2080.

The current distribution of each species was recorded on a 50 x 50 kilometre grid covering the entire continent. To assess the level of threat posed by climate change the researchers used criteria developed by the International Union for Conservation of Nature and Natural Resources (IUCN).

Little is known about the ability of species to migrate with their climate zones, so the researchers used two extremes – no migration and universal migration. The actual migration of each species will naturally lie somewhere between these extremes.

Under the assumption of no migration, more than half the species considered become vulnerable or committed to extinction by 2080.

The scenario that portrays the biggest rise in the mean temperature in Europe, 4.4°C, results in a mean species loss of 42 per cent and turnover of 63 per cent in each 50 x 50 kilometre square, but with very large variations depending on where in Europe the square is located.

Species loss in this scenario ranges from 2.5 to 86 per cent per square, while turnover – a measure of how many species disappear and how many new ones appear – ranges from 22 to 90 per cent. The percentage of species loss could exceed 80 per cent in some mountainous areas, such as north central Spain and the Cevennes and Massif Central in France.

In the boreal regions of Europe immigrant plants from the south replace many of the plants that cannot cope with the rise in temperature. Alpine flora are severely affected, however. Species that already face competition and have found refuge at high altitudes will be out-competed by species that move up-slope as the temperature rises.

The researchers acknowledge that there are large elements of uncertainty, but believe their findings provide an illustration of the potential importance and the likely direction of climate change effects. Even under the least severe scenario considered, the risks to biodiversity appear to be considerable.

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Source: Climate change threats to plant diversity in Europe. Published in Proceedings of the National Academy of Sciences of the United States of America, PNAS 7 June 2005, vol. 102, no. 23, 8245-8250. Available in pdf format at www.pnas.org.

Fish on the move

Since the 1970s the mean water temperature at the bottom of the North Sea has risen by around 1°C. When researchers compared the distributions of 36 species of fish in 1977 and 2001 it was found that 21 of them had moved north, some by over 100 kilometres in 25 years – a full four kilometres per year. Species that showed the biggest change in distribution include some that are important to the fishing industry, including cod and haddock. If the North Sea continues to warm as expected, at least two species of commercial fish, blue whiting and redfish, will have disappeared by 2050.

Many of the species studied also moved to deeper waters as they shifted north, which may also have been driven by a search for cooler seas. Populations of six species, including plaice and cuckoo rays, moved to deeper waters without changing latitude.

There are also differences in response depending on the life cycle duration of species, which could cause further disruptions in an ecosystem that has already had to cope with major stress, including over-fishing.

Source: Guardian, 13 May 2005. Study published in Science Vol. 308, Issue 5730, 1912-1915, 24 June 2005.

Migratory species threatened

Climate change could affect and disrupt breeding, hamper migration and increase disease transmission in migratory birds and animals, according to a report by a group led by the British Trust for Ornithology. The species most at risk are those that either can't move and can't adapt fast enough or those that migrate over long distances but find their specialised stop-over points gone or disappearing and their vital food supplies dwindling.

The report draws together broad research on the effects of climate change on migratory wildlife. Changing weather patterns, rising sea levels and increases in extreme weather events such as droughts and floods due to global warming are already destroying habitats, and scientists expect the rate of destruction to increase, it said.

Because they rely on such separated and often diverse habitats, migratory birds and animals seem to be especially vulnerable to the impacts of climate change. The migratory species can probably be seen as alarm bells – some of the problems they are experiencing now are problems we can expect to see in other animals in the decades ahead.

Further information: The full report can be downloaded from www.defra.gov.uk/wildlife-countryside/resprog/findings/climatechange-migratory/index.htm. A more detailed account can be found in the article "Melting Planet", published in The Independent on 2 October 2005 and available at www.zmag.org/content/showarticle.cfm?SectionID=56&ItemID=8862

The CAFE programme and the thematic strategy on air pollution

Environmental Fact sheet No. 19 December 2005

Current levels of air pollution cause severe health impacts in the European Union, resulting in some 370,000 premature deaths each year, increased hospital admissions, extra medication, and millions of lost working days. Additionally, there is widespread and significant damage to ecosystems, agricultural crops, modern materials, and our cultural heritage. The annual cost to society of health impacts alone from fine particles and ozone for the year 2000 has been estimated at between 276 and 790 billion euro.

Adopted by the Council and the European Parliament in July 2002, the EU's Sixth Environmental Action Programme (6EAP) establishes the objective of achieving levels of air quality that do not give rise to significant negative impacts on and risks to human health and the environment. For ecosystems this includes the requirement that critical loads and levels shall not be exceeded.

The Clean Air For Europe (CAFE) programme was launched by the Commission in 2001, with the aim of reviewing current air quality policies and assessing progress towards the long-term objectives of the 6EAP. (See box for more details about the aims and activities of CAFE.)

The 6EAP calls on the Commission to develop seven thematic strategies, including one on air pollution. One of the main tasks of CAFE up to 2005 has been to inform and assist the development of the thematic strategy on air pollution.

Emission trends up to 2020

In order to assess the effectiveness of current air quality policies, CAFE constructed a baseline scenario (also called the "current legislation" scenario – CLE) showing the expected emission levels up to 2020.

The main tool used for the scenario construction and analysis was the RAINS computer model for integrated assessment, essentially the same as that used a few years ago in putting together the directive on national emission ceilings. In addition, other computer models were employed to provide information on trends in the energy, transport and agriculture sectors.

The baseline energy scenario provides a consistent EU-wide view of energy developments, including certain measures needed for implementation of the Kyoto Protocol. It results in a reduction in CO_2 emissions of 7.4 per cent by 2010 and 3.6 per cent by 2020, as compared to the base year 1990.

Based on this energy scenario, and assuming full implementation of current air quality legislation[1], emissions of sulphur dioxide (SO_2) in the 25 EU member countries will fall by two-thirds by 2020, as compared to the base year 2000. Emissions of nitrogen oxides (NOx), volatile organic compounds (VOCs), and fine particles ($PM_{2.5}$) will be reduced by nearly half, while those of ammonia (NH_3) are expected to remain more or less the same up to 2020. (See figure 1.)

Concentrations and depositions of air pollutants are also influenced by emissions from international shipping in the sea areas surrounding Europe. In contrast to the progress in reducing emissions from land-based sources, shipping emissions are expected to continue increasing.

Even after accounting for enforcement of MARPOL Annex VI and the new EU directive on sulphur in marine fuels, emissions of SO_2 from ships are expected to increase by more than 42 per cent by 2020, and those of NOx by two-thirds. In both cases, by 2020 the emissions from international shipping around Europe will have surpassed the total from all land-based sources in the 25 member states combined.

Current legislation inadequate

Damage to health is caused primarily by two types of air pollutants, namely fine particles and ozone. The latter is formed in the atmosphere from the reactions of NOx and VOCs. It is a strongly oxidising gas that can damage vegetation (including agricultural crops and forest trees), certain type of materials, and human health.

Concentrations of $PM_{2.5}$ are increased through direct emissions of so-called primary particles, as well as indirectly through the release of gaseous pollutants (especially SO_2, NOx, and NH_3) that react in the atmosphere to form so-called secondary particles.

[1] Some directives of importance for air pollutants emissions were not included in the baseline scenario, namely the air quality framework and daughter directives, the national emission ceilings directive, and the directive on integrated pollution prevention and control.

See also related fact sheets in this series:

No. 18, September 2005:
Renewable energy in the EU

No. 17, September 2004:
EU emission standards for light and heavy road vehicles

No. 16, May 2004:
EU directive on national emission ceilings (NEC)

No. 15, March 2004:
EU on climate change: Targets, strategies and legislation

No. 10, June 2002:
EU legislation on air pollution

No. 9, June 2001:
Air pollution and health

Available at www.acidrain.org/pages/publications/factsheets.asp

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For $PM_{2.5}$ the RAINS model estimates changes in the loss of statistical life expectancy that can be attributed to changes in anthropogenic emissions. It should be noted that these calculations do not include secondary organic aerosols and they only refer to impact on the population over 30 years of age, thus underestimating the total impact.

Using the pollution levels for the year 2000, it is estimated that $PM_{2.5}$ results in an average shortening of statistical life expectancy of more than eight months in the EU, equivalent to 3.6 million life years lost annually. Under current legislation, by 2020 this figure comes down to about 5.5 months (equivalent to 2.5 million life years lost). See Figure 2.

When it comes to ozone, the RAINS model estimates the number of premature deaths associated with ozone levels above a cut-off level of 35 parts per billion (ppb). Since there is medical evidence of health impact even below 35 ppb, the use of this cut-off level results in an underestimation of the impact. The number of premature deaths estimated as above will gradually decrease up to 2020 as a result of decreased emissions of the ozone precursors NOx and VOCs.

Acidification, i.e. excess deposition of acidifying sulphur and nitrogen compounds, causes damage to both freshwater and terrestrial ecosystems. For the year 2000, nearly one quarter of a million square kilometres – or 21 per cent – of the forest area received acid deposition above the sustainable levels (the critical loads). By 2020 this is calculated to come down to about 10 per cent.

Excess input of nutrient nitrogen, in the form of nitrogen oxides or ammonia, to terrestrial ecosystems gives rise to changes in plant communities and a consequent loss of biodiversity. The present nitrogen deposition exceeds the critical loads over 57 per cent of the area of sensitive ecosystems – a figure that will come down to 46 per cent by 2020. See Figure 3.

The critical level for protecting forest trees from ozone damage is currently exceeded over two-thirds of the ecosystem area. Under current legislation, by 2020 this figure will only be marginally reduced.

Table 1 provides a summary of the health and environmental impacts of various scenarios analysed by CAFE. It is clear that significant negative impacts will persist and that the objectives of the 6EAP will not be achieved by 2020, even with effective implementation of current legislation.

Emission reduction potential

In order to assess the emission reduction potential of applying currently available technical abatement measures, a so-called maximum technically feasible reductions (MTFR) scenario was investigated. As indicated by the name, it does not include structural abatement measures such as fuel switching or energy efficiency improvements.

This scenario would result in a cut in SO_2 emissions of 85 per cent, while those of NOx, VOCs and $PM_{2.5}$ would all come down by between 60 and 70 per cent. Emissions of NH_3 would be reduced by about 40 per cent (see Figure 1).

The MTFR scenario has been criticized for not properly accounting for all available opportunities to reduce emissions, which means that the actual emission reduction potential is underestimated.

Three policy scenarios

Following the production of the CLE and the MTFR scenarios, a number of scenarios were investigated, all set to achieve interim environmental targets with various levels of ambition. For practical reasons, the analysis was limited to the range of emission levels that exists between the CLE and the MTFR scenarios.

The three final policy scenarios were arrived at through a series of model iterations, and they can be said to reflect a lower (A), a medium (B), and a higher (C) overall level of ambition.

Besides providing country-by-country figures on the resulting emission levels of the five air pollutants (SO_2, NOx, VOCs, NH_3, and $PM_{2.5}$), the analysis also includes estimates of the resulting health and environmental impacts in each member state, as well as estimates of the costs and benefits associated with the additional emission reductions (see Table 1).

For the EU as a whole, the additional annual costs range between six and 15 billion euro for the year 2020, equal to about 13–33 euro per person in 2020.

The estimated costs could be compared to monetised annual health benefits of the three policy scenarios, which were valued at 37–160 billion euro for the year 2020, equal to 83–359 euro per person.

Cleaner air brings huge benefits

Earlier benefit analyses have shown that improvements in health generate the largest quantified monetary benefits when air pollution is reduced. The health assessment addresses impact related to both long-term (chronic) and short-term (acute) exposures. It deals with both mortality (i.e. deaths) and morbidity (i.e. illness).

The morbidity effects that can be quantified include hospital admissions and the development of chronic respiratory disease, but also less serious effects, which are likely, however, to affect a greater number of people. These include changes in the frequency of use of medicine to control asthma, and days of restricted activity.

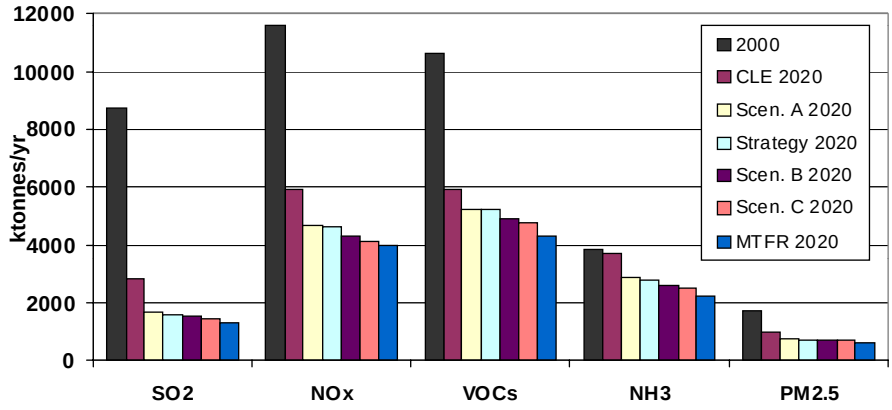
Concentrations of $PM_{2.5}$ have a much more important effect than ozone with respect to mortality. Significant reductions in concentrations and impacts are expected over the period 2000 to 2020, especially regarding $PM_{2.5}$ (see Table 1). The annual health benefits of implementing current legislation up to 2020 are valued at between 89 and 193 billion euro, for the year

Table 1: Summary table of the CAFE analysis and the strategy.

		Human health			Natural environment (km^2)		
	Cost of reduction (euro bn)	Life years lost due to $PM_{2.5}$ (million)	Premature deaths due to $PM_{2.5}$ and O_3	Monetized health benefits (euro bn)	Acidification (forest area exceeded)	Eutrophication (ecosystem area exceeded)	Ozone (forest area exceeded)
2000	-	3.62	370,000	-	243,000	733,000	827,000
Baseline 2020	-	2.47	293,000	-	119,000	590,000	764,000
Scen. A 2020	5.9	1.97	237,000	37-120	67,000	426,000	699,000
Strategy 2020	7.1	1.91	230,000	42-135	63,000	416,000	699,000
Scen. B 2020	10.7	1.87	225,000	45-146	59,000	375,000	671,000
Scen. C 2020	14.9	1.81	219,000	49-160	55,000	347,000	652,000
MTFR 2020	39.7	1.72	208,000	56-181	36,000	193,000	381,000

Note: Costs and benefits are given as annual amounts for the year 2020, and only the costs and benefits of moving beyond the baseline scenario are included. Benefits to the natural environment and the cultural heritage have not been monetized. MTFR illustrates "maximal technical feasible reductions" and does not include structural abatement measures such as fuel switch or energy efficiency.

Figure 1. Emissions in EU25 in the base year 2000 and six scenarios for 2020.



CLE is based on full implementation of current EU legislation; scenarios A, B and C are policy scenarios reflecting various level of ambition; Strategy illustrates the ambition level of the Commission's proposed Thematic Strategy; and MTFR illustrates implementation of so-called maximum technically feasible reductions (MTFR).

2020. This translates to an estimated annual average benefit across the EU of 191–397 euro per person.

Moreover, two additional types of air pollution impact have been quantified in economic terms, namely the effects of ozone on crop yield and the damage to modern buildings. For the year 2000, this damage was valued at 2.8 and 1.1 billion euro, respectively.

Those effects of air pollution that were not quantified in monetary terms, and thus would ordinarily be omitted from a cost-benefit analysis, were covered by a so-called extended analysis. Some conclusions from the extended analysis were that:

❏ Inclusion of impacts on forests, freshwater and other ecosystems could add significantly to the quantified benefits;

❏ Inclusion of the effects of chronic exposure to ozone on health, social impacts of air pollution on health, altruistic effects and damage to cultural assets may be important, but there is currently inadequate evidence available to make a firm conclusion; and,

❏ Other effects are unlikely to make a substantial difference to quantified benefits at the European level, but may be significant in some areas.

The thematic strategy

Following the CAFE analysis of the various scenarios, the Commission adopted in September 2005 its thematic strategy on air pollution.

By establishing interim environmental objectives for 2020 in the strategy, the Commission sets the level of ambition regarding air quality in the EU up to 2020.

The interim objectives are shown in Table 1, which also shows the estimated costs and benefits of the strategy. When compared to the CAFE policy scenarios, the Commission's chosen level of ambition is between scenarios A and B.

Although this means some improvements as compared to "business as usual", it is clear that significant damage from air pollution will remain in 2020. The emission reductions needed to achieve the strategy's interim objectives can be seen in Figure 1.

On top of the analysis of costs and benefits, the wider economic and social impacts were also investigated. The costs of meeting scenarios A, B and C were estimated at respectively 0.04, 0.08, and 0.12 per cent of EU GDP in 2020. The overall impact on employment was negligible, and EU competitiveness relative to other industrialised countries such as the USA and Japan would not be affected. It should be noted that the positive impacts of reduced mortality and better health were not taken into account in this analysis.

As regards specific legislative proposals, the strategy is accompanied by a proposal to merge the air quality framework directive and three so-called daughter directives containing minimum requirements for air quality. The proposed new directive aims to clarify and simplify provisions, and to modernise and streamline monitoring and reporting requirements. It also introduces new provisions for fine

Clean Air for Europe – the CAFE programme

The Clean Air for Europe (CAFE) programme was launched by the European Commission in 2001, with the aim of reviewing current air quality policies and assessing progress towards attainment of the EU's long-term air quality objectives, as laid down in the Sixth Environment Action Programme. CAFE has dealt with health and environmental problems related to fine particles (PM), ground-level ozone, acidification, and eutrophication.

CAFE has provided the analysis for the EU's thematic strategy on air pollution, which was adopted by the Commission in September 2005. The idea is that CAFE should evolve into an ongoing five-year cyclical programme, in which the 2005 thematic strategy on air pollution simply marks the first milestone.

The activities of the programme include:

❏ Developing and collecting scientific information on the effects of air pollution, making inventories and projections of emissions and air quality, doing studies of cost-effectiveness and carrying out integrated assessment modelling – all leading to new and/or revised objectives in respect of air quality and pollutant deposition, and identifying the measures required for reducing emissions.

❏ Supporting the implementation of existing legislation and reviewing its effectiveness, especially in view of the directives on air quality and on national emission ceilings, and developing new proposals for measures to abate emissions.

❏ Determining at regular intervals an integrated strategy to define appropriate air-quality objectives for the future and cost-effective measures for meeting those objectives.

❏ Disseminating the information emerging from the programme.

A steering group comprising representatives of the member states and stakeholders (e.g. industry and environmental NGOs) meets two or three times a year to advise the Commission on the strategic direction of the programme. In addition, during 2001–2005 four consultative working groups have been engaged. Altogether, the CAFE programme held more than one hundred stakeholder meetings in the last four years.

More information on the CAFE programme can be found on the website of the Commission's environment directorate: http://europa.eu.int/comm/environment/air/cafe/index.htm

Figure 2. Loss in statistical life expectancy that can be attributed to anthropogenic contributions to $PM_{2.5}$ (months). For the emission levels in the year 2000 (left), and for two projected emission levels for 2020: CLE (centre) and MTFR (right).

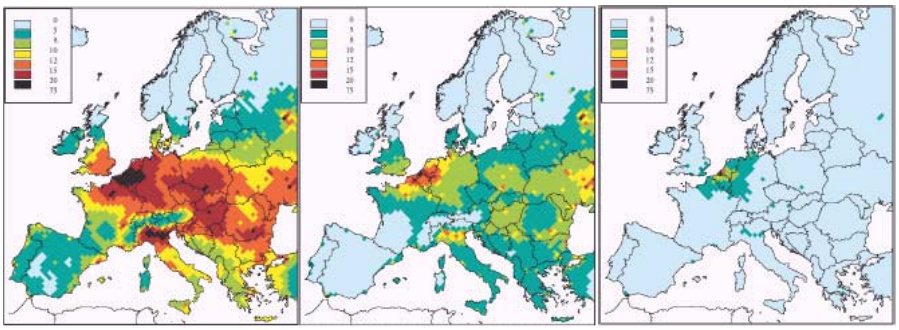
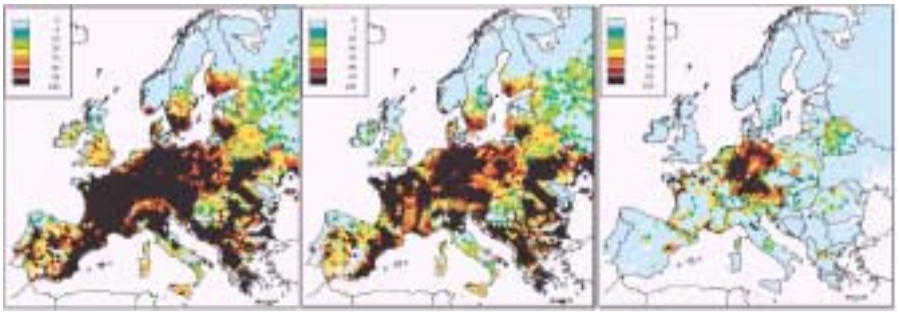


Figure 3. Percentage of total ecosystems receiving nitrogen deposition above the critical loads for eutrophication. For the emission levels in the year 2000 (left), and for two projected emission levels for 2020: CLE (centre) and MTFR (right).



particles ($PM_{2.5}$).

When it comes to emission reductions, there are no specific proposals for new or revised EU legislation presented together with the strategy. The Commission announces however that it will review the national emission ceilings (NEC) directive, and in late 2006 propose revised emission ceilings that will be based on the level of ambition set out in the strategy.

In addition, the strategy outlines a number of expected or possible actions at EU level, for example:

❏ Strengthened emission standards for new road vehicles;

❏ Revision of the directive on integrated pollution prevention and control (IPPC), including a possible expansion to cover small combustion plants;

❏ A possible new directive to reduce VOC emissions from petrol stations; and,

❏ Measures to reduce NOx emissions from shipping.

The Commission also makes clear that meeting air quality targets will require efforts in other policy areas, in particular the energy, transport and agriculture sectors, and for each of the sectors a number of possible actions are discussed.

It is foreseen that the strategy will be reviewed in 2010, and that the results will feed into the review of the 6EAP.

More information

Communication from the Commission to the Council and the European Parliament: thematic strategy on air pollution. COM(2005) 446 final.

Commission staff working paper: Impact assessment of the thematic strategy on air pollution and the directive on "Ambient air quality and cleaner air for Europe". SEC(2005) 1133.

Reports produced under the CAFE programme (scenario analysis, CBA, etc.).

All documents and reports are available from the website of the Commission's environment directorate: http://europa.eu.int/comm/environment/air/cafe

Overestimated costs and underestimated benefits

There are several factors that have led to an overestimate of the incremental cost of the various CAFE scenarios. They include the following:

❏ The estimates of incremental costs were based on the application of technical abatement measures only, and did not account for structural measures – such as switching fuels, increasing energy efficiency, greater use of alternative energy sources and changes in the transportation and agricultural sectors. These measures can reduce emissions more and at much lower cost as compared to relying solely on technical "end-of-pipe" solutions.

❏ The performance of the technical abatement measures was based on the current situation, i.e. technical developments and improvements have not been accounted for.

❏ The baseline scenario failed to include implementation of some important air pollution directives, for example those on national emission ceilings and air quality limit values. Similarly, for agriculture, the impact of the Common Agriculture Policy reform or the implementation of the nitrate and IPPC directives were not accounted for.

❏ The underlying energy scenario assumed a reduction in emissions of the major greenhouse gas CO_2 of only 3.6 per cent between 1990 and 2020, which is contradictory to the EU's commitment to reduce greenhouse gas emissions. In March 2005, the EU Heads of State agreed a target to reduce overall emissions of greenhouse gases by 15-30 per cent by 2020. Measures aimed at reducing CO_2 emissions will in general also reduce emissions of SO_2, NOx, and $PM_{2.5}$, and applying a "lower-CO_2" energy scenario would therefore reduce the estimated costs for additional emission reductions.

These shortcomings in the analysis are of major importance, because the combined result of overestimating the costs of attaining various targets and underestimating the real potential for emission reductions gives a false impression that ambitious environmental targets are very costly or even "unattainable", which leads to a general lowering of the level of ambition of the strategy.

While only some of the benefits can be estimated in monetary terms, the quantifiable health gains of the CAFE scenarios have been estimated to range from 37 to 181 billion euro in the year 2020, i.e. up to 20 times higher than the (over)estimated costs. Even for the most ambitious of the scenarios investigated, the MTFR scenario, the benefits still outweigh the costs by 1.4 to 4.5 times. Among the gains *not* included in these figures are less acidification of soil and water, less eutrophication, fewer effects on biological diversity, less long-term effect on forest productivity, and less damage to the cultural heritage.

There is a negative correlation between the occurrence of cowberries *Vaccinium vitis-idaea* and the current deposition of nitrogen in coniferous forests in Sweden.

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CRITICAL LOADS

Boreal forest flora more sensitive than thought

BOREAL FORESTS were thought to be able to withstand 10–15 kg of nitrogen per hectare and year without endangering biodiversity. But new research suggests that the limit should be set much lower.

Several studies show that the supply of plant-available nitrogen is one of the biggest threats to European flora. Deposition of airborne nitrogen amounts to a few kg per hectare in northern Scandinavia, but in parts of central Europe it is in the region of 20–40 kg per hectare per year.

At a number of trial sites Swedish researchers have been spreading between three and 50 kg of nitrogen per hectare per year. To isolate the effects as much as possible the experiments have been carried out in areas where nitrogen deposition is low.

It has been known for some time that the addition of nitrogen changes the biochemistry of keystone understorey species in boreal forests, such as bilberry, *Vaccinium myrtillus*, and cowberry, *V. vitis-idaea*, in a way that favours attack by commonly occurring parasitic fungi.

The experiments confirm this mechanism, but also show that the increased light penetration that results from damage to shrubs makes it easier for grasses such as wavy hair-grass, *Deschampsia flexuosa*, to gain a foothold. Wavy hair-grass also benefits from the fact that it is better than shrubs at making use of the added nitrogen.

The reduced abundance of bilberries in nitrogen-addition experiments is in accordance with large-scale monitoring data that show negative correlation between the occurrence of bilberries and cowberries and the current deposition of nitrogen in coniferous forests in Sweden.

Researchers have also studied the effects on various common mosses in boreal forests. Mosses have no roots but can efficiently take up the nitrogen that is supplied by precipitation. However, storing this nitrogen in the form of amino acids in the plant cells uses energy and slows the growth of mosses. Follow-up work on earlier experiments in which nitrogen was added to forest land also show that this effect is long-acting.

The conclusion the researchers draw is that the critical load for understorey vegetation in boreal forests should be reduced from the current figure of 10–15 kg of nitrogen per hectare per year to 6 kg. They also point to the need for long-term studies, as it takes a long time for some changes to show.

PER ELVINGSON

Further reading: Nitrogen Deposition and the Biodiversity of Boreal Forests: Implications for the Nitrogen Critical Load. Ambio Vol. 34, pp. 20-24. No. 1, February 2005.

FOREST DAMAGE

Twenty years of monitoring

A NUMBER OF WARNINGS of widespread forest damage in Europe in the early 1980s led to the start of internationally co-ordinated monitoring of forest condition twenty years ago.

Initially the studies focused mainly on crown condition, which reflects tree vitality. It is useful as a fast reacting indicator for numerous environmental factors and can be assessed with reasonable effort. More recently the monitoring programme has been extended to include factors such as soil chemistry, etc.

Two decades of annual monitoring of crown condition have revealed high spatial and temporal variation in defoliation. Forest damage has developed far less dramatically than predicted by some scientists two decades ago, but on the other hand emissions of acidifying air pollutants in particularly have also fallen very significantly over this period.

Monitoring during 2004 shows that more than 23 per cent of around 135,000 trees assessed in 31 countries were classified as damaged. Defoliation varied greatly between species and regions. European and sessile oak had the highest and Scots pine the lowest defoliation.

The trends in defoliation also differ with species and region. As of last year, most of the main tree species show a clear worsening of crown condition as compared to the previous year. This effect was particularly pronounced for common beech.

Plausible explanations are delayed effects of the extreme heat and drought in summer 2003. While defoliation of several main species has increased since 1990, defoliation of Scots pine is now clearly lower than in the mid-1990s.

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Further reading: The Condition of Forests in Europe. 2005 Executive Report. Europe's Forests in a Changing Environment. Twenty years of Monitoring Forest Condition by ICP Forests 1985-2005. Both available in pdf format at www.icp-forests.org

Abatement measures investigated

Cost-effective to do more at sea compared to additional measures at shore side.

A NEW CONSULTANCY STUDY prepared for the European Commission concludes that emission abatement measures, such as the use of selective catalytic reduction and switching to low-sulphur fuel, can yield large reductions in air pollutant emission from shipping, and that these measures can be very cost-effective compared to additional measures to reduce emissions from land-based sources, such as power plants, industrial processes, and road transportation.

The research was ordered following an EU strategy on shipping emissions launched in 2002, and applications where these results are likely to be used include the next step of the Clean Air For Europe programme and the forthcoming revision of the directive on national emission ceilings (NEC).

The investigation of the technical potential and costs to reduce airborne emissions from shipping in EU waters was carried out by the UK consultancy Entec, which initially states in its report that *"the study generally errs on the side of caution, in order to try to avoid overestimating the emission reduction potential."*

A wide range of emission abatement measures was studied, and Table 1 provides a summary of their respective reduction potential.

SO_2 reductions

Regarding sulphur dioxide (SO_2), two types of measures were studied, namely sea water scrubbing and switching from high-sulphur to low-sulphur fuel.

The sea water scrubbing technique works by mixing the hot exhaust gases in a turbulent cascade with sea water. In this process exhaust SO_2 is transferred to the sea water, which is then re-circulated to allow the solid particles from the exhaust gases to be trapped and removed. The sea water, with its increased content of sulphate, is released into the sea.

To date there is very limited practical experience of sea water scrubbing, but starting in autumn 2004 commercial trials have been carried out on a European passenger ferry. One producer of the technology expects that with design improvements, SO_2 reductions of 90 per cent should be possible, but based on results from the trials, the study assumes an efficiency rate of 75 per cent. With this assumption, costs were estimated to be in the range of 320 to 576 euro per tonne of reduced SO_2.

Two options for fuel switching were considered – from the current average of 2.7 per cent sulphur residual oil down to 1.5 and 0.5 per cent sulphur residual oil, respectively. There is a wide range of estimates for the additional cost of low-sulphur fuels, and the study uses figures from two sources. According to these, switching to 1.5-per-cent sulphur fuel would cost 1,230 or 2,053 euro/tonne of reduced SO_2, and for switching to 0.5-per-cent sulphur fuel the cost would be 1,439 or 1,690 euro/tonne.

It is worthwhile noting that cost figures for low-sulphur marine fuels used in analyses by the Convention on Long-Range Transboundary Air Pollution and previously by the CAFE programme, which are also accepted by the European oil industry, are significantly lower – at 500–600 euro/tonne of reduced SO_2.

NOx reductions

When it comes to nitrogen oxides (NOx), several techniques were studied, including:

BASIC INTERNAL ENGINE MODIFICATIONS: Basic IEM means the exchange of conventional fuel valves with low-NOx slide valves, a method that is currently applicable only to slow-speed two-stroke engines. Virtually all new engines of this type are thought to have these valves fitted as standard, as a means of meeting the IMO NOx standard. Retrofitting is considered easy. Cost is estimated at 9–12 euro/tonne NOx (see Note 1).

ADVANCED INTERNAL ENGINE MODIFICATIONS: Advanced IEM involves combinations of a number of techniques – such as retarded injection, higher compression ratio, increased turbo efficiency, common rail injection, etc – optimized for particular engine types. Costs are estimated at 19–98 euro/tonne NOx for reductions to 30 per cent below the IMO NOx standard, although some producers claim that reductions of 40 per cent can be attained now, and that further improvements can be expected.

Table 1. Emission reduction efficiencies.

Measure	Emission reduction			
	SO_2	NOx	PM	VOC
Shore-side electricity (2.7% S RO fuel)	96%	97%	96%	94%
Shore-side electricity (0.1% S MD fuel)	0	97%	89%	94%
Basic internal engine modification (IEM)	0	20%	0	0
Advanced internal engine modification (IEM)	0	30%	0	0
Direct water injection (DWI)	0	50%	0	0
Humid air motors (HAM)	0	70%	0	0
Exhaust gas recirculation (EGR)[1]	93%	35%	>63%	+/-2
Selective catalytic reduction (SCR) (2.7% S RO fuel)	0	90%	0	0
Selective catalytic reduction (SCR) (1.5% S RO fuel)	44%	90%	18%	+/-
Selective catalytic reduction (SCR) (0.1% S MD fuel)	96%	90%	>63%	+/-
Sea water scrubbing	75%	0	25%	+/-
Fuel switching 2.7 -> 1.5% S RO fuel	44%	+/-	18%	+/-
Fuel switching 2.7 -> 0.5% S RO fuel	81%	+/-	>20%	+/-

[1] Assumes switching from 2.7% S residual oil (RO) to 0.2% S middle distillate (MD) oil.

[2] The sign +/- indicates that no conclusive information is available.

PHOTO: SÖDRA

The freighter MS Cellus emits 90 per cent less NOx and 80 per cent less sulphur dioxide than an equivalent standard ship. It is equipped with an SCR flue gas emission control system and uses low-sulphur fuel oil.

DIRECT WATER INJECTION (DWI): Fresh water is injected to cool the combustion chamber, which requires storage and bunkering of fresh water on board the ship. Installation can be done while the ship is in normal service. Cost is estimated at 345–411 euro/tonne NOx.

HUMID AIR MOTOR: The HAM system uses heated charge air enriched with evaporated seawater. So far HAM has only been retrofitted to four engines on one ship, but with very good experience. Cost is estimated at 198–306 euro/tonne NOx.

EXHAUST GAS RECIRCULATION: A fraction of the exhaust gases are filtered, cooled and redirected into the engine intake air, thus reducing the combustion temperature. This technique may be best suited to engines running on high-grade low-sulphur fuels. No cost estimate provided.

SELECTIVE CATALYTIC REDUCTION: In the SCR process, a urea solution is injected into the exhaust gas stream, which then passes through a catalyst housing, which usually also replaces the silencer. SCR is suitable for both new vessels and retrofit installations. Cost is estimated at 313–809 euro/tonne NOx.

All measures cost-effective

When the costs per tonne of reducing emissions of NOx or SO_2 from shipping are compared to the costs for additional (i.e. beyond current legislation) abatement measures for land-based sources in the EU, it is concluded that all the above-mentioned types of measures investigated for the shipping sector are cost-effective.

Shore-side electricity

While in port, ships use their auxiliary engines to produce electricity for hotelling and for unloading and loading activities.

Currently, these engines are often fuelled with high-sulphur residual oil, resulting in significant emissions of air pollutants. According to the recently adopted EU directive on sulphur in marine fuels (2005/33/EC), as from 2010 ships at berth must use fuel with a sulphur content of 0.1 per cent or less.

An alternative way to reduce emissions from ships while at berth is to provide electricity to the ship from the national grid, instead of producing electricity onboard the ship by running its engines. (Using shore-side electricity will exempt ships from having to meet the 0.1-per-cent sulphur fuel requirement.)

Although not yet widely used, there are a number of examples of shore-side electricity in practical use, for example in the ports of Gothenburg, Sweden, and Los Angeles, USA.

Apart from reducing the emissions of SO_2, NOx, PM and VOCs in ports, using shore-side electricity also reduces emissions of other pollutants contained in ship exhaust gases, such as polycyclic aromatics, carbon dioxide, carbon monoxide, methane and nitrous oxide. It also eliminates noise and vibration from the auxiliary engines whilst at berth.

When calculating the emission reduction potential for shore-side power connection, EU average emission factors for 2010 for electricity generation were estimated, and included in the calculations.

The emission reductions achieved and their associated costs depend on several factors, including whether the fuel replaced is assumed to be the currently used high-sulphur (2.7 per cent) residual oil, or the future 0.1-per-cent sulphur oil. Both SO_2 and NOx reductions are estimated to cost from around 4,000 to nearly 13,000 euro per tonne. (These figures result from assuming *all* costs to be carried by one pollutant only, thus disregarding the fact that shore-side electricity actually results in a simultaneous abatement of several pollutants.)

When comparing additional operating costs for shore-side electricity

Continued on next page

Assignment of international emissions

If countries are to be made responsible for the emissions at sea the choice of allocation method is critical to results. The best method is probably based on location of emissions, according to a new study.

FOR MANY YEARS international shipping has escaped environmental requirements like those imposed on land-based sourced of emissions. This is largely because no single country has been responsible for these emissions and because supranational authority has not been strong enough. Emissions of air pollutants from shipping – mainly oxides of sulphur and nitrogen – therefore represent a large and growing problem.

Change is on the way, however. MARPOL Annex VI, drawn up by the International Maritime Organization, provides international regulations that are admittedly weak, but which could be strengthened (see AN 3/05, p.6).

In addition the EU Commission has set up an investigation to determine if and how shipping emissions in European waters can be assigned to individual countries and included in their undertakings, in a forthcoming revision of the EU National Emission Ceilings Directive (2001/81/EC).

The study, which was conducted by the UK consultancy Entec, looks at sulphur dioxide (SO_2), nitrogen oxides (NOx), volatile organic compounds (VOCs), particulate matter (PM) and carbon dioxide (CO_2).

Seven different methods were used to assign emissions to each of the EU25 member states, plus Bulgaria, Romania, Turkey and Croatia. The methods were appraised against several criteria, within an overall multi-criteria analysis.

The choice of method has a big influence on the share of responsibility assigned to each country for emissions from international shipping.

For assignment based on **location of emissions** (Method A), for the 12-mile zones, the UK has the highest emissions from ships, followed by a group that includes Greece, Germany, Italy, Netherlands, Spain, Denmark and France, each with broadly similar levels of emissions. For the 200-mile zones, Italy has the highest emissions from ships, followed by Greece, Spain and the UK.

For assignment based on **flag of ship** (B), Cyprus has the highest emissions from ships, followed by Malta, and for some pollutants Greece, while for others Germany.

For assignment based on **fuel sales** (C) and **fuel consumption** (D), the Netherlands has the highest emissions from ships, followed by Spain, Belgium and Greece.

For assignment based on **freight tonnes loaded** (E), the Netherlands has the highest emissions from ships, followed by the UK, Italy and France.

For assignment based on **national emissions** (F), countries will be ranked in different orders, depending on the particular pollutant.

For assignment based on **country of departure/destination** (G), the UK, Italy and Spain have the highest emissions from ships.

Entec does not recommend any single method as best, but dismisses alternatives B and F as of little interest, since the connection between flag country and emissions is weak and because these is no link between national emissions and shipping emissions.

The method that is given the widest support is A, i.e. that emissions are assigned to the nearest country. This method is considered "clearly worthy of further investigation", writes Entec. Further work that is recommended includes studies on the size of zones for assigning emissions and potential enhancements to the underlying database.

The remaining four methods are also, according to Entec, considered worthy of further investigation, as they have certain positive characteristics.

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Preliminary Assignment of Ship Emissions to European Countries. Final Report, August 2005. Entec UK Limited. Can be downloaded in pdf format from the Commission's environment directorate: http://europa.eu.int/comm/environment/air/transport.htm#3

Abatement measures investigated

Continued from previous page

to those of switching to burning fuel containing 0.1 per cent sulphur, it was concluded that for prices above 320 euro per tonne for substituted fuel, the costs for shore-side electricity are lower than the onboard generating option. If the total costs of shore-side electricity are considered, this could be an economically attractive option for fuel prices above 450 euro per tonne. The report quotes information that in September 2005, marine gas oil was sold at a market price of 540 euro per tonne.

As well as providing estimates of emission reduction efficiencies and costs for the various abatement measures, the study also gives an assessment of their technological maturity (ranked on a scale of 1–3), and outlines the expected uptake under a business as usual scenario for EU flagged vessels.

CHRISTER ÅGREN

Note 1. Regarding the range in cost estimates for the various measures, the lower cost figure usually refers to installation on a new large vessel, and the higher figure to retrofit installation for an existing small vessel. In general the cost per unit emission reduction will be lower for larger vessels and if abatement technology is installed at the time of building the engine/ship, and higher for smaller vessels and if the technology is retrofitted to existing ships.

Note 2. The studies on ship emissions abatement are split into four reports, namely: Task 2 – General report; Task 2a – Shore-Side Electricity; Task 2b – NO_x Abatement; and, Task 2c – SO_2 Abatement. The reports can be downloaded in pdf format from the Commission's environment directorate: http://europa.eu.int/comm/environment/air/transport.htm#3.

PHOTO: SWEDISH SHIPOWNERS ASSOCIATION

SHIPPING

Economic instruments for reducing emissions

REDUCING EMISSIONS of sulphur and nitrogen oxides at sea is generally regarded to be much cheaper than achieving similar reductions from land-based sources. In socioeconomic terms it therefore makes good sense to take stronger measures to reduce shipping emissions than at present.

On behalf of the European Commission a UK consultancy, NERA, has investigated whether financial incentives can be used to promote measures that reduce emissions at sea. NERA describes in detail four previously discussed methods, all of which are based on voluntary participation.

CREDIT-BASED TRADING APPROACH. Credit programmes provide tradable emissions, or credits, to sources – in this case ships – that voluntarily reduce emissions below their "business as usual" levels. For this approach to work it will be necessary to have buyers of credits, which would require either the introduction of a cap-and-trade programme for emissions from land-based sources, or alternatively a subsidy programme whereby government simply purchases the credits generated by ships.

It is noted that land-based trading programmes are likely to require modification of at least two EU directives, namely those for large combustion plants (LCP) and integrated pollution prevention and control (IPPC).

CONSORTIUM BENCHMARKING. In this approach, vessels would have the option of joining a consortium that would voluntarily commit to achieving an average emissions rate, known as the benchmark. Participation in a consortium would be entirely voluntary – the alternative would be for a vessel to comply directly with whatever existing regulation applied. The consortium approach requires some existing mandatory regulation to offer incentives for trading consortia to form. NERA notes that one potential problem is that individual consortium members in fact are allowed to exceed what would otherwise be maximum allowable emission limits.

Infrastructure charges may be a more promising alternative

ENVIRONMENTALLY DIFFERENTIATED CHARGES. This approach involves the differentiation of port dues based on environmental criteria, thus providing a financial incentive for low-emission operation. The greater the number of ports that participate, the stronger the incentive would be.

ENVIRONMENTAL SUBSIDY APPROACH. Subsidies could be used alone or to supplement other policy options. One example of the latter was a programme that ran in Sweden until 2002 to pay for part of the cost of installing SCR or HAM equipment to reduce emissions of NOx, coinciding with the introduction of environmentally differentiated infrastructure charging.

NERA draws the conclusion that the credit-based approach appears most promising for NOx, because there is a wide choice of potential abatement measures to reduce emissions, and the cost of abatement appears low compared to the cost of additional land-based abatement. Baselines could be established on the basis of the IMO NOx curve, and monitoring appears to be feasible.

In the case of sulphur dioxide, the consortium benchmarking approach is recommended. The costs are reduced in comparison with the "command-and-control" approach, in which all ships would be compelled to use low-sulphur fuels, mainly because sea water scrubbers are cheaper in many instances.

When it comes to environmentally differentiated port dues, NERA considers that the incentive effect would be poor, partly because port dues may not be high enough to provide sufficient incentives, even with substantial differentiation. The ports also operate in a competitive market, which means they are likely to show little interest in participating. Raising charges for some classes of ships may not be commercially feasible.

Swedish experience suggests that when combined with a centrally determined mandatory charging programme, a voluntary programme with differentiated port dues could be successful. NERA writes that a more coordinated effort to apply infrastructure charges to a wider geographical range than individual ports may be a more promising alternative in the medium term.

On the subject of subsidies NERA asserts that these would have to be large in order to generate significant emission reductions.

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Source: **Economic Instruments for Reducing Ship Emissions in the European Union**. NERA Economic Consulting, September 2005. Available at http://europa.eu.int/comm/environment/air/transport.htm#3

PHOTO: NORSK HYDRO

The most likely method for storing carbon dioxide would be to pump it underground during the extraction of oil and gas.

IPCC report on carbon capture and storage

IF IT WERE POSSIBLE to trap and store the carbon dioxide that is released during combustion we could continue using fossil fuels without affecting the climate.

A survey by 100 experts on behalf of the Intergovernmental Panel on Climate Change (IPCC) shows that this is feasible, but at a high cost. Electricity prices could typically rise by 25–80 per cent if power plant operators adopted the technology, according to the report.[1]

The first step, trapping the CO_2, could only be done at a reasonable cost at large combustion plants, the IPCC finds. Further demonstration of the technology is also required over the coming years and decades.

The most likely method for storing carbon dioxide would be to pump it underground during the extraction of oil and gas. Other solutions, such as ocean storage or fixing CO_2 in stable carbonates, are still in the research phase.

The environmental organization WWF said the report raised more questions than answers and urged governments to stick to pledges to cut carbon dioxide emissions with a focus on energy efficiency and renewable energy.

Greenpeace called it a "clarification of the limits of the technology". The conclusions further reinforced the need for massive deployment of renewable energy and energy efficiency technologies, it said.

[1] **IPCC Special Report on Carbon dioxide Capture and Storage**. Available at www.ipcc.ch.

Strong market growth

GLOBAL INVESTMENT in renewable energy set a new record of $30 billion in 2004, according to a report released in November by the Renewable Energy Policy Network for the 21st Century (REN21).[1]

Technologies such as wind, solar, biomass, geothermal, and small hydro now provide 160 gigawatts of electricity generating capacity, about four per cent of the world total, the report finds.

Other findings in the report include:

❑ The fastest growing energy technology in the world is grid-connected solar photovoltaic, which grew in existing capacity by 60 per cent per year from 2000–2004, to cover more than 400,000 rooftops in Japan, Germany, and the United States.

❑ Second is wind power capacity, which grew by 28 per cent last year, led by Germany, with almost 17 GW installed as of 2004.

❑ Nearly 40 million households worldwide heat their water with solar collectors, most of them installed in the last five years.

❑ Sixteen million households cook and light their homes with biogas, and two million households use solar lighting systems.

❑ Production of biofuels (ethanol and biodiesel) exceeded 33 billion litres in 2004, when ethanol displaced about three per cent of the 1,200 billion litres of gasoline used globally.

❑ Altogether, renewable energy industries provide 1.7 million jobs.

The report finds that government leadership provides the key to market success and that government support for renewable energy is growing rapidly. At least 48 countries now have some type of renewable energy promotion policy, including 14 developing countries.

Worldwatch Institute, which produced the report, believes that it fills a gap in the international energy reporting arena, which has tended to neglect the emerging renewable energy technologies. Regular updates are promised in the future.

[1] **Renewables 2005: Global Status Report**. Can be downloaded at www.worldwatch.org. REN21 is a global policy network aimed at providing a forum for international leadership on renewable energy. Further information: www.ren21.net.

China raises the mark

Renewables should account for 15 per cent of national energy use by 2020, Vice Premier Zeng Peiyan said at the international conference on renewable energy in Beijing. China had previously aimed to get 10 per cent of its energy from renewable sources by 2020, though the 15 per cent figure had been mentioned as a possibility as Beijing has talked about getting away from polluting fossil fuels and soaring oil prices.

Source: Planet Ark (Reuters), 8 November 2005.

European Parliament wants binding targets

The European Parliament has approved a report calling for a 20-per-cent mandatory target for renewable energy in relation to total EU energy use by 2020. This proportion could be increased to 25 per cent if energy efficiency is increased at the same time.

The Parliament report follows a 2004 communication from the European Commission on renewable energy, in which the Commission was unwilling to specify a target for 2020 before the measures that have already been taken to meet the 2010 target have been evaluated.

The Parliament stresses that the EU power market is "still suffering from a number of serious distortions," including large direct and indirect subsidies for fossil fuels and nuclear power, lack of internalization of external costs and unbalanced funding for renewable energy research.

Further reading: Report on the share of renewable energy in the EU and proposals for concrete actions, 2004/2153 (INI), Committee on Industry, Research and Energy, A6-0227/2005. Can be downloaded at http://www.europarl.eu.int/oeil/file.jsp?id=5199472

Large and inefficient

OF THE thirty power plants that have the highest carbon dioxide emissions in the EU member states 27 are coal-fired. The least efficient (i.e. those with the highest emissions in relation to useful energy) are Agios Dimitrios in Greece, Frimmersdorf in Germany and Aboño in Spain.

The ranking was drawn up by WWF. Using a variety of databases it identified the thirty power plants that have the highest absolute emissions (in tonnes of CO_2 per year) in the EU countries, and then ranked the 30 biggest emitters according to their level of efficiency (in grams of CO_2 per kilowatt hour).

Most of the so-called Dirty Thirty are located in Germany (nine plants), followed by Poland (five), Italy, Spain, and the UK (four plants each). Greece has two lignite plants ranked in first and fourth place.

Germany comes off particularly badly in the survey. It is home to five of the ten dirtiest plants, and four of them are run by the German power giant RWE, the biggest CO_2 emitter in the European power sector. The Dirty Thirty shows that only half a dozen companies account for most of Europe's dirtiest power stations: 19 of the 30 plants analyzed are run by RWE (German), Vattenfall (Swedish), Enel (Italian), Endesa (Spanish), E.ON (German) and EDF (French).

According to WWF the power sector accounts for 37 per cent of all man-made CO_2 in the EU25. The organization points out that many of the worst offenders on the list are old and will be decommissioned over the next 20 years.

WWF declares that this is "a historic window of opportunity" to cut CO_2 emissions. The study considers three replacement scenarios for the thirty plants:

1. Replacing them with new coal plants that are more efficient than the old ones would result in a 13.5 per cent reduction in CO_2 emissions from current levels by 2030.
2. A switch from coal to gas in the decommissioned plants would slash CO_2 emissions by 47.8 per cent by 2030.
3. Replacing decommissioned plants with renewable energy sources would result in a 73.4 per cent cut in CO_2 emissions by 2030 (increasing to 100 per cent when all old plants are decommissioned).

"A crucial part of the solution to CO_2 emissions from power production is the European Emission Trading Scheme," comments Imogen Zethoven at WWF. "WWF is pushing for strong pollution limits and clear incentives to invest in wind, water and sun to be included in the second phase of the scheme. Only tough limits on CO_2 will force the utilities to replace dirty coal plants with cleaner gas or clean renewables."

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Information: www.panda.org/powerswitch

Top ten in the WWF list of big power plants with the lowest efficiency in the EU25.

No.	Name	Country	Fuel	Commissioning date	Relative emissions[1]
1	Agios Dimitrios	Greece	Lignite	1984-1986, 1997	1.350
2	Frimmersdorf	Germany	Lignite	1957-1970	1.270
3	Aboño	Spain	Hard coal	1974, 1985	1.270
4	Kardia	Greece	Lignite	1975, 1980-1981	1.250
5	Jänschwalde	Germany	Lignite	1976-1989	1.200
6	Weisweiler	Germany	Lignite	1955-1975	1.180
7	Neurath	Germany	Lignite	1972-1976	1.150
8	Turow	Poland	Lignite	1965-71, 1998-2004	1.150
9	Rodriguez (Puentes)	Spain	Lignite	1976-1979	1.150
10	Niederaußem (w/o BoA)	Germany	Lignite	1963-1974	1.120

[1] Grams of CO_2 per kilowatt hour (g CO_2/kWh). Where two plants have the same relative emissions, the plant with the higher absolute emissions (million tonnes CO_2 per year) ranks dirtier.

NEWS IN BRIEF

Old plants to be shut down

Four coal-fired stations and 19 oil-fired plants in Spain will be shut down before 2015. The plants, all built before 1987, have a combined capacity of 6,500 megawatts, which is equivalent to a third of the country's coal and oil-based electricity generating capacity.

The closures are being made to comply with the EU's large combustion plants directive. Under a national plan drawn up by the government, operators could elect to introduce strict emission controls on older power stations after 2008 or allow them to operate for no more than 20,000 hours between 2008 and 2015.

Operators have decided that it would be cheaper to phase out the plants before the end of 2015 under the national plan than to install emission control systems. Last year the plants emitted 23,860 tonnes of NOx and 85,800 tonnes of SO_2.

Source: **Environment Daily**, 24 October 2005.

New plant rejected

The Spanish environment ministry has refused permission for a 400 MW combined cycle electricity generating plant, which generator Endesa wanted to build in Seville. The reason is that the plant would add two per cent to local nitrogen dioxide levels, which already exceed EU limit values effective from 2010.

Source: **Environment Daily**, 21 October 2005.

Energy efficiency highest priority

Major efforts will be required by Spain to meet its Kyoto commitment, reports the International Energy Agency (IEA) in a review of the country's energy sector.[1] By 2003, greenhouse gas emissions had already increased by 41 per cent over the 1990 level, well beyond the targeted maximum rise of 15 per cent for the period 1990 to 2008–12.

Spain will have to make major investments in energy efficiency to achieve the target and improve security of supply, according to the IEA, which praises the newly adopted action plan. The transport sector is identified as problematic due to its steadily climbing emissions. The government will have to address this with a comprehensive set of measures for urban mobility, increased use of public transport and fleet rejuvenation, writes IEA.

[1] **Energy Policies of IEA Countries: Spain – 2005 Review**. Available at www.iea.org.

A clean energy future for the EU

It's possible to reduce emissions of CO_2 and at the same time phase out nuclear power.

EUROPE CAN PHASE OUT nuclear power and, at the same time, reduce its carbon dioxide emissions by 30 per cent by 2020. By 2050 half of Europe's energy demand could be supplied from renewable energy sources and CO_2 emissions could be reduced by nearly 75 per cent.

This is the outcome of a scenario outlined by Greenpeace,[1] which also warns that if the EU fails to reform its energy sector, CO_2 emissions will increase by 50 per cent by 2050.

The electricity sector in the EU is dominated by large power plants using fossil and nuclear fuels. As much as 80 per cent of Europe's primary energy supply still comes from fossil fuels, according to Greenpeace.

More than half of Europe's operating power plants are over 20 years old, however. The decisions that are made on new power production over the next ten years will play a critical part in Europe's energy system for a long time to come.

The report from Greenpeace describes the current situation and the opportunities that are available to improve efficiency and use more renewables.

Greenpeace contends that a clean energy future requires that governments set legally binding targets for the use of renewable energy for power, heat and transport. Moreover they must give renewable energy guaranteed and priority access to the grid, and shift their investment away from fossil and nuclear fuels.

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Burning wood chips for combined heat and power generation is energy-efficient and produces no emissions of fossil carbon dioxide.

An important first step is to eliminate direct and indirect subsidies to fossil fuels and nuclear power. In 2004, the European Environment Agency estimated that energy subsidies in the EU15 for solid fuel, oil and gas amounted to more than 23.9 billion euro, and for renewable energy 5.3 billion euro.

"There is no quick fix when it comes to the power sector – invest-

The Energy Revolution Scenario in brief

Exploitation of existing potential to achieve high energy efficiency will reduce the current primary energy demand by 36 per cent: from 72,000 PJ (petajoule) per year today (2003) to 46,000 PJ per year in 2050.This reduction in primary energy demand is a crucial prerequisite for achieving a significant share of renewable energy sources in the overall energy supply system, compensating for the phasing out of nuclear energy, and for reducing the consumption of fossil fuels.

The increased used of combined heat and power generation (CHP) will increase the supply system's energy conversion efficiency. Fossil fuels for CHP are increasingly being replaced by biomass and geothermal energy. The availability of district heating networks is a key precondition for achieving a high share of decentralised CHP. In the long term, the decreasing heat demand and the large potential for producing heat directly from renewable energy sources will limit the further expansion of combined heat and power generation.

The electricity sector will continue to be the forerunner in renewable energy utilisation. By 2050, more than 70 per cent of electricity is to be produced from renewable energy sources (including large hydropower plants). A capacity of 720 GW will produce 1,920 TWh of electricity per year in 2050.

In the heat supply sector, the contribution of renewables will continue to grow to more than 50 per cent in 2050. In particular, this applies to biomass, solar collectors and geothermal energy, as substitutes for conventional systems for direct heating and cooling.

Before biofuels are introduced on a massive scale into the transport sector, the existing potential for high energy efficiency has to be exploited. Due to the more cost-effective use of biomass for CO_2 reduction in stationary applications, the use of biofuels is limited by the availability of biomass within the EU25 countries.

By 2050, nearly half of primary energy demand will be provided by renewable energy sources.

ments and solutions are long-term. Renewable energies have slightly higher costs now, but most of them will be cheaper in less than 15 years. It is also clear that these results can only be achieved in time, if we start this drastic shift in the power sector without any delay," says Sven Teske, author of the study and energy expert at Greenpeace International.

Teske also believes that a commitment to renewable energy and efficiency improvements will lead to a whole string of benefits for the EU:

"This will not only protect the climate, it will insulate national economies from the fluctuations of the global markets for fossil and nuclear fuels, benefit the economy and provide secure access to energy for future generations. In the short term, it could create 700,000 jobs by 2010."

But it is not just the supply of energy that is important. One of the prerequisites for realizing Greenpeace's "Energy Revolution Scenario" is a widespread commitment to energy efficiency.

The exploitation of existing energy efficiency potentials such as the insulation of houses, the use of "waste-heat" from power plants for district heating instead of discharging it via cooling towers and the efficient use of electricity could reduce the current primary energy demand by more than one third (36 per cent) by 2050.

Today, renewable energy sources account for six per cent of primary energy production in the EU25. Biomass, which is used primarily for heating, is the main renewable energy source. The share of renewable energies for electricity generation is 15 per cent, with hydropower plants being the largest source. The contribution of renewables to primary energy demand for heat supply is around nine per cent.

PER ELVINGSON

[1] **Energy Revolution: a sustainable pathway to a clean energy future for Europe.** Developed by the Institute of Technical Thermodynamics at the German Aerospace Centre. Available at: www.greenpeace.org/international/press/reports/energy-revolution-a-sustainab

"EU has power to freeze climate change"

THE EUROPEAN UNION can cut a third of its greenhouse gas emissions by 2020 through energy efficiency measures and the use of renewable energy, combined with a strong emissions trading system, according to a study presented by WWF in October.

The report compares a "business as usual" scenario, that assumes existing policies will continue without specific emphasis on climate and energy, with a "target 2020" scenario, which considers the potential to increase energy efficiency and market penetration of renewable energy sources. This scenario also assumes a fuel switch to less carbon-intensive fossil fuels and a moratorium on new nuclear power plants and compliance with ongoing nuclear phase-out.

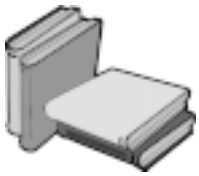
The report shows that by 2020 the EU's energy demand could be reduced by 20 per cent without reducing living standards or damaging the economy. Without immediate action energy demand will grow up to 1.46 per cent per year, while it could decrease by 0.4 per cent per year if concrete policies are adopted.

Private households alone could save a fifth of their energy demands and the power sector could reduce its emissions of carbon dioxide by more than half.

WWF calls on the EU to adopt a comprehensive climate policy strategy with a strong emissions trading system at its heart, supported by directives that promote mandatory targets for energy efficiency as well as legal and fiscal support for renewable energy.

An ecological finance reform should also be implemented to remove direct and indirect subsidies for unsustainable energy.

The report **Target 2020: Policies & Measures to Reduce Greenhouse Gas emissions in the EU** has been developed for WWF by the Wuppertal Institute, Germany. Available in pdf format at www.panda.org/epo.



Recent publications

Reducing emissions from ships in the Baltic Sea area (2005)
By Per Kågeson. Final report based on the conclusions of the Greening Motorways of the Sea Conference in Stockholm, April 2005. This report discusses the feasibility of introducing a distance-related en-route charge for shipping in the Baltic Sea.

Published by the European Federation for Transport and Environment (T&E). Report 2005/2. Available at www.t-e.nu

The Maple Leaf in the OECD. Comparing Progress Toward Sustainability
Ranks the 30 member countries of the OECD based on 29 key environmental indicators, including energy use, water consumption, greenhouse gas emissions, air pollutants, and extent of protected areas. The list is topped by Turkey, with Canada and USA in bottom places.

Available from David Suzuki Foundation, www.davidsuzuki.org.

EU Environmental Policy Handbook. A Critical Analysis of EU Environmental Legislation (2005)
A reference volume, presenting an outline of EU environmental policy history as well as an explanation and analysis of the network of some sixty EU environmental laws and policies.

344 pp. Published by European Environmental Bureau. Can be ordered from International Books, Grifthoek 151, 3514 JK Utrecht, the Netherlands or downloaded from www.eeb.org.

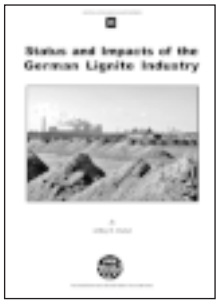
Communicating Sustainability – How to produce effective public campaigns
This guide from the UN Environment Programme (UNEP) provides national and local governments with advice on how to implement communications campaigns on environmental and development issues.

68 pp. Available in English, French and Spanish. Can be downloaded from the UNEP website www.unep.fr/sustain

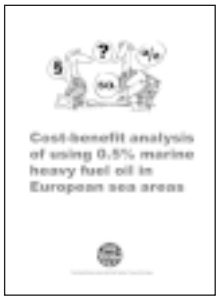
How much biomass can Europe use without harming the environment?
Europe could produce very large quantities of biomass energy without destroying its environment, according to this briefing from the European Environment Agency.

4 pp. Briefing No. 2/2005. Available at http://reports.eea.eu.int/briefing_2005_2

Recent publications from the Secretariat



Status and Impacts of the German Lignite Industry
This report includes a historical treatment of German lignite use and discusses many of the hidden costs involved: excessive greenhouse gas emissions, depletion of groundwater resources, and destruction of hundreds of villages. Special consideration is paid to eastern Germany, where lignite accounts for up to 85 per cent of electrical power consumption in some regions. By Jeffrey H. Michel, April 2005.



Cost-benefit analysis of using 0.5% marine heavy fuel oil in European sea areas
A lowering of the sulphur content of marine heavy fuel oil to 0.5 per cent would reduce SO_2 emissions from international shipping around Europe by more than three quarters by 2010. The benefits of such a measure clearly outweigh the costs, according to this study. By Christer Ågren, January 2005.

Atmospheric emissions from large point sources in Europe
This report identifies and lists the 200 largest emitters of sulphur dioxide and the 200 "best" fossil-fuelled power stations, in terms of SO_2 and NOx emissions per useful output. By Mark Barrett, SENCO. Published October 2004.

Air and the Environment
Which are the main air pollutants, how they arise, and what they are doing to us and our environment, as well as what can be done to counteract their spread, is described in detail in this book, which also brings out the fact that it will actually pay to cut down the emissions. By Per Elvingson and Christer Ågren, published March 2004.

HOW TO ORDER. Single copies of the above mentioned material can be obtained from the Secretariat (free of charge within Europe). Please call for quotation if more copies are required. Can also be downloaded in pdf format from www.acidrain.org

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Coming events

For the latest news and direct links, please visit www.acidrain.org.

EU Environment Council. Brussels, Belgium, 2 December 2005.

The importance of Non-Technical Measures for reductions in emissions of air pollutants and how to consider them in Integrated Assessment Modelling. Göteborg, Sweden, 7–9 December 2005. *Information*: http://asta.ivl.se/workshops/NTM.htm

LRTAP Convention Executive Body. Geneva, Switzerland, 12–16 December. *Information*: www.unece.org/env/lrtap

Challenges and Innovations for Environment, Transport and Tourism. Conference on environmentally friendly travelling. Vienna, Austria, 30–31 January 2006. *Information*: www.eco-travel.at/english/

CEM - the International Conference on Emissions Monitoring. Paris, France, 1-2 February 2006. *Information*: www.mci-salons.fr/cem06/

EWEC 2006 – European Wind Energy Conference. Athens, Greece, 27 Febr–2 March, 2006. *Information*: European Wind Energy Association, www.ewea.org

World Sustainable Energy Days 2006. Wels, Austria, 1–3 March 2006. *Information*: O.Ö. Energiesparverband, www.esv.or.at/esv/

3rd Conference on Future Urban Transport. Göteborg, Sweden, 2–5 April 2006. *Information*: www.fut.se.

Workshop on economic impacts of air pollution on cultural heritage. Sicilly, Italy, 6–7 April 2006. *Information*: www.unece.org/env/lrtap

8th International Conference on Greenhouse Gas Control Technologies. Trondheim, Norway, 19–23 June 2006. *Information*: www.ieagreen.org.uk/ghgt8.html