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Acid News

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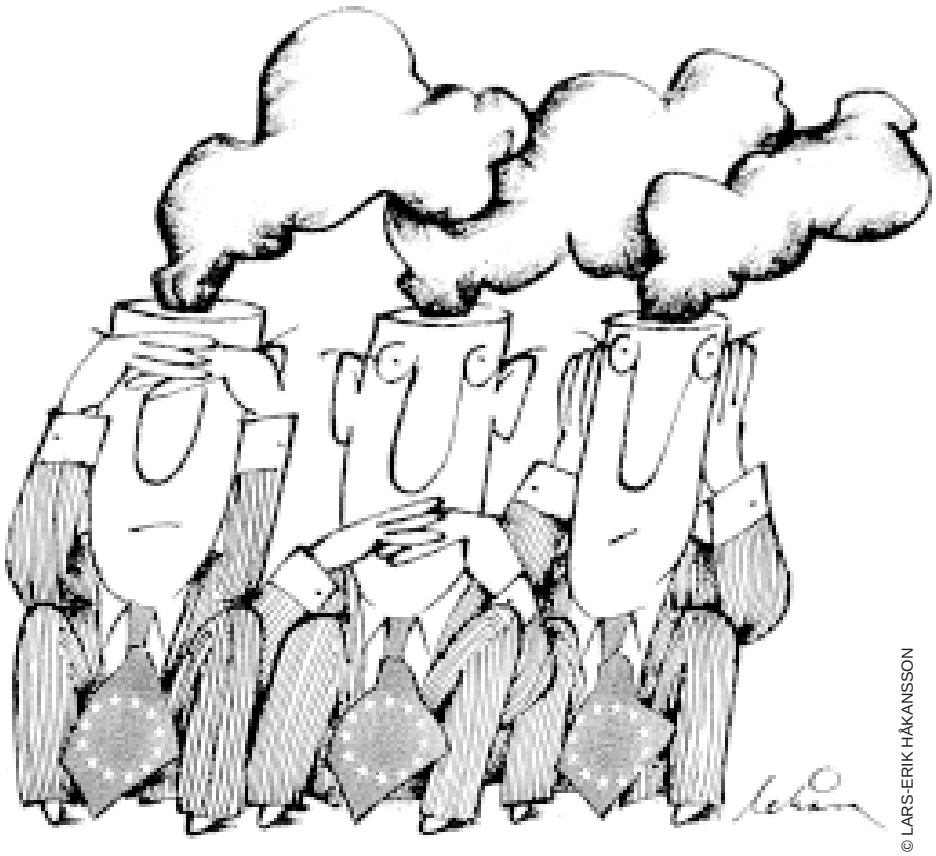

NATIONAL EMISSION CEILINGS

Way off target

A NEW REPORT[1] from the European Topic Centre on Air and Climate Change (ETC/ACC) of the European Environment Agency shows that most EU countries foresee difficulties in reducing their emissions of air pollutants sufficiently to meet the emission ceilings that are laid down in the national emission ceilings directive (2001/81/EC).

The NEC directive covers the four pollutants sulphur dioxide, nitrogen oxides, volatile organic compounds and ammonia. Based on "business as usual" projections as reported by member states until 1 December 2003, only Finland and the UK will comply with all of their ceilings by 2010. If envisaged additional measures are considered, Germany will also meet all its emission ceilings.

On behalf of the European Commission's Environment Directorate the ETC/ACC has examined whether each country's report contains the information that is required according to the directive. On the basis of the information submitted by each country an evaluation was also carried out on emissions trends to date, as well as expected future emissions.

The study shows that there are major deficiencies in reporting. Four countries – Belgium, Greece, Ireland, and Luxembourg – had by 1 December 2003 still failed to report to the Commission how they propose to reduce their emissions of air pollutants so as to fulfil their commitments

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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.

For or against emissions trading?

IS EMISSIONS TRADING really the success story it is so often made out to be? In light of the fact that emissions trading appears to be growing in popularity this is a highly pertinent question.

In the US, where this system has been practically applied for almost ten years to emissions of sulphur dioxide from power plants, a proposal to introduce a similar trading system for mercury emissions has led to intense debate.

One objection raised by environmental organizations is that the trading system is inappropriate for toxic air pollutants such as mercury, since it could give rise to more local hot spots.

Those who have caused most pollution in the past get the largest allocation to continue polluting

In Europe the debate has so far centred primarily on the new EU directive on emissions trading for the greenhouse gas carbon dioxide. It appears, however, that emissions trading is growing in popularity, and the debate in Europe is no longer solely about emissions of greenhouse gases.

In several EU member countries, including the Netherlands and the UK, there are more or less far-reaching plans to introduce trading systems for "traditional" air pollutants such as sulphur dioxide and nitrogen oxides. Proposals have also been put forward to introduce trading systems for emissions of sulphur and nitrogen oxides from international shipping.

There are many different sides to this question. Some people believe that systems that are based on emissions trading can be regarded as better – above all more cost-effective – than more traditional systems that are based on regulation (such as emission standards), and that they should therefore replace them.

One possible alternative may be to use regulation to set minimum standards, and then to use economic incentives, such as emissions trading, to achieve further reductions in emissions.

In light of the above there is also the question of whether emissions trading is possibly more appropriate for certain types of air pollutants, and less appropriate – or simply inappropriate – for others.

In those cases where emissions trading is considered, for various reasons, to be an appropriate alternative or complementary approach, the actual design and application of this instrument are of critical importance.

One issue is the initial allocation of "emission allowances". Should these be auctioned off or doled out free of charge? Although economic theory points clearly towards the former alternative, practical experience has so far been based exclusively on free distribution. This has often taken place according to the so-called grandfathering principle, which in practice means that those who have caused the most pollution in the past get the largest allocation to continue polluting.

Because there are clearly widely differing opinions about emissions trading and its role in environmental policy, today and in the future, an open debate on this question would be valuable.

This issue of Acid News therefore includes a debate feature (pp. 22-23) that examines and questions emissions trading. It is hoped that this will promote further thought and discussion, and we welcome further contributions on this highly topical and important issue.

CHRISTER ÅGREN

'Business as usual' (BAU) projections for 2010 under the NEC directive. 2002 submission reported until 1 December 2003.

	Sulphur dioxide (ktonnes)			Nitrogen oxides (ktonnes)			VOCs (ktonnes)			Ammonia (ktonnes)		
	BaU projection	ceiling	% shortfall	BaU projection	ceiling	% shortfall	BaU projection	ceiling	% shortfall	BaU projection	ceiling	% shortfall
Austria	31	39	-20.5%	150	103	45.6%	160	159	0.6%	52	66	-21.2%
Belgium		99			176			139			74	
Denmark	56 (56)	55	1.8%	146 (146)	127	15.0%	83 (83)	85	-2.4%	83 (83)	69	20.3%
Finland	100 (97.5)	110	-9.1%	155 (151)	170	-8.8%	130 (130)	130	0.0%	31 (31)	31	0.0%
France	461 (387)	375	22.9%	990 (988)	810	22.2%	953 (954)	1050	-9.2%	857	780	9.9%
Germany	513	520	-1.3%	1126	1051	7.1%	1192	995	19.8%	585	550	6.4%
Greece	(<300)	523		(344)	344		(261)	261		(73)	73	
Ireland		42			65			55			116	
Italy	470	475	-1.2%	1057	990	6.7%	1117	1159	-3.6%	433	419	3.3%
Luxembourg		4			11			9			7	
Netherlands	70 (70)	50	40.0%	289 (289)	260	11.2%	220 (220)	185	18.9%	132 (127)	128	3.1%
Portugal - low	165	160	3.2%	249	250	-0.6%	265	180	47.0%	88	90	-1.9%
Portugal - high	170	160	6.3%	262	250	4.6%	240	180	33.3%	91	90	1.3%
Spain	-	746		-	847		-	662		-	353	
Sweden	50 (67)	67	-25.4%	155 (148)	148	4.7%	220 (220)	241	-8.7%	(57)	57	
UK	585 (585)	585	0.0%	1167 (1167)	1167	0.0%	1200 (1200)	1200	0.0%	297 (297)	297	0.0%
EU10 - BAU	**2501**	**2436**	**2.7%**	**5484**	**5076**	**8.0%**	**5540**	**5384**	**2.9%**	**2558**	**2487**	**2.9%**

Projections reported under the 2003 submission are shown in brackets. Shaded entries = projection exceeds ceiling. Shortfall is calculated as a percentage of the emissions ceiling. Portugal has provided two scenarios referred to as a low and a high emission scenario. Spain has not provided a quantitative emission projection for any of the gases. Belgium, Greece, Ireland and Luxembourg have not submitted a 'national programme' under the NEC Directive for analysis (per Dec 2003). EU10 excludes Spain, Belgium, Greece, Ireland and Luxembourg. The NH_3 projection for the Netherlands from the 2003 subvention (due 31/12 2003) meets the ceiling. The NO_x-projection for Sweden from the 2003 subvention meets the ceiling.

Continued from front page

under the directive, despite the fact that the directive's deadline elapsed over a year ago (Belgium had provided information for some of its regions, but not for the whole country). Moreover, many of those that have reported have failed to do as the directive requires – Spain, for example, failed to present any emission projections for 2010.

The national reports that were submitted (see table above) reveal that the main problems foreseen by countries relate to emissions of nitrogen oxides, and that seven or eight – Austria, Denmark, Italy, France, Germany, the Netherlands, Portugal (high projection) and Sweden – out of ten countries project emissions in 2010 that are higher than their ceilings. By comparison, only four (Denmark, France, the Netherlands and Portugal) out of ten predict that they will not meet their ceilings for sulphur dioxide.

It is however not easy to determine how great the difficulties for meeting the ceilings are, since most of the national programmes lack the information needed for an analysis, namely, quantitative estimates of the effect of the measures proposed or undertaken.

Almost half of the reporting countries failed to provide any quantification of the effect of policies and measures in terms of kilotonnes of pollutant emissions abated. Only three member states – France, Germany and the Netherlands – provided an additional projection for each pollutant incorporating the effect of both adopted and envisaged (planned) policies and measures.

The main problems foreseen by countries relate to NOx emissions

To assess whether countries are on track to achieve their emission targets or not the ETC/ACC uses a "distance-to-target" indicator (graphs on next page). This is a measure of the deviation of actual emissions in 2001 from a linear path between 1990 and 2010. Since the assumption of a linear emission trend is somewhat hypothetical, the report stresses that this analysis is only indicative.

Based on these assumptions, in 2001 eleven member states were heading towards *not* meeting their emission ceilings for nitrogen oxides. Portugal, Ireland, Austria, Spain and Belgium appear to have the biggest problems in meeting their emission ceilings.

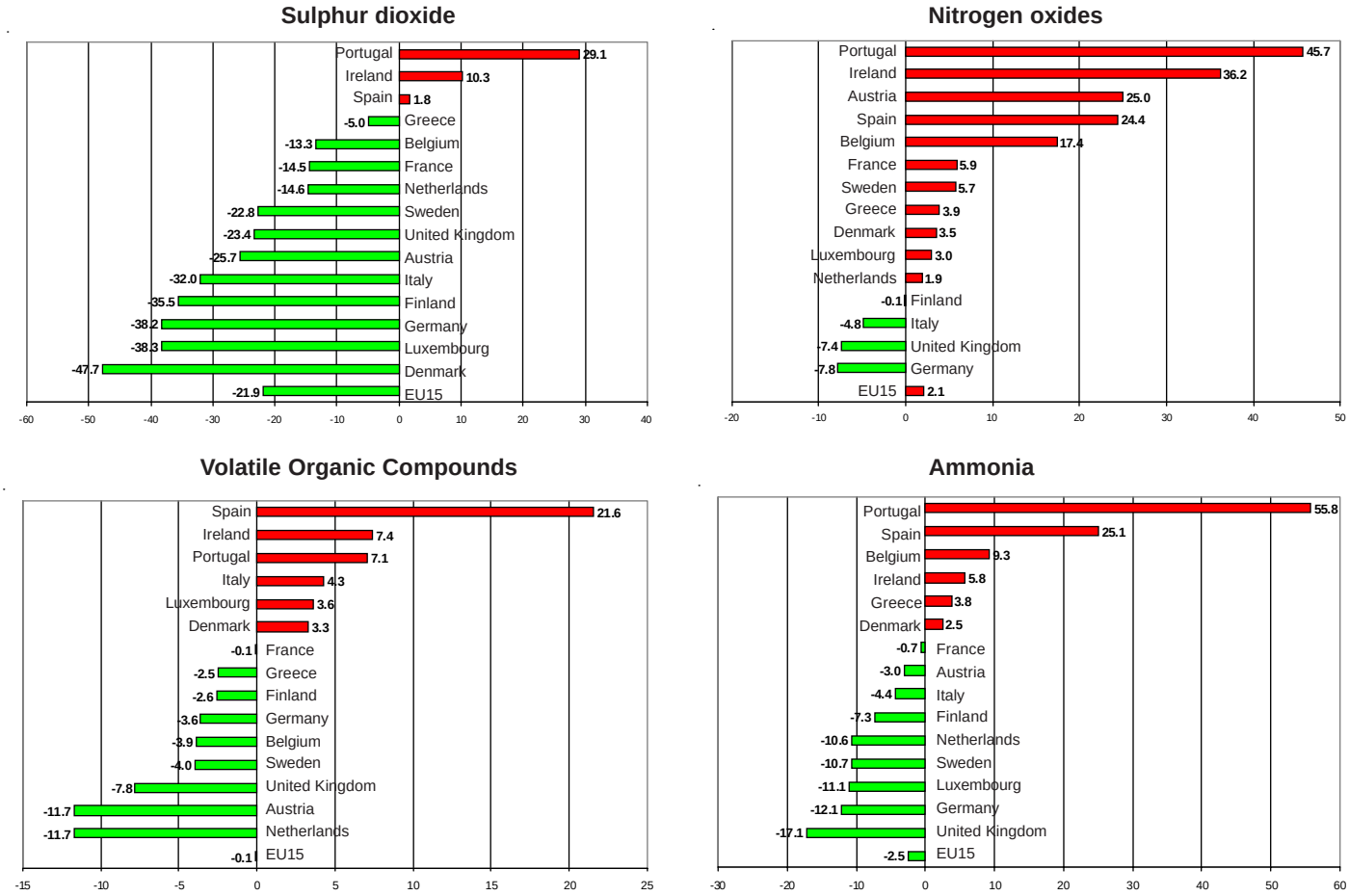
The trend appears more encouraging for sulphur dioxide – in which case twelve countries are on the right course. Only Portugal, Ireland and Spain have emissions that lie above the target path.

Regarding volatile organic compounds, there are six countries – Ireland, Spain, Portugal, Italy, Luxembourg and Denmark – that look as if they may have problems meeting their emission ceilings. Again in the case of ammonia there were six countries whose emissions were "too high" in 2001, namely Spain, Portugal, Belgium, Ireland, Greece and Denmark.

Full and accurate reporting by the countries is highly important not only for the implementation of the directive, but also for its review and revision. This is necessary to provide the information for the report that the Commission has to produce in 2004, in accordance with Article 9 of the directive, and deliver to the EU Parliament and the Council of Min-

“Distance-to-target” indicators for the targets in the NEC directive

(a measure of the deviation of actual emissions in 2001 from a (hypothetical) linear path between 1990 and 2010)



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isters. In its report the Commission must describe what progress has been made towards achieving the national ceilings, and state the extent to which the interim environmental objectives of the directive are likely to have been met by 2010.

In its conclusions the ETC/ACC makes four recommendations in which it proposes that member states should:

❏ Report two scenarios – a “business as usual” projection including current policies and measures, and a “with additional measures” projection, accounting for planned policies and measures.

❏ Quantify the effect of individual measures and policies, whether planned, adopted, or implemented.

❏ Report on changes in the geographical distribution of their emissions – or if there is no change, then make this clear (this is already explicitly requested in the directive).

❏ Report on key socio-economic assumptions underlying their emission projections.

The report constitutes an input to the Commission’s forthcoming review of the NEC directive. According to the directive, this review should be completed in 2004.

CHRISTER ÅGREN

[1] An initial assessment of Member States’ national programmes and projections under the national emission ceiling directive (2001/81/EC). Summary paper. ETC-ACC Technical Paper 2003-8, published in April 2004. Available at http://air-climate.eionet.eu.int/announcements/ann1082666299

The reports on national programmes received by the Commission can be found on the environment directorate’s website http://europa.eu.int/comm/environment/air/nationalprogr_dir200181.htm

The NEC directive

Article 6 of the NEC directive says that the member states shall, by 1 October 2002 at the latest, have drawn up programmes for the progressive reduction of the four pollutants covered by the directive. These programmes should be so formulated as to make it possible to get down to their allotted ceilings by 2010 at the latest. They should state what policies and measures have been adopted or envisaged, and give quantified estimates of the effect they will have had on emissions by 2010. Article 8 says that the member states shall have informed the Commission of their programmes by 31 December 2002 at the latest.

Article 6 also says that the member countries must make their programmes available to appropriate organizations such as those dealing with environmental matters, as well as to the public. The information shall be “clear, comprehensible and easily accessible.”

A more detailed description of the NEC directive is given in the secretariat’s fact sheet no. 16, which can be found in the centre of this issue of Acid News.

Non-binding targets for heavy metals and PAHs

IN A SO-CALLED first-reading agreement[1] in April the EU Council, Commission and Parliament have agreed on setting ambient air quality targets for arsenic, cadmium, nickel and polycyclic aromatic compounds (PAHs).

The new law will set non-binding target values for the four pollutants, and is more ambitious than the original proposal by the Commission, but less ambitious than the report from the Parliament's Environment Committee, which called for the introduction of binding limit values and complementary long-term objectives.

Member states will have to take "all necessary measures not entailing disproportionate costs" to meet the ambient air quality targets for the three heavy metals, plus benzo-a-pyrene, a marker for PAHs.

"The targets are a step in the right direction, but they should be binding," said Kerstin Meyer, air pollution policy officer at EEB, the European Environmental Bureau. "I doubt that the target values will guarantee cleaner air in Europe, particularly in places where air quality is really bad. Air quality standards have to be legally enforceable to be effective in protecting people from these carcinogenic pollutants."

The currently proposed target values mean that member states should take measures to keep pollution levels below them. If levels are exceeded states have to draw up detailed maps and estimate the population exposed to the pollutants. They will also have to demonstrate what they are doing in order to attain the target values, specifying those measures directed at the most important emission sources.

For industrial installations covered by the IPPC directive, member states will need to demonstrate that these installations apply the best available technology (BAT) as defined under the directive. It does not require member states to go beyond BAT however, so this new directive will not form a basis for issuing stricter permits for industrial installations in pollution hotspots.

The Commission has been told to review the law in 2010, at which time it should "consider regulating" the deposition of all four pollutants. Member states are allowed to introduce more stringent standards nationally.

The new directive should come into force before the summer, with member states required to implement it within two years. It is the fourth daughter directive under the framework directive on ambient air quality (96/62/EC). It originally also aimed to cut ambient mercury levels, but this was dropped early on pending a wider strategy due later this year.

PER ELVINGSON

[1] A first reading agreement means that the three EU institutions negotiate a common text, which is then agreed to by the Parliament at its first reading. The legislative process is cut short and the directive could enter into force earlier as no second reading would be necessary in the Parliament.

VOCs in paints

New limits on organic solvents in paints and varnishes sold within the EU will take effect in two stages, in 2007 and 2010. This is the result of the second reading of the proposed directive on 30 March, at which the European Parliament approved the Council of Ministers' common position, the content of which is very close to that originally proposed by the Commission.

The European paint producer lobby organization Cepe deemed the requirements "challenging but workable." The European Environmental Bureau, EEB, feels however that the directive is not sufficiently ambitious.

In addition to imposing binding limit values, paints and varnishes will have to carry a mandatory label specifying VOC limit values and maximum VOC quantity. Implementation of the law is estimated to reduce the emissions of VOCs in the EU15 by around 280,000 tonnes per year by 2010.

EU NEWS IN BRIEF

Car makers try to shift attention

European and Japanese car makers have said they cannot achieve a better overall carbon dioxide emissions average for new cars than 130 g/km within the next few years.

Their position has emerged following a confidential statement given to the Commission in December that was seen by the Environment Daily news service in March. The statement confirms rumours that Europe's car maker umbrella organization Acea had rejected the Commission's proposed extension of the current voluntary emissions reduction target to 120g/km by 2010.

The car makers say the EU should do more to get fuel producers and drivers to make a contribution to reducing the environmental effect of road traffic. They say improved traffic management and blending traditional fuels with biofuels could make significant contributions.

There is still doubt about whether the industry will meet its current voluntary target of 140 g/km by 2008, which itself was a watered down target from the Commission's original proposal of 120 g/km by 2005.

Source: **T&E Bulletin** 127, April 2004.

Getting transport's prices right

Transport ministers from the EU countries were unable to reach a common position in March when they considered the Commission's draft directive on charging of heavy goods vehicles for the use of the infrastructure (COM(2003)448). The main obstacle is reported to have been the Commission's requirement that the revenues from road pricing should be used for the construction of new roads.

At its first reading in April Parliament asked for amendments to the proposal that included giving the Commission a clear deadline for a methodology to calculate all external costs (two years after the revised directive enters into force) and to allow member states to decide upon the use of revenues according to the principle of subsidiarity.

The European Federation for Transport and Environment, T&E, stressed the need for the incoming Commission to relaunch work on a framework for pricing all transport modes in Europe. The present Commission had promised such a framework, but abandoned it in 2003.

Further information: www.t-e.nu

EU NEWS IN BRIEF

Realistic testing

The EU's institutions reached a first-reading agreement in March on technical legislation complementing the Euro IV emission standards for heavy-duty engines to prevent lorry makers from designing engines that pass standard emissions tests but then exceed the standards on the road.

Source: **T&E Bulletin** 127, April 2004.

Green law breaches prompt warning

France, Belgium, the Netherlands, Germany, Austria, Italy, Portugal and Sweden have been sent "second warning" reasoned opinions from the Commission, urging them to transpose the law under which all road fuels should have a maximum sulphur content of ten parts per million by January 2009. The directive was adopted a year ago and the transposition deadline elapsed last June.

Source: **Environment Daily**, 5 April 2004.

Slow phase-out of f-gases favoured

On March 31 the European Parliament voted for a strategy based on containment rather than replacement to reduce emissions of fluorinated industrial gases, also known as f-gases.

The parliamentary vote was the first reading of the Commission's proposed new directive (COM(2003)492). The Parliament voted to place no limits on the use of f-gases in stationary commercial, domestic or industrial air conditioning or refrigeration, and rejected an environmental legal base for the law.

On the draft law's key proposal to phase out HFCs in vehicle air conditioning systems, Parliament ditched a complex quota system proposed by the Commission in favour of a phased ban, but pushed back by two years to 2011 the point at which the ban will begin to affect newly approved models. The ban would apply to all new cars from 2014.

The draft directive will be considered by the environmental ministers on 28-29 June.

No limit for the use of flexible mechanisms

ON 1 JANUARY next year a system will be introduced that will allow more than 12,000 energy-producing and/or energy-intensive plants in the enlarged EU to trade emission rights for carbon dioxide.

Companies that need more allowances than they have been allocated can either buy them from other companies operating under the system or look outside the union. The latter was made possible when the Council of Ministers, Parliament and Commission agreed in April on the linking directive that the Commission put forward last summer (COM (2003)403; see AN 3/03, p.9).

This new directive – which complements the emissions trading directive[1] – will allow companies in the EU trading scheme to use credits from projects under two of the Kyoto Protocol's so-called flexible mechanisms: the Clean Development Mechanism and Joint Implementation.

Each member country has to decide the extent to which its companies may be allowed to use these mechanisms, since the directive sets no limits, although the aim is that "a significant reduction" of greenhouse gas emissions should be achieved within the EU, and not abroad.

European firms will be able to use CDM credits from January 2005 and JI credits from 2008, independent of the entry into force of the Kyoto Protocol. Credits are not however permitted from nuclear energy projects and "carbon sinks" (temporary storage of carbon in forests). The use of credits from carbon sinks will be reviewed by the Commission in 2006.

EU environment commissioner Margot Wallström has declared herself satisfied with the new directive. She believes that it will reduce costs for the companies participating in emissions trading and promote the transfer of environmentally sound technology to developing countries.

Several environmental organizations, including the Climate Action Network, have strongly criticized the agreement, however, since they feel that the EU is undermining both its own climate policy and its international credibility by allowing unlimited volumes of cheap credits to be brought into the system, thereby greatly reducing the incentive for domestic emission cuts among EU industry.

The environmental organizations believe that urgent action must be taken at member state level if the EU's climate policy is to retain any credibility at all. Member states should agree to a strict and harmonized cap on the use of Kyoto project credits.

PER ELVINGSON

[1] Directive establishing a scheme for greenhouse gas emissions trading within the Community (2003/87/EC).

For more information, see the Commission's website at http://europa.eu.int/comm/environment/climat/home_en.htm. See the press release from the Climate Action Network at www.climnet.org/pubs/PR_LinkingDirective_20April2004.pdf.

Joint Implementation and the Clean Development Mechanism

Under the Kyoto Protocol, the project-based "Clean Development Mechanism" (CDM) and "Joint Implementation" (JI) mechanism allow governments to conduct emission-reduction projects abroad and count the reductions achieved against their Kyoto targets. JI projects can be undertaken in other industrialized countries that have quantitative emissions reduction targets under the protocol. CDM projects can be hosted by developing countries, which have no quantitative targets.

The Kyoto Protocol allows credits for CDM projects to be issued for emission reductions achieved from the year 2000 onward, while emission reductions achieved under JI projects will be credited from the year 2008 onward. Detailed rules and supervisory structures have been set up to ensure that the system functions as envisaged.

"Time to take the next step now"

IT IS WIDELY AGREED that the Kyoto Protocol is just the first step in international climate negotiations. In order to meet the ultimate objective of the climate convention – to prevent dangerous anthropogenic interference with the climate system – the protocol must be quickly followed up with broader and more far-reaching agreements.

Negotiations on future measures have not however started yet. The Climate Action Network (CAN) has therefore presented, in the form of a discussion paper,[1] what it has called a viable global framework for climate action, with the objective of keeping global warming as far below 2°C as possible in order to prevent dangerous interference with the climate system.

CAN's global framework for achieving this objective reflects the moral responsibility of those who have benefited the most from the use of the global commons to reduce their emissions first, and to compensate the victims of unavoidable human-induced climate change. The framework is built on core principles of equity and fairness and includes an appropriate balance of rights and obligations.

CAN's discussion paper states that the climate regime needs three parallel, interlinked tracks operating on the same or a very similar timetable:

❏ The Kyoto track builds upon the climate convention and the Kyoto Protocol, with its system of legally binding absolute emission reductions and compliance regime. This track, with its tradable emission obligations, provides the core of a system that will drive rapid technological development and diffusion, and provide the technological basis for win-win solutions to climate and sustainable development objectives.

❏ The "Greening" (decarbonization) track would drive the rapid introduction of clean technologies that can reduce emissions and meet sustainable development objectives in developing countries. Industrialized countries would provide resources and technology to drive much of this track.

❏ The Adaptation track provides the resources to the most vulnerable regions (small island states, least developed countries) to deal with unavoidable climate changes. Countries receiving support under this track could also operate in the Greening track.

Industrialized countries have the obligation to act first to reduce their absolute emissions. The emission reduction targets in the Kyoto track would be set with a strong reference to the need for per capita emissions to converge over the course of the 21st century. Other fairness criteria such as ability or capacity to act (including measures such as per capita income) and historical responsibility would also play a role in setting the overall timing, level and character of the emission action required of different countries, as well as in determining when and how countries move from the Greening track to the Kyoto track.

It is said in the Kyoto Protocol that negotiations concerning the next period of commitments (after 2012) must start at the latest by 2005 (provided that the protocol comes into force). It is important that the countries involved immediately begin planning for greater reductions in the second commitment period and that industrialized and developing countries begin concrete discussions together on how to implement the Greening track.

Accelerated work on the Adaptation track should be initiated in order to identify the concrete needs of countries and regions that will be adversely affected by further unavoidable warming even under the 2°C global temperature limit.

BILL HARE
GREENPEACE INTERNATIONAL

[1] **A Viable Global Framework for Preventing Dangerous Climate Change – CAN Discussion Paper**. December 2003. Available at www.climatenetwork.org/docs/CAN-DP_Framework.pdf

Hydrogen economy a long way off

REDUCING EMISSIONS of air pollutants and dependency on foreign oil have been cited as major motives for the $1.2 billion hydrogen plan that the Bush administration presented last year and which is intended to make it practical and cost effective for US consumers to use clean, hydrogen powered fuel cell vehicles by 2020.

Such a scenario is scarcely likely according to a report from the US National Academies of Science that was produced on behalf of the Energy Department. Even under the best case scenario the hydrogen transition will do little to cut oil imports or emissions of greenhouse gases during the next 25 years.

According to the committee there are a wide array of technical, economic and infrastructure challenges:

❏ there is little existing capacity for hydrogen production, which remains expensive;

❏ fuel cell technologies face challenges of storage, cost, reliability, and safety, and, perhaps most important of all:

❏ the high cost and logistical complexity of hydrogen distribution to fuelling stations.

The committee recommends continued R&D on hydrogen and fuel cells, but also measures "to explore supply and demand alternatives that do not depend upon hydrogen."

Antonia Herzog of the Natural Resources Defense Council environmental organization feels that more attention can be directed at what can be achieved with existing technology, and that improved fuel economy standards are one of the most important means for reducing emissions.

"We simply can't bank on hydrogen alone to cut our dependence on Middle East oil or fix the global warming problem," said Herzog, pointing out that Americans will buy 450 million new cars and trucks before the hydrogen car is available.

[1] **The Hydrogen Economy: Opportunities, Costs, Barriers, and R&D Needs**, National Academies of Science, 2004. Available at www.trb.org/news/blurb_ detail.asp?id=2370

Majority of worst emitters are found in just a few countries

Five plants are among the twenty worst for all three pollutants

COAL-FIRED POWER PLANTS dominate the twenty worst emitters, not only of carbon dioxide but also of sulphur dioxide and nitrogen oxides, in the former fifteen EU member countries.

Carbon dioxide

German plants fired with lignite are among the worst in respect of carbon dioxide. They are mainly situated close to the areas in western and eastern Germany where the deposits of lignite are found. But three British, two Greek and four Italian plants also figure in the list, as do one Spanish and one Portuguese. Of the twenty largest emitters, nineteen were power plants.

Sulphur dioxide

Topping the list for sulphur dioxide is the coal-fired Puentes As Pontes power plant in Galicia, in the northwest of Spain. The plant is also among those topping the lists for carbon dioxide and nitrogen oxides. Because of the stricter regulations for emissions that will take effect in the EU in 2008 (through the LCP directive), the plant's owners have decided to install emission control equipment that will reduce the emissions of sulphur dioxide by 95 per cent.

Second highest as regards sulphur dioxide is the Megalopolis A (I, II, III) complex on the Peloponnese peninsula in Greece. Close by is Megalopolis B (IV), with emissions of sulphur dioxide approaching 28,000 tonnes a year. All are fired with lignite from local deposits.

Third on the sulphur list is yet another Spanish power plant – at Teruel in the northeast of the country – and there are three more Spanish plants among the twenty greatest emitters of sulphur dioxide.

Half of those on the list are however British plants. It is worth noting on the other hand that, owing to strict national regulations, there is not a single German plant there – despite the fact that Germany has several of the largest coal-fired power plants in the EU15. Eighteen of the twenty largest emitters of sulphur dioxide in the EU15 are power plants.

Nitrogen oxides

British plants also account for about half of the twenty worst emitters of nitrogen oxides. The only German plant on the list is Jänschwalde, which is also the largest emitter of carbon dioxide in the EU15. Of the twenty largest sources of nitrogen oxides, eighteen were power plants.

Five plants are among the twenty worst on all three lists. They are Drax and Longannet in the UK, Puentes As Pontes in Spain, Sines in Portugal and Taranto in Italy. The Greek Megalopolis can also be included if the A and B plants are considered together.

The new member countries

All the above figures are for 2001. Information on emissions in 2004 will be published in 2006, and include figures for the ten new members of the EU as well. Data already exists however for Hungary, where two coal-fired power plants, Oroszlányi and Mátra, have emissions of sulphur dioxide large enough (87,000 and 43,000 tonnes respectively) to appear on the present twenty-worst list.

PER ELVINGSON
CHRISTER ÅGREN

EPER in brief

The figures in the tables come from EPER, the European Pollutant Emission Register, which was launched by the EU Commission and the European Environment Agency in February.

The decision to set up the register and make it generally available was taken as part of the 1996 EU directive on integrated pollution prevention and control (IPPC). Details can be found in a Commission decision (2000/479/EC), according to which member countries are obliged to report every three years on the emissions of 50 different airborne and waterborne pollutants from all plants listed in Annex I of the IPPC directive that emit more than a certain threshold value of each pollutant.

The EPER register today covers 9,342 industrial facilities in the EU15 countries as well as Norway and Hungary. The figures are mostly for 2001.

The plants in the register account for about 70 per cent of the total emissions of sulphur dioxide in the EU15, and 42 and 26 per cent of those of carbon dioxide and nitrogen oxides respectively.

Descriptions of each of the substances, their uses, major emission sources and effects on human health and the environment can also be found on the EPER website.

The EPER website is only in English at present, but will be translated into all the other official EU languages.

How to use the register

Start at www.eper.cec.eu.int/eper/

By using the search function, data can be obtained for individual plants, for all the plants in one country as well as for the whole of the EU, for each of the 50 pollutants that are included.

We obtained the figures in the adjoining tables by choosing the Pollutants option under EPER Search, and then proceeding to the required pollutant and the emissions for the whole EU15 area.

The first page that appears when you do such a search gives a summary. Under the heading “Facilities” the member states are listed as well as the number of plants in each country and for the EU15 as a whole.

Selecting the figure showing the number of plants (say, 1238 for sulphur dioxide in the EU15) brings up a list of all the plants, which can then be arranged in order of emissions.

Selecting the particular plant’s name brings up a page showing its location, type, and the pollutants it emits. In most cases satellite pictures are also shown.

One can also find the location of a particular plant by clicking on maps (select Map search on the home page).

The 20 worst in 2001 for sulphur dioxide (EU15).

Name	Country	Emissions (000 tonnes SO_2)	Type of facility
Puentes As Pontes	Spain	315	power station
Megalopolis A (I, II, III)	Greece	161	power station
Teruel	Spain	152	power station
Porto Tolle	Italy	73	power station
Meirama	Spain	71	power station
Cottam	UK	70	power station
West Burton	UK	68	power station
Longannet	UK	68	power station
Eggborough	UK	60	power station
Setúbal	Portugal	57	power station
Belfast West	UK	53	power station
Ferrybridge 'C'	UK	48	power station
Repsol Petroleo	Spain	44	refinery
Didcot A	UK	40	power station
Sines	Portugal	39	power station
Taranto	Italy	38	metal industry
Solvay Quimica, Torrelavega	Spain	36	chem. industry
Drax	UK	35	power station
Rugeley	UK	34	power station
High Marnham	UK	33	power station

The 20 worst in 2001 for carbon dioxide (EU15).

Name	Country	Emissions (million tonnes)	Type of facility
Jänschwalde	Germany	25.0	power station
Weisweiler	Germany	22.6	power station
Niederaussem	Germany	20.2	power station
Frimmersdorf	Germany	20.1	power station
Drax	UK	16.4	power station
Neurath	Germany	16.2	power station
Federico II (Brindisi)	Italy	15.3	power station
Ag. Dimitriou	Greece	13.9	power station
Schwarze Pumpe	Germany	12.9	power station
Scholven	Germany	11.8	power station
Boxberg	Germany	11.0	power station
Puentes As Pontes	Spain	10.4	power station
Kardia	Greece	10.2	power station
Longannet	UK	10.0	power station
Lippendorf Block R+S	Germany	9.8	power station
Ratcliffe on Soar	UK	9.2	power station
Sines	Portugal	8.5	power station
Taranto	Italy	8.1	metal industry
Montalto di Castro	Italy	8.0	power station
Porto Tolle	Italy	7.8	power station

The 20 worst in 2001 for nitrogen oxides (EU15).

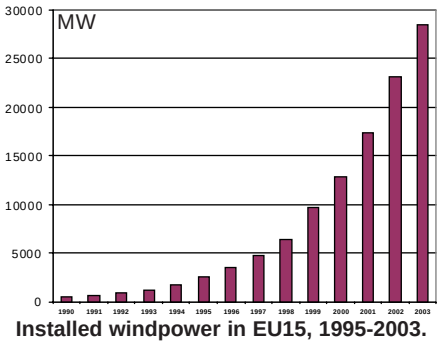
Name	Country	Emissions (000 tonnes NOx)	Type of facility
Drax	UK	50	power station
Taranto	Italy	25	metal industry
Longannet	UK	24	power station
Aberthaw	UK	23	power station
Ratcliffe on Soar	UK	23	power station
Moneypoint	Ireland	22	power station
Sines	Portugal	21	power station
Teruel	Spain	20	power station
Puentes As Pontes	Spain	20	power station
Ag. Dimitriou	Greece	20	power station
Peñasanta-Robra	Spain	20	food industry
Tilbury	UK	19	power station
Cottam	UK	18	power station
Jänschwalde	Germany	17	power station
Aboño	Spain	16	power station
Kingsnorth	UK	16	power station
Imola	Italy	16	power station
West Burton	UK	16	power station
Kardia	Greece	16	power station
Ferrybridge 'C'	UK	16	power station

A third of electricity demand could be supplied from offshore windpower

ACCORDING TO A STUDY conducted by the energy consultants Garrad Hassan[1] on behalf of Greenpeace, a third of the EU15 electricity demand could be supplied from offshore wind power by 2020. Development on the necessary scale would moreover, according to the consultants' estimate, create a market worth hundreds of millions of euros and up to three million new jobs.

At the end of 2003 the installed wind power capacity in the EU15 amounted to 28,542 megawatts (MW) and in the ten accession countries just 102 MW (see chart).

But the potential for wind power in Europe is very great, especially at offshore sites, where few installations are as yet in place. To arrive at the level of 720 TWh per annum in 2020, as suggested in the Garrad Hassan report, would require a total capacity of around 240,000 MW, calling for some 50,000 new large turbines. The area they would take up would not need to be very great, amounting to no more than 3 per cent of the EU15 countries' seabed.



Installed windpower in EU15, 1995-2003.

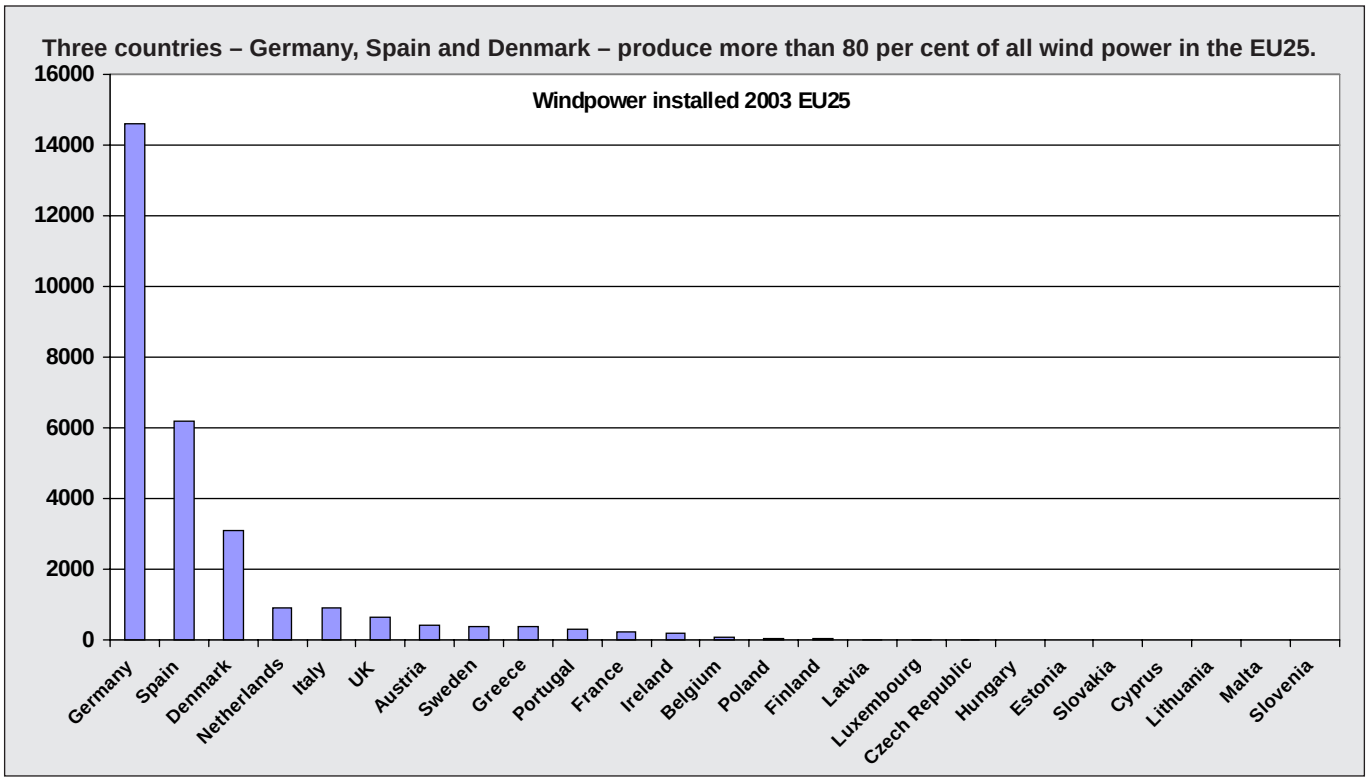
The consultants assert that offshore wind power is already economically competitive, costing about the same as coal and nuclear power. If the hidden costs are also taken into account, wind power comes out a clear winner, they point out – since it does not, in contrast to nuclear and fossil fuel based power, give rise to any important negative side effects. Investments in renewable energy in fact bring appreciable positive side effects – such as reduced dependence on imported energy and reduced emissions of greenhouse gases.

If they are to get development going, politicians will have to set a clear target for renewable energy. The EU members should aim at making 20 per cent from renewables by 2020 the goal at the International Conference for Renewable Energies in Bonn this June (see AN 1/04 p.9). This is quite possible, according to the Greenpeace view.

Greenpeace also emphasize the importance of switching over to renewable energy sources the large sums that taxpayers now hand over in subsidies to the nuclear and coal industries. In Germany, where the highest subsidies are now paid, 2.5 billion euros go every year to subsidizing coal production – which is about 70,000 euros per coal worker. Improving the opportunities for those businesses that want to invest and to some extent improve the power grid are further aspects that the EU needs to concentrate on in order to ensure a large-scale development of offshore wind power.

PER ELVINGSON

[1] **Sea Wind Europe**. February 2004. Published by Greenpeace and available in pdf format at www.greenpeace.org



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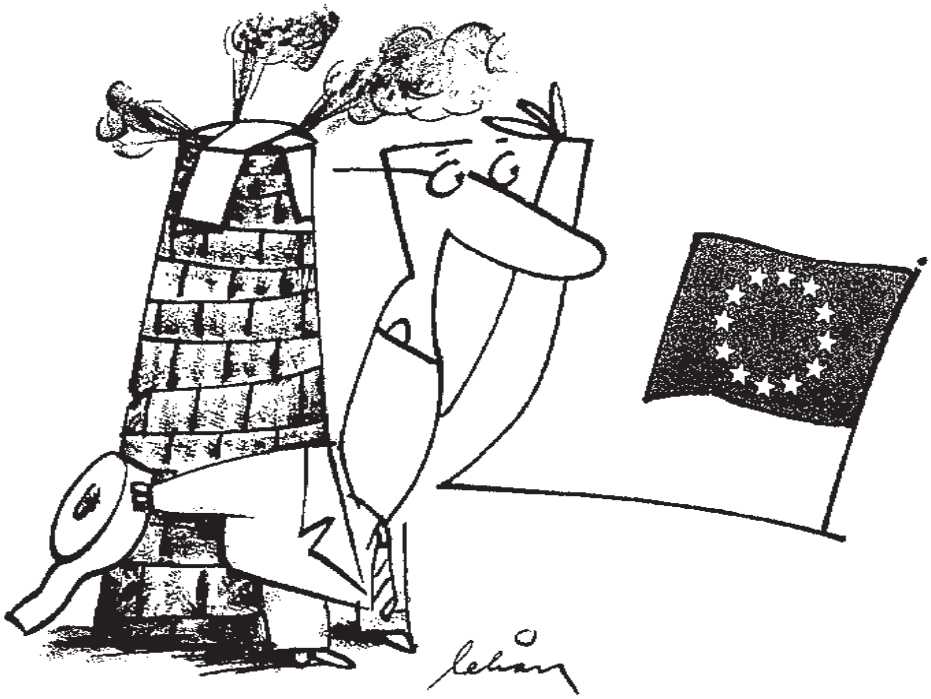

Directive 2001/81/EC on national emission ceilings for certain atmospheric pollutants

In June 1999 the European Commission presented a proposal for a directive setting national emission ceilings (NECs) for four air pollutants that cause acidification and the formation of ground-level ozone: sulphur dioxide (SO_2), nitrogen oxides (NOx), volatile organic compounds (VOCs), and ammonia (NH_3). After two years of negotiation, it was adopted by the Council of Ministers and the European Parliament in July 2001.

The aim of the directive is to gradually improve, through a stepwise reduction of the four pollutants, the protection both of human health and the environment throughout the EU. By means of EU strategies to combat acidification and ground-level ozone, the directive establishes interim environmental quality targets that are to be attained by 2010.

These targets constitute the first step towards the achievement of the long-term objectives of not exceeding the so-called critical loads,[1] and of effective protection of human health against risks from air pollution, as laid down in the Fifth Environmental Action Programme. This NEC directive is the key legislation for the achievement of those environmental objectives, as well as for attaining the EU air quality standards for a number of pollutants, including SO_2, NO_2, fine particles (PM_{10}), and ozone.

Background

After its adoption of the acidification strategy in March 1997, the Commission spent

[1] Critical loads have been defined as: "The highest load that will not cause chemical changes leading to long-term harmful effects on the most sensitive ecological systems." It can be said that in a strict sense a critical load, according to that definition, is one that does not produce any effect on the most sensitive receptor even in the long term. Receptors may be individual species, types of soil, ecosystems, etc. For further info, see: www.acidrain.org/cl_fact.htm#Critical_loads.

See also related factsheets in this series:

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

No. 14, September 2003: The LRTAP Convention

Available at www.acidrain.org/publications.htm

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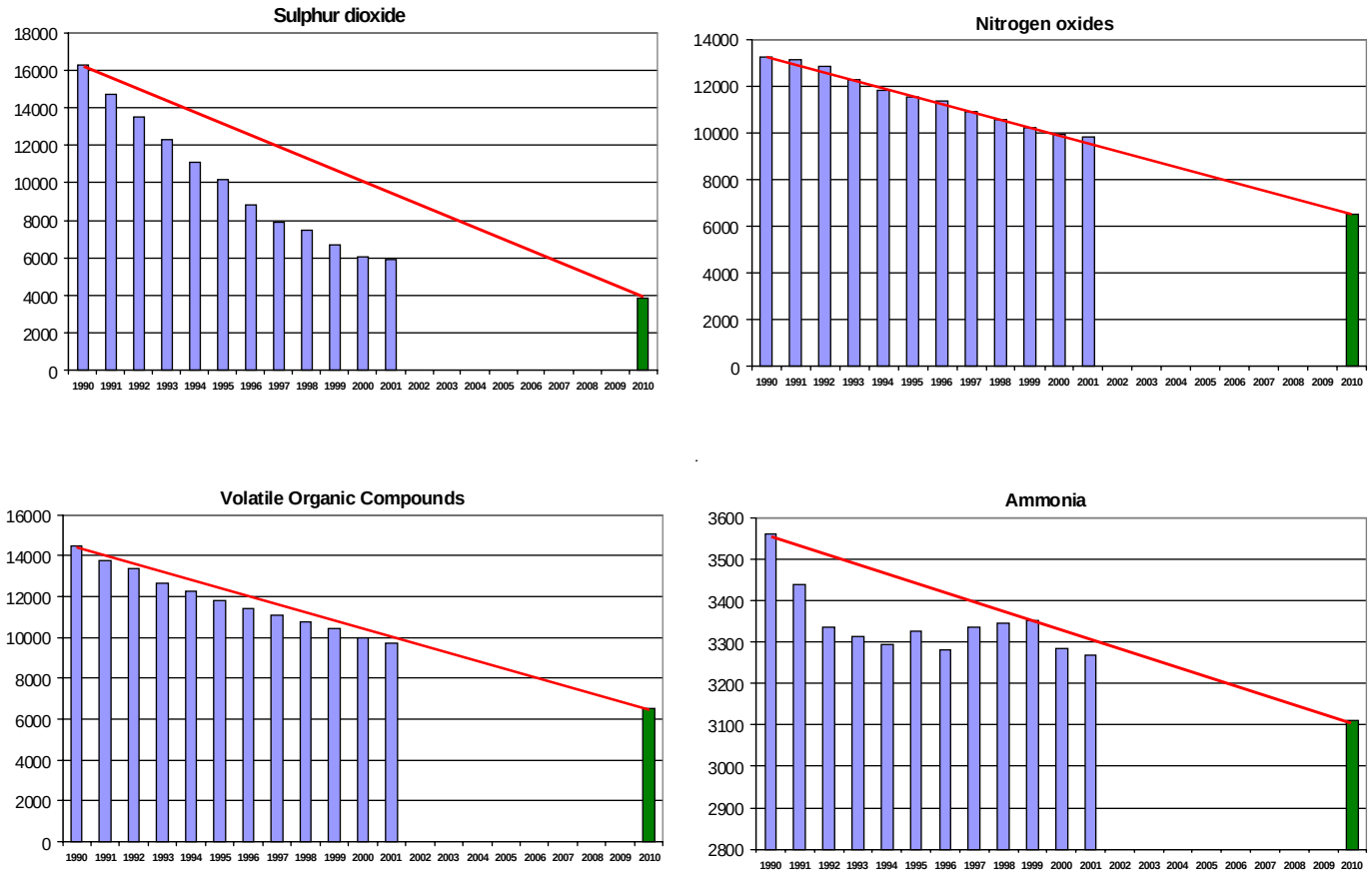
EU15 emissions 1990-2001, and emission ceilings for 2010.

Emissions in ktonnes. *Source*: **Review and revision: Emission data reported to CLRTAP**. EMEP MSC-W Report 2003.



two years on thorough analysis in order to determine the ways by which the interim targets for ground-level ozone and acidification could be met at the lowest possible cost for the EU as a whole. This work was done with the RAINS computer model, the same as that used for many years by the Convention on Long-range Transboundary Air Pollution, for example when preparing and negotiating the 1999 Gothenburg Protocol. During this process of analysis, experts from member states, as well as from other stakeholders (including industry and environmental NGOs) were continuously being informed and consulted.

According to the Commission's original proposal from June 1999, the total emissions of sulphur dioxide in the EU should come down by 78 per cent, between 1990 and 2010. In the same time period, the emissions of nitrogen oxides should be reduced by 55 per cent, and those of volatile organic compounds and ammonia by 60 and 21 per cent respectively.

While the parliament gave unreserved support to the Commission's proposed emission ceilings, most member states were not prepared to do so. After conciliation negotiations between parliament and the Council, the NECs in the resulting directive will mean less emission reductions: SO_2 will come down by 77 per cent, NOx by 51 per cent, VOCs by 54 per cent, and ammonia by 14 per cent. Consequently there is great risk that the interim environmental targets for ozone and acidification will not be achieved, a fact that has been strongly criticised by environmentalist NGOs.

In most cases the emission ceilings of the directive do not deviate very much from those the EU member countries had already undertaken in 1999 by signing the Gothenburg protocol to the Convention on Long-range Transboundary Air Pollution. This may give rise to questions as to why the EU was investing so much time and effort in order to come up with a NEC directive for the EU.

One main reason is that EU legislation is in practice more demanding than international agreements. Having legally binding national emission ceilings established in EU legislation gives stronger provisions for follow-up and control of member states' implementation and compliance with the NECs.

Another reason is that the Commission is responsible for the achievement of EU environmental objectives, which in turn may require binding EU legislation. Since the EU has ratified the Gothenburg Protocol, it will furthermore be up to the Commission to ensure fulfilment of the Protocol obligations, and a practical way to do this will be through EU legislation, such as the NEC directive.

The directive's objectives

The aim is "to limit emissions of acidifying and eutrophying pollutants and ozone precursors" in order to improve the protection of the environment and human health against risks of adverse effects, and "to move towards the long-term objectives of not exceeding critical levels and loads and of effective protection of all

people against recognized health risks from air pollution."

Emission ceilings

By 2010 member states must have so limited their annual national emissions so that they do not exceed the emission ceilings laid down in Annex 1 (see Table 1), and they must also ensure that these emission ceilings are not exceeded in any year after 2010. The purpose of the emission ceilings is "to meet broadly" the interim environmental targets, set down in Article 5.

Following adoption of the NEC directive, national emission ceilings for 2010 have also been agreed with ten of the twelve so-called acceeding countries. These NECs are prescribed in the accession treaties between the EU and each acceding country, and shown in Table 2.

Interim targets

The three interim environmental targets in Article 5, are:

ACIDIFICATION. The areas where critical loads are exceeded shall be reduced by at least 50 per cent in all areas as compared with the situation in 1990.

HEALTH-RELATED OZONE EXPOSURE. Ground-level ozone above the critical level for health shall be reduced by two-thirds in all areas compared with the situation in 1990. Moreover the ground-level ozone load shall not exceed a given absolute limit anywhere.

VEGETATION-RELATED OZONE EXPOSURE. Ground-level ozone above the critical level for vegetation shall be reduced by one-third in all areas compared with the situation in 1990. In addition, the load shall not exceed a given absolute limit anywhere.

Since the political compromise between the Council and the parliament resulted in less demanding binding emission ceilings (as compared with the Commission's proposal), the NECs of the directive will not be sufficiently stringent to attain the emission reductions necessary for meeting the interim targets. The directive therefore also contains so-called indicative emission ceilings (set out in Annex II). These are set for the EU as a whole (not for each member state), and reflect the emission reductions estimated to be needed EU-wide to meet the interim targets (see Table 3).

Programs and reporting

The directive lays down that by October 2002 member states must draw up programmes for the progressive reduction of national emissions of the four pollutants, and report them to the Commission, at latest by December 2002. These reports shall provide information on measures and action taken at the national level to attain the emission ceilings. The national programmes shall be updated and revised by October 1, 2006. Member states are also obliged to make this information available to the public.

If prepared in accordance with the obligations, these programmes could provide useful information not only on projected future emission levels, but also on national forecasts regarding future levels of activity in the energy, transport, industry, and agriculture sectors. Moreover, if member states produce and disseminate this type of information properly, the likelihood of compliance with other air quality legislation, such as the EU air quality standards, could be better evaluated.

Member states shall also annually report their national emission inventories and projections for 2010 to the Commission. Methodologies for emission inventories and projections are specified in the directive.

Review and revision

Based on among others the information from member states, the Commission shall report to the European Parliament and the Council in 2004 and 2008 on progress made in the implementation of the national emission ceilings as well as on the extent to which the interim environmental targets are likely to be met by 2010, and on the extent to which the long-term objectives could be met by 2020.

In the review that is to be completed in 2004, the Commission shall include an evaluation of the indicative emission ceilings for the Community as a whole, and consider further cost-effective actions that might be taken in order to reduce emissions with the aim of attaining the interim environmental targets by 2010.

The reports by the Commission may be accompanied by proposals for modification of the national emission ceilings for 2010 and/or the interim environmental targets. The Commission may also propose "further emission reductions with the aim of meeting, preferably by 2020, the long-term objectives".

Stepwise improvements

In essence the methodology used when developing the directive is intended to ensure the attainment of agreed targets for improving protection of the environment and health, and to bring about an equal relative environmental improvement everywhere in the EU, while at the same time ensuring extraordinary improvements in the worst affected areas.

Table 1. National emission ceilings for SO_2, NOx, VOCs and NH_3, to be attained by 2010 by the EU15 member states (kilotonnes).

Country	SO_2	NOx	VOCs	NH_3
Austria	39	103	159	66
Belgium	99	176	139	74
Denmark	55	127	85	69
Finland	110	170	130	31
France	375	810	1050	780
Germany	520	1051	995	550
Greece	523	344	261	73
Ireland	42	65	55	116
Italy	475	990	1159	419
Luxembourg	4	11	9	7
Netherlands	50	260	185	128
Portugal	160	250	180	90
Spain	746	847	662	353
Sweden	67	148	241	57
UK	585	1167	1200	297
EU15	**3850**	**6519**	**6510**	**3110**

Table 2. National emission ceilings for SO_2, NOx, VOCs and NH_3, to be attained by 2010 by the acceding[1] and accession candidate[2] countries (kilotonnes).

Country	SO_2	NOx	VOCs	NH_3
Bulgaria	*856*	*266*	*185*	*108*
Czech Rep.	265	286	220	80
Cyprus	39	23	14	9
Estonia	100	60	49	29
Hungary	500	198	137	90
Latvia	101	61	136	44
Lithuania	145	110	92	84
Malta	9	8	12	3
Poland	1397	879	800	468
Romania	*918*	*437*	*523*	*210*
Slovakia	110	130	140	39
Slovenia	27	45	40	20

[1] The NECs for the eight acceding countries are not given in the NEC directive (2001/81/EC), but in the accession treaty for each country.

[2] The NECs for the two accession candidate countries (Bulgaria and Romania) have not yet been established. Therefore, the figures given in this table for these two countries are taken from the 1999 Gothenburg Protocol.

Table 3. Indicative EU-wide emission ceilings for SO_2, NOx and VOCs (kilotonnes).

	SO_2	NOx	VOCs
EU15	3634	5923	5581

The aim of the general relative improvement is expressed in the form of a so-called gap closure towards the long-term objective where there will be no exceeding of critical loads. "Gap closure" means a stepwise gradual closing of the gap between the current environmental situation and the "ideal" situation (with no exceeding of critical loads). The extraordinary improvements are to be achieved by including absolute limits for exposure to pollutants in the gap-closure procedure.

A computer model for integrated assessment was used to arrive at a so-called joint optimization to find the most cost-effective way, for the EU as a whole, of achieving the environmental aims. This enabled the Commission to propose differentiated national emission ceilings, which largely reflect the polluter-pays principle and should maximize the environmental benefits of emission reductions.

Costs overestimated

A drawback of this methodology is that it tends to overestimate the costs of reducing emissions. The reason is partly that only technical emission abatement measures have been considered with no account taken of structural measures such as switching from coal to gas, increasing energy efficiency, greater use of alternative energy sources, and changes in the transportation and agricultural sectors. Emissions could be reduced at much lower cost through some of these structural changes than by relying solely on technical end-of-pipe solutions.

Furthermore, a highly doubtful energy scenario has been used in the computer modelling. This is largely based on information submitted by the individual member states, and would imply an *increase* in the EU emissions of carbon dioxide by about 8 per cent by 2010.

Such an increase is in absolute disregard of the commitments made by the EU and its member countries under the Kyoto protocol, which would involve a reduction of 8 per cent in the EU emissions of greenhouse gases (of which carbon dioxide is the most important). A computer run simulating a low-CO_2 scenario that would roughly accord with the Kyoto agreement brought the extra cost down by more than 40 per cent.

Benefits to health and the environment

The area of ecosystems where the depositions of acidifying air pollutants exceed the critical loads should be diminished as a result of the directive. There will also be reductions in the exposure to damaging levels of ozone, both for people and vegetation. By lowering the emissions of SO_2 and NOx, the directive will help reduce exposure to health-damaging fine particles (PM), since these two pollutants act as precursors to secondarily formed sulphate and nitrate particles.

Although no interim targets have been set for eutrophication, improvements can nevertheless be expected as result of the lower emissions of NOx and ammonia. However, significant further reductions in emissions are needed in all cases in order to attain the long-term objectives for the protection of health and the environment.

The Commission has also made an analysis of the quantifiable gains from reducing emissions in terms of money. Account was taken chiefly of the effects on human health (morbidity and mortality), on farm crops and modern buildings and materials. Calculations showed the gains to be significant, and that the economically quantifiable benefits significantly outweighed the estimated costs. It should however be noted that a number of gains were not included, such as the direct health effects of NO_2 and VOCs, less acidification of soil and water, less eutrophication, fewer effects on biological diversity, lesser long-term effect on forest productivity, and less damage to historical monuments.

Level of ambition too low

The Commission's original proposal contained relatively strict national emission ceilings. Although largely supported by the parliament, they were firmly rejected by the Council. The resulting political compromise means that the NECs contained in the directive will not suffice even to attain the agreed interim environmental objectives for 2010.

The process of review and revision provides an opportunity to strengthen the existing NECs for 2010, but will more likely result in a future stepwise strengthening of the emission ceilings – for example by establishing new NECs for 2015 and 2020. In any case it is obvious that the attainment of the long-term objectives will require significant further reductions in the emissions of all four pollutants.

National reporting on programs

By early 2004, four EU countries – Belgium, Greece, Ireland and Luxembourg – had still failed to report to the Commission how they propose to reduce their emissions of air pollutants so as to fulfil their commitments under the NEC directive. Moreover, many of those that had reported failed to do as the directive requires.

From the eleven national reports that were delivered, it appears that several of the member countries foresee difficulties in meeting their ceilings. The main problem seems to be nitrogen oxides. Based on "business as usual" projections as reported by member states, only Finland and the UK would comply with all of their emission ceilings by 2010. If envisaged measures are considered, Germany would also meet all its emission ceilings.

It is not however easy to determine how great the difficulties for meeting the ceilings actually are, since virtually all of the national programmes lack the information needed for an analysis – namely, quantitative estimates of the effect of policies and measures that are either planned, proposed or undertaken.

Future developments

The directive is scheduled for review and revision by 2004, thus providing an opportunity to strengthen the emission ceilings for 2010, to set new ceilings for later target years (say, 2015 and/or 2020), and to decide when the long-term environmental objectives should be achieved.

It is however likely that the first review and revision will be delayed by about a year, the reason being that the analysis and evaluation are to be co-ordinated with the ongoing Clean Air For Europe (CAFE) programme, initiated by the Commission in 2001.

The CAFE programme will result in a so-called thematic strategy for air pollution, to be presented by the Commission by July 2005 at the latest. This strategy is to be accompanied by proposals for revised and/or new directives relating to air pollution. Current developments under CAFE indicate that the NEC directive may also be extended to include national emission ceilings for fine particles (PM_{10} or $PM_{2.5}$, or both).

Further information

An initial assessment of Member States' national programmes and projections under the national emission ceiling directive (20 01/81/EC). Summary paper. ETC-ACC Technical Paper 2003-8, published in April 2004. Available at http://air-climate.eionet.eu.int/announcements/ann1082666299

The reports on national programmes received by the Commission can be found on the environment directorate's website http://europa. eu.int/comm/environment/air/nationalprogr_ dir200181.htm

Unexpected effects quite possible

The rise in global temperature this century may suffice to cause the northern branch of the Gulf Stream to slow down or even to collapse. It would then become much colder in western Europe.

What greenhouse effect – it was supposed to get warmer wasn't it?

NORTHWESTERN Europe is kept warm by what is known as the North Atlantic Current, an extension of the Gulf Stream that brings warm water from the tropics to the north. Without that heat pump the average temperature in Scandinavia, for instance, would be 5-10°C lower than it is today. In Germany it would be 3-4°C lower. The east coast of North America is also warmed by the same current.

This current is sensitive to global warming and could slow down, or even break down as a result of increasing global temperatures. Studies of Earth's ancient climate show that the North Atlantic Current has changed repeatedly and dramatically in the past, resulting in massive and sudden regional climate changes.

"Rapid changes of up to 10°C in a decade have happened more than 20 times in the past 100,000 years," says Professor Stefan Rahmstorf of the Potsdam Institute for Climate Impact Research in Germany. The last time that happened was after the last ice age, about 8,000 years ago.

"Many scientists are concerned that similar rapid shifts in ocean currents could be triggered again by global warming. We are not yet sure how warm it has to get before this happens, but once the threshold is crossed the consequences for northwestern Europe are likely to be severe," says Rahmstorf. "The threshold may well lie within the range of warming expected under business-as-usual within this century."

Rahmstorf emphasizes however that it is still not too late to sway this development.

"If we start reducing emissions now to limit global warming, we can most likely prevent this from happening. The risk for unpleasant surprises increases the longer we wait."

Climate modelling shows, too, that the Gulf Stream will not only be affected by the extent of global warming, but also by the speed at which it occurs. The quicker the warming, the greater will be the risk of sudden collapse. A slower rate of warming would allow gradual changes, leading to a new state of equilibrium.

Professor Rahmstorf's conclusions can be read in a new book, in which research from the last few decades concerning the functioning of our planet and the way it is being changed by human and natural forces is presented.

An outstanding conclusion of the book – based on the findings of 5,000 researchers in the International Geosphere-Biosphere Programme – is the recognition that the relationship between climate, ecosystems and the effects of human intervention is highly complex and that change will not be linear. There are several thresholds to be crossed, but it is uncertain where they will be. When they are crossed, however, the effects could be enormous and occur quickly.

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[1] **Global Change and the Earth System: A Planet Under Pressure**. Steffen et al. Springer Verlag, Heidelberg, Germany, 2004. 336 pp. There is a 34-page executive summary in pdf format on www.igbp.kva.se.

Why the Gulf Stream may be affected

The ocean currents are driven by differences in the water's density, which in turn depends both on its temperature and salinity – hence the term thermohaline circulation. The colder and saltier the water is, the higher will be its density.

The North Atlantic Current arises from the saltwater gradually being cooled down and thus becoming steadily heavier. When the water carried by the current starts to freeze, all its salt passes into the surrounding water which then becomes heavier – so heavy that when it reaches Greenland it starts to sink down to the bottom of the sea. This process can be regarded as a pump that drives the current.

Two things will occur to slow down the circulation when the global mean temperature rises. Not only will the water not be cooled so much, but – and most importantly – its salinity will be reduced as a result of reduced ice formation and dilution by meltwater from ice and glaciers in the far north.

More about thermohaline circulation can be found at Stefan Rahmstorf's website: www.pik-potsdam.de/~stefan/

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LARGE COMBUSTION PLANTS

Biggest lignite-fired plant in Europe

In 2000 the emissions of sulphur dioxide from Belchatow amounted to some 230,000 tonnes.

WITH A CAPACITY OF MORE than 4,400 MW, the Belchatow power plant in Poland is the biggest fired by lignite in Europe. While in generation capacity it represents approximately 15 per cent of the country's total installed power, it in fact supplies almost 20 per cent of Poland's power, mainly because it offers the lowest priced electricity on the Polish market.

The plant is located in mid-Poland, 180 km southwest of Warsaw, not far from the cities of Lodz and Belchatow, in a small village called Rogowiec. The reason for locating it there was the discovery in 1960 of a rich deposit – with some 2 billion tonnes of lignite – near Belchatow. Exploitation started in 1980 as a strip pit mine.

The power plant is located about two kilometres from the mine, and the first block came into operation in December 1981. Over the following six years, additional blocks were constructed, with the result that a total of twelve blocks have been brought into operation since 1988. Following modernization between 1999 and 2004, each will have a rated capacity of 370 MW, resulting in a total of 4,440 MW.

Each block consists of a steam boiler, a turbine and a generator. The three newest blocks have been constructed for the combined production of heat and power, together supplying some 600,000 MWh of heat to the city of Belchatow.

Because the lignite from the mine has to be brought on conveyors, the distance between the power plant and the mine has to be limited to avoid extra cost.

The Belchatow lignite is of declining quality, with increasing contents of sulphur and ash. Between 1995 and 2000 the ash content increased from about 8 to above 11 per cent, and average sulphur content from 0.6 to over 0.8 per cent, and the levels are still rising.

The quality will continue to worsen and it is presumed that the bed will be either exhausted or extraction will become impractical within the next 10 to 15 years. Since geological investigations have revealed an extension of the bed, a new mine is being opened a few kilometres further away, near the village of Sczercow. This new mine will supply lignite, but to a new power plant. As mentioned above, lignite supply is economically justified only when transported by conveyors, and the most economical solution was to construct a new plant – Belchatow II – close to the new mine.

The tender for the new 833 MW Belchatow II has been announced,

and construction is expected to start this year, followed by operation in 2007. It will be run by ELBIS, a newly created company.

Environmental performance

The yearly average lignite consumption over the five-year period 1996 to 2000 amounted to around 35 million tonnes, resulting in annual emissions of the greenhouse gas carbon dioxide of approximately 24 million tonnes.

In 2000 the emissions of sulphur dioxide from Belchatow amounted to some 230,000 tonnes, or about 15 per cent of the country's total emissions.

Construction of desulphurization installations started in 1994, so that by the end of 2003 eight blocks were so equipped. The four oldest have no desulphurization.

Emission control is based on calcium-gypsum wet technology. The desulphurizing efficiency is quite high – in 2002 about 94 per cent of the sulphur was captured. That same year, desulphurization had been retrofitted to six of the twelve blocks, and emissions of sulphur dioxide had been further reduced to 174,000 tonnes. If all blocks are fully retrofitted, annual emissions are projected to come down to less than 50,000 tonnes.

Although the desulphurization technology generates significant amounts of gypsum as a by-product, fortunately it is of fairly good quality and can practically all be utilized for making construction material.

Emissions of nitrogen oxides are being reduced only by primary methods, i.e. by modifying combustion. Compared to the previous situation, these modifications have resulted in emission reductions of about 40 per cent. Annual emissions of nitrogen oxides amount to approximately 40,000 tonnes.

Compared to some other Polish power plants, Belchatow is relatively new and was constructed using advanced technologies. On the other hand, despite considerable progress, the Belchatow power plant and lignite mine together represent one of the biggest projects in Europe as regards impact on the natural environment.

Legal aspects

In general, Belchatow complies with Polish environmental law. According to the IPPC directive (96/61/EC), which was incorporated in Polish Environmental Law in 2001, it should obtain a so-called integrated permit as a precondition of operation after 2007. The directive involves employing BATs (Best Available Technique) as one of the conditions of future operation. The BATs are described in so-called BREF notes. The BREF for large combustion plants is currently in the final stages of preparation, and will be adopted later this year. It is expected to set strict guidance on requirements regarding environmental performance.

In April 2003 Belchatow was granted an integrated permit under the IPPC directive – the first integrated permit issued in Poland and valid for the next ten years. To obtain it, Belchatow had participated in a pilot project with the support of Danish funds and specialists, making it possible to avoid obligations to fulfil the more strict regulations and benchmarks laid down in the new LCP directive (2001/80/EC) and draft BREF for LCPs that are currently being finalized.

A new plant, Belchatow II, will be constructed close to a new mine

According to the rules, both the application and the permit should be public documents, and the nature of the pilot project has led to increased expectations of a very open and truly public discussion.

Neither the application nor the permit are however available from the website of the pilot project or the Lodz Voivodship which issued the permit. Moreover, the Ministry of Environment, the beneficiary of the pilot project, does not allow these documents to be reviewed using its internet service. It seems that some people have forgotten that integrated permits are subject to reporting and monitoring within the EU, as regulated by Decision 2000/479/EC on reporting and registering of emissions.

Future developments

Belchatow supplies electricity to the Polish Power Grid (PSE) through five regional distributors in western Poland and some other local and regional distributors. In 2000 about 5 per cent of the energy in Poland was sold on the market, an amount that is expected to grow. Prices offered by Belchatow (and presumably by ELBIS) are still very competitive.

Other transactions, even long-distance ones, are also probable. The Laziska Steel Mill located in Silesia, close to the Czech border, has for instance recently contracted for a supply of electricity from the Konin power plant in central Poland. Developments in the energy market can, however, lead to other patterns of transactions, possibly reflecting commercial links between the distributors and producers of energy.

The Belchatow plant is a state-owned enterprise (as is the new ELBIS), although theoretically it could – like other companies in the energy sector – be subject to privatization.

Belchatow has a long-term-contract with the Polish power grid. This mechanism was used to support investments by providing a guarantee of a high price for energy sold to PSE, valid for several years. This is however in contravention of EU rules on fair competition, and to comply with EU legislation it will have to be terminated. The government will nevertheless pay compensation. In the case of Belchatow, the assessed value is around PLN 1 billion (ca 200 million euros), a sum that could roughly cover the cost of building the new Belchatow II power plant.

For the future it has been proposed that one of Belchatow's boilers could be used for burning oilseed rape (*Brassica oleifera*) straw. This is a renewable source of energy and large amounts of rape straw are expected to become available since it is a by-product of the production of rape oil biofuel (to be used by motor vehicles). Burning biofuel in Belchatow will require other methods of waste management, as the resulting ash is not suitable for construction purposes. The burning of rape straw is in line with EU policies to increase the proportion of electricity generated from biofuels and to promote its use in the energy market.

This article is adapted from a manuscript delivered by the Polish Ecological Club.

Compare for yourself!

Pages 8-9 give the twenty worst emitters of CO_2, SO_2 and NOx in the EU15.

Power sector generates more CO_2

Total emissions by the 21 largest power generators in the EU15 grew by 0.8 per cent to 693 million tonnes of carbon dioxide in 2002. These 21 companies accounted for approximately 75 per cent of total emissions of the power and heat sector in Europe. The European carbon factor – the amount of carbon oxide released in relation to the quantity of electricity generated – remained at roughly the same level as the year before, 360 kg CO_2/MWh. The information is taken from a report produced by PricewaterhouseCoopers.[1]

The report also compares the European power sector with that in Japan. The aggregate Japanese generation capacity and emissions in 2002 were equivalent to one third of those in Europe. The carbon factor was 379 kg CO_2/MWh, i.e. slightly higher than in Europe. Last year's report included a comparison with the US, which had a carbon factor of 720, in other words twice as high as that of Europe (AN 1/03, p.15). This difference was explained by the lower proportion of coal-fired plants and the higher efficiency of the European power sector.

[1] **Climate Change and the Power Industry. European Carbon Factors 2: a Benchmarking of CO_2 Emissions by the largest European Power Producers**. November 2003. Available at www.pwc.com.

Renewable targets receding

Two EU targets for renewable energy are unlikely to be met, according to a draft report from the European Commission seen by the newsletter Environment Daily. The proportion of electricity obtained from renewable sources in 2010 is expected to reach 18-19 per cent, compared with the target of 22 per cent. In the case of energy use as a whole the target is for 12 per cent from renewable sources by 2010, but the actual proportion looks set to be around 10 per cent.

The directive on renewable energy sources (2001/77/EC) also gives indicative national targets. The Commission's analysis suggests that just three out of fifteen countries are certain to meet them: Germany, Denmark and Spain. Greece and Portugal will certainly not meet them, and the outlook is uncertain for the remaining countries.

Source: **Environment Daily** 26 April, 2004.

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Logging, burning and clearing are severe threats to the rainforests worldwide. Rising temperatures and increasing levels of carbon dioxide add to the human pressure.

CLIMATE CHANGE

Rising levels of CO_2 are fertilizing the forests

IT HAS LONG BEEN KNOWN that human activities such as logging, burning and clearing are a severe threat to the rainforests. Research recently conducted in the Amazonas indicates however that rapid changes are occurring even in supposedly pristine regions.[1]

The researchers stumbled across the trend when studying the effects of rainforest clearance. They surveyed tree growth over the past two decades in 69 remote one-hectare plots, intended as pristine "controls" to highlight changes in other areas, where humans are active.

"But suddenly the controls weren't acting like controls," says William Laurance of the Smithsonian Tropical Research Institute in Balboa, Panama, who led the study. During the course of the study, most species of trees began growing faster. The forests also became more dynamic, with existing trees dying faster and being replaced by young new trees.

All the tree groups that increased in abundance were fast growers that make up the forest canopy, whereas half of those that declined were subcanopy trees.

"It's clear that this is not random variation," says Laurance, "rainforest dynamics are changing."

The most likely reason for these changes, say the researchers, is that rising carbon dioxide levels are fertilizing the forests, leading to faster growth and more competition among trees for light, water, and soil nutrients. Under these conditions, big, fast-growing species of trees probably have an advantage over small, slower-growing trees.

"Sadly, this could be a signal that the forest's ecology is changing in fundamental ways," says Laurance. "Tropical rainforests are renowned for having lots of highly specialized species. If you change the tree communities then other species – especially the animals that feed on and pollinate the trees – will undoubtedly change as well."

Source: Nature Press Release, March 10, 2004. *The study*: Laurance, W.F. et al. Nature, 428**,** 171-175 (2004).

Pristine forests are changing

THE RATES OF GROWTH and death of trees in pristine forests across the Amazon Basin have accelerated substantially in recent decades, which appears to have led to an increase in biomass in these pristine forests. This has been shown by research that is presented in a themed issue of the British journal Philosophical Transactions B.[1]

The most likely explanation for the accelerated growth, according to the contributing researchers, is increases in atmospheric concentrations of carbon dioxide and surface air temperatures, and possible continent-wide changes in sunshine.

The researchers can show that tropical forests globally have warmed by half a degree in the last 20 years, and this is expected to increase by a further three to eight degrees by the end of the century, a development that could have very serious negative consequences for ecosystems, human welfare and the entire climate system.

"Whilst this increase in biomass may well have helped to slow the rate of global climate change so far, computer model simulations suggest that this 'carbon sink' cannot be taken for granted. The process could be reversed in as short a space of time as the next two decades by the combined effects of deforestation and global warming," says Dr Oliver Phillips of the University of Leeds, one of the scientists and co-editor of the publication.

The researchers also cite examples of rainforests that already appear to be breaking up under a combination of climatic and human pressure.

Dr Yadvinder Malhi, co-editor, concludes: "This research shows that conservation of the remaining rainforests will need to take into account the new pressures that global atmospheric change are placing on these forests. In the 21st century we are moving into a human-made atmospheric and climatic situation that has not been experienced on earth for at least 20 million years. We are deeply concerned with how the earth's most biodiverse ecosystems will respond to these changes."

[1] Tropical Forests and Global Atmospheric Change. Themed issue of Philosophical Transactions B, Vol. 359, No 1443, March 2004. Published by the Royal Society, 6 Carlton House Terrace, London, SW1Y 5AG. Website: www.royalsoc.ac.uk

Arctic environment faces drastic change

THE ARCTIC REGION faces a diverse range of threats from unsustainable development, pollution and climate change, according to a report[1] compiled by experts at the UNEP GRID Arendal centre in Norway. The responsibility for this impact is shared by the industrialized countries, while the indigenous population, the Inuit, are hit by the negative effects. The report asserts that the European Union bears much of the responsibility for these threats and must take action quickly.

"With the high levels of toxic chemicals in local Inuit peoples, the melting of permafrost and the retreat of glaciers across the region, the Arctic is like an environmental early warning system for the world," commented UNEP Executive Director Klaus Töpfer when the report was presented in March.

[1] **Arctic environment: European perspectives**. Published jointly by the United Nations Environment Programme (UNEP) and the European Environment Agency (EEA). Available at http://reports.eea.eu.int/environmental_issue_report_2004_3/en

NEWS IN BRIEF

Leading the way at sea

As part of its environmental work the shipping company Wallenius Wilhelmsen has signed supply contracts with Shell Marine Products and ExxonMobil for a total of 300,000 tonnes of bunker oil with a sulphur content of 1 per cent, and with BP for a further 180,000 tonnes of oil containing 1.5 per cent sulphur. The shipping company, which has a total annual consumption of around 800,000 tonnes of bunker oil, has set itself the target that all its vessels, including those on long-term charters, should run on oil with a maximum sulphur content of 1.5 per cent by the end of 2004. It expects to meet its remaining demand for low-sulphur oil through purchases on the spot market, primarily in Europe.

Source: www.2wglobal.com, 10 February 2004.

Lorry charging scheme resurrected

The distance-based charging scheme for heavy lorries that was to be introduced on German motorways last autumn (AN 1/03, pp.18-19) had to be postponed several times due to technical problems. In February this year the German government cancelled its contract with Toll Collect, the consortium that was in charge of the project. A new agreement reached in March means that the consortium will now launch a simpler version of the satellite-based tolling system in 2005, before introducing more sophisticated elements in 2006. If the technology fails, Toll Collect will be liable to pay up to 780 million euros in 2005 and 1 billion euros each year thereafter.

Source: **Environment Daily**. 4 March 2004.

German subsidy for particle filters

At the start of April the German minister of the environment Jürgen Trittin put forward a bill that would give tax concessions for diesel vehicles if they are equipped with particle filters – including aftermarket installations. The total discount, in the form of reduced vehicle excise duty, would amount to a maximum of 600 euros, although the precise figure depends on the environmental class of the vehicle.

Diesel vehicles now account for 44 per cent of new vehicles sales in Germany, compared with 13 per cent in 1990.

Further information (in German): www.bmu.de/de/1024/js/presse/2004/pm093/

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CORAL REEFS

"The first major casualties of climate change"

THERE IS an evident risk of the coral populations on the Great Barrier Reef collapsing in the next hundred years as a result of the rising water temperature, according to a study[1] commissioned by WWF Australia and the Queensland Tourism Industry Council.

The Great Barrier Reef is a World Heritage Area and the world's largest living reef formation, stretching 2,000 km north to south along Australia's northeast coast.

"Coral reefs are one of the first major casualties of climate change," said Ove Hoegh-Guldberg, professor at the University of Queensland and co-author of the report, in an interview with Reuters. "The only hope we have of saving these beautiful ecosystems lies in massively reducing heat-trapping gas emissions and stabilizing the Earth's climate within two degrees Celsius of pre-industrial levels."

The worst occurrence of bleaching of the Great Barrier Reef so far occurred in 2002, when 60 to 95 per cent of the reefs within the Great Barrier Reef Marine Park were affected. While most reefs that were surveyed survived with relatively low levels of coral death, some locations suffered severe damage with up to 90 per cent of corals killed.

During the next 100 years climate researchers foresee a rise in temperature of 2-6°C.

"There is little to no evidence that corals can adapt fast enough to match even the lower projected temperature rise. Most evidence points to rates of adaptation that involve centuries and millennia," according to the study.

Under the best-case scenario in the report the loss will be recoverable only if global temperature increases remain below two degrees, which will call for greatly reduced emissions of greenhouse gases during this century.

Under the worst-case scenario the coral cover may decline to less than five per cent on most reefs by the middle of the century and a collapse can be expected by 2100. Reefs will not disappear but they will be devoid of coral and dominated by other less appealing species such as macroalgae and cyanobacteria. A re-establishment of coral reefs will be "highly unlikely over the following 200-500 years."

The Great Barrier Reef is not only important for global biodiversity, it also supports huge fishing and tourism industries in the region. The report estimates that destruction of the reef's coral could end up costing the Australian economy A$8 billion (3.5 billion euros) and more than 12,000 jobs by 2020.

PER ELVINGSON

[1] **The Implications of Climate Change for Australia's Great Barrier Reef**. March 2004. Can be downloaded from WWF Australia at www.wwf.org.au.

Up-to-date reports on coral bleaching etc. can be found at the Great Barrier Reef Marine Park Authority's website, www.gbrmpa.gov.au.

Factfile:

Coral reefs

Corals are colonies of sea anemone-like animals, or polyps, that lay down a limestone skeleton. The living tissue is a veneer over a mass of coral bones piled sometimes more than 1000 metres above the seabed; the last mortal remains of previous generations of coral polyps. The polyps live in a tight symbiotic relationship with single-celled algae called zooxanthellae. These algae live inside the tissue of the coral host.

Coral reefs occur mainly in the tropical zone, and alongside rainforests are the ecosystems most rich in species anywhere in the world.

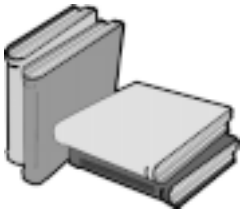
But they are exposed to a multitude of threats. Tourism, over-fishing, flows of sediment and pollutants from land, together with pollution at sea may, according to the researchers, result in more than half of the reefs disappearing in the next 30 to 50 years.

There will be another stress factor if the water also becomes warmer. Coral has a narrow comfort zone and is highly stressed even by a temperature rise of less than one degree Celsius. When corals are exposed to stressful conditions they lose the colourful symbiotic algae necessary to their continued health and survival, a process known as bleaching.

Coral bleaching events began in 1979, and since then reports of global cycles of mass coral bleaching have only increased. The global episode of mass coral bleaching in 1998 was the largest in recorded history, and coincided with the warmest year and decade on record. It removed an estimated 16 per cent of the world's living coral, with estimates for the Indian Ocean rising as high as 46 per cent of living coral dying over a period of a few months.

Another effect of the increasing levels of carbon dioxide in the air is higher concentrations of carbonic acid in seawater, which in turn decreases the availability of carbonate, which the coral polyps need for building the reefs.

Recent publications



Yearbook of International Co-operation on Environment and Development 2003/2004
By the Fridtjof Nansen Institute. Reports on international conventions and organizations concerned with the environment and development.

11th volume. 352 pp. £70.00. Available from Earthscan, 8-12 Camden High Street, London NW1 0JH, UK. Internet: www.earthscan.co.uk. Extracts from the publication are also available at: www.greenyearbook.org

Air Quality Management in the United States (2004)
By the National Research Council's Committee on Air Quality Management. An assessment of current legislation, including claims that the Clean Air Act does not do enough to protect communities that suffer most from air pollution, nor does it adequately consider the effect on ecosystems and the role of air pollutants in climate change. The report also recommends, among other things, that a more integrated approach should be taken to air pollutants and that ecosystems should be given better protection.

330 pp. $45. Can be ordered or read at www.nap.edu/books/0309089328/html/

The Eastern Promise (2004)
Progress report on the EU renewable electricity directive in the accession countries. Published by WWF European Policy Office, Avenue de Tervuren, 36, 1040 Brussels, Belgium. Available in pdf format at www.panda.org (News & Facts > Publications > Climate Change).

2nd Report on Road Transport Best Industry Practices
Report compiled by the Fraunhofer Institute, highlighting many measures that achieved cuts in fuel consumption and exhaust emissions, for example "eco-driving" training schemes, upgrading to cleaner engines, and "eco-efficient distribution."

60 pp. Published by the International Road Transport Union. Available in pdf format, free of charge, at www.iru.org/Publications/Welcome.E.html

Expert Paper on the Global Impacts of Road Transport Biofuels (2004)
Compiled by a group of independent UK experts, on the lifecycle emissions associated with different transport biofuel options. 25 pp. Available in pdf format at www.nsca.org.uk/pages/topics_and_issues/biofuels.cfm

Potential Environmental and Rural Impacts of Biofuel Production in the UK (2004)
Addresses the local impacts of biofuels, such as land use, biodiversity, regional development, agricultural practices, etc. 26 pp. Available in pdf format at www.nsca.org.uk/pages/topics_and_issues/biofuels.cfm

Assessment & Decision Making for Sustainable Transport (2004)
Makes recommendations for good practice in the transport sector on the basis of reviews of recent experience in infrastructure planning and policy development in France, Italy, Netherlands, UK, Finland, Germany and Spain.

234 pp. 55 euros. Published by the European Conference of Ministers of Transport. Can be ordered from OECD online bookshop (www.oecd.org), where a pdf version is also available free of charge.

EMEP/CORINAIR Emission Inventory Guidebook
Third edition. Designed to provide a comprehensive guide to state-of-the-art atmospheric emissions inventory methodology to support reporting under the Convention on Long-range Transboundary Air Pollution and the National Emission Ceiling Directive of the EU.

Technical report No 30, October 2003. Available at http://reports.eea.eu.int/EMEPCORINAIR4/

Air Pollution, Global Change and Forests in the New Millennium (2003)
D.F. Karnosky et al. A long list of researchers describe how trees and forests react to climate variability, rising levels of carbon dioxide, tropospheric ozone, acid deposition, etc.

470 pp. 140 euros. ISBN 0-08-044317-6. Available from Elsevier, Customer Service Dept., Linacre House, Jordan Hill, Oxford OX2 8DP, UK, www.elsevier.com.

Predicting recovery of acidified freshwaters in Europe and Canada
Special issue of Hydrology and Earth System Sciences, Vol. 7, No. 4, August 2003. Published by European Geophysical Union. ISSN 1027-5606.

Air pollution trading – marketing failure

GIVEN THE RAPID ADVANCE of emissions trading onto the world stage and its enthusiastic embrace by governments and businesses alike, it would seem reasonable to expect the literature to be filled with thorough analyses of this policy, documenting its successes irrefutably and in detail, especially contrasting it to the failures of the regulatory programmes that the supporters of trading want repealed. But that is not the case.

In this examination, which is the result of a study conducted over a six-month period starting in mid-2002, three trading schemes in the U.S. were studied in detail:

- ❏ The leaded gasoline trading programme, which began operation in 1974;
- ❏ The acid rain trading programme, which was created by the 1990 Clean Air Act amendments;
- ❏ The RECLAIM programme, which commenced in southern California in 1993.

Comparing and contrasting these programmes revealed grave flaws common to all of them. Finding the same failings in all trading programmes suggests that the deficiencies are intrinsic to trading itself, not the result of faulty programme design or implementation.

These failings include the following.

Abandoning protection of health

The Clean Air Act of 1970 was designed to save lives and avoid illness. It requires that a concentration of air pollution that is generally safe be identified, then that sources of that pollutant reduce emissions enough to reach that level. The key to this is source-by-source permitting, so both regulators and the public know exactly how much pollution flows from the smokestack.

Trading is the antithesis of source-by-source permitting. Instead of reducing pollution as fast as technologically achievable, trading allows it – and the illness and death that it causes – to continue for the express purpose of saving money for polluters. Yet the premise of replacing source-by-source review with trading is that the health benefits of every unit of pollution are identical, independent of the location of the emission source. This is simply, and obviously, untrue.

Removing the stigma of pollution

Air pollution kills and injures. The stigma associated with such harmful action often acts as a powerful deterrent. Trading, by treating pollution as a commodity – and, indeed, using euphemisms such as "allowance" rather than pollution – affirmatively sanctions pollution, thus removing the stigma.

Killing environmental innovation

Because trading focuses solely on reducing a single pollutant by an exact date and a precise amount at least cost, techniques and practices that deliver multiple benefits – e.g. new ways of energy conversion, as well as conservation, and renewable forms of energy – are frozen out of the market.

In the acid rain programme, the innovation stimulated was in new railroad tracks, on-loading and off-loading systems, and other ways of increasing the use of lower sulphur coal. While trading stimulates cost innovation, it has the opposite effect on environmental innovation, suffocating emerging technologies, such as integrated gasification combined cycle (IGCC).

This rigidity is perhaps the greatest single practical flaw in trading. Under a technology-forcing regime, the multiple benefits of specific technologies or practices can be seized. Eliminating permits in favour of trading leaves no mechanism for bringing new technologies on line.

Hindering mid-course adjustments

Trading provides polluters with a degree of flexibility in choosing the means by which to reduce a pollutant and, to some degree, the timing. It is otherwise rigid, however, so as a practical matter it becomes impossible to adjust goals based on new information – new technology for example, or the discovery of more substantial injuries.

Because the emission reductions mandated by the 1990 acid rain programme are manifestly inadequate, proposals to increase them have been put forward. They have not been adopted, and there is no likelihood of that in the foreseeable future. To finally eliminate leaded gasoline required enactment of a congressional ban. Tardy achievement of the RECLAIM reductions occurred only after a massive outcry.

Delay and undercontrol

Delay is implicit in trading because it requires time for markets to develop. Undercontrol is also implicit, because if all polluters are doing their utmost to reduce air pollution, there is nothing available to trade. To create a commodity that can be traded, regulators must allow polluters to do less than their best.

For example, from the time an acid rain programme was first proposed in the U.S. in 1980, to the date at which it will take full effect in 2010, roughly 30 years will have passed. Emissions in the U.S. will then have been cut by about 35 per cent. In contrast, Germany cut power plant emissions by 90 per cent in six years, from the first proposal in 1982 to completion in 1988. In the case of leaded gasoline, the U.S. required 23 years to eliminate the fuel, while China took only three years.

Fraud and secrecy

While emissions allocations are public, trades and prices are not. In the

trading programmes examined, the prices actually paid are secret, so there is no way to test the proposition that trading reduces control costs. In addition, in the leaded gasoline programme the ownership of the credits was also secret. While ownership of acid rain allowances is public, actual emissions information becomes available only after the fact, too late to avoid health damage. Extracting information from the government database is a complex, tedious, and time-consuming task well beyond the capabilities of ordinary citizens.

The shroud of confidentiality surrounding emissions and the trades opens the door to fraud. This certainly occurred in the leaded gasoline programme, and has been alleged in RECLAIM.

Converting a public good to private property

The effect of trading is to convert a common good – clean air – into a sump for waste by creating and then conferring on the polluters the right to use it to dispose of their pollution. Thus, what once belonged to all – air quality – is converted to private property. The explanatory language accompanying one programme, acid rain, characterizes this property as "right", while in others it is an undefined privilege conferred on polluters.

Health and environmental objectives are not achieved

In every case examined, trading failed to produce the reductions required to protect the resource in question, requiring – for two of the programmes – recourse to the very command-and-control mechanisms crafters had sought to avoid.

Conclusions

The experience of the U.S. – and, indeed, the world – with emissions trading is limited principally to three programmes. None of these has before been subjected to close, critical analysis to determine whether they in fact are the unbridled success that their proponents claim.

There can be little doubt that trading certainly failed in two of the three cases examined, RECLAIM and leaded gasoline, and seem destined to do the same in the third, acid rain.

This analysis does not pretend to be the exhaustive analysis that ought to be devoted to trading before it is extended beyond its current scope. It is, nevertheless, the most ambitious effort undertaken to date, which is a reflection of the abdication of responsibility by government officials in the U.S. and elsewhere, who are proposing to extend trading into new arenas without careful review of U.S. experience.

It merits noting that much of the pressure to extend trading into new arenas is generated by those anxious for the appearance of progress in addressing global warming and power plant emissions. Public groups have increasingly embraced such proposals in the mistaken belief that any action is better than none at all. Two generations of American children with diminished intelligence, hundreds of thousands of children subjected to years of illness, and hundreds of lakes that remain acidified, belie such a belief. In the cases of leaded gasoline, smog and acid rain, there was room for error, and time for corrective action. There will be neither in the case of global warming.

Perhaps the conclusions of this analysis are too pessimistic. Then again, perhaps not. Government, universities, and some public interest groups have the resources to amplify on and confirm – or refute – this examination. They also have an obligation to do so.

CURTIS A. MOORE

The author is coeditor of the Health & Clean Air Newsletter (http://healthandcleanair.org). A more detailed presentation of the study can be found in Environmental Law Reporter News & Analysis, No. 3, 2004.

How to set the cap

Advocates of trading say that where it has failed to reduce emissions enough to protect resources, whether these are alpine lakes or Californian children, the blame lies with policymakers who opted for too lax a limit, whether it is called a cap, baseline, pool, or whatever. In theory, there are essentially four ways to choose the number on which a trading programme is based.

Protection of a resource. Here scientists determine what level of pollution a given resource – for example a sensitive ecosystem or asthma aggravation in exercising children – can tolerate without injury, then work backwards to arrive at the aggregate emission reduction required to achieve that level.

Consideration of costs. Economists or others calculate both the monetary value of the benefit (by, for example, assigning a dollar value to the life of a child) and the costs of control, then balance the two against each other. The aggregate reduction is set at the point where the two lines cross.

Consideration of technological availability. Industrial experts review the technologies and practices available to reduce emissions and, on the basis of this and other criteria, calculate the total reduction that would be achieved if these technologies were required. The criteria used to determine which technology should serve as the yardstick might take cost into account (as with best available control technology), reject cost (as with lowest achievable emission rate), or some variation (as with maximum achievable control technology).

Selection of a more or less arbitrary reduction based on political considerations. Policymakers, mindful of a number of intangible considerations – for example, the impact of a reduction in sulphur emissions on coal sales (and, hence, employment) in different regions – negotiate a number that is politically acceptable to a critical mass of decision-makers.

In the emission trading programmes examined and proposed, it is quite clear that in none was the number selected to protect a resource. Similarly, none was selected on the basis of technological availability. It is quite clear that the numbers have been adopted through a combination of the considerations of costs and politics.

The conclusion is that pollution caps in trading programmes will always be inadequate, because policy-makers resort to trading when they lack the political will to either require uniform application of a technology-based limit or one based on protecting the resources. By definition, the cap is selected on the basis of costs to polluters and political considerations, and these only exert pressure in the sense of too little, too late.

Cheaper energy has reduced incentives to save

The energy share of total production costs in some industries fell by 50 per cent from the early 1980s until the late 1990s.

THE INTERNATIONAL Energy Agency has been analyzing developments in the energy sector since the organization was founded thirty years ago.[1] One of the major findings is that IEA countries[2] have significantly reduced the need for energy to fuel economic growth. Compared to 1973, it now takes one-third less energy to produce a unit of GDP in IEA economies.

In the case of carbon dioxide emitted per unit of GDP, the greatest improvement took place in the period 1973-1990. However, since 1990 only a few countries have managed to sustain the downward trend. While total emissions of carbon dioxide from IEA countries in 1990 were only marginally higher than in 1973, they increased 13 per cent between 1990 and 2001.

Oil continues to dominate the IEA fuel mix and consumption today is roughly at the same level as in 1973. Considerable reductions have been made in manufacturing industry – thanks to improved energy efficiency and shifts to a less energy-intensive structure – but at the same time consumption has increased by 50 and 80 per cent respectively for passenger and goods transport.

Energy prices are an important factor behind these long-term trends, according to the IEA analysis. The sharp price increases associated with the oil crises of the early 1970s necessitated major improvements in efficiency. But from the 1980s onwards energy became cheaper again. This, combined with more efficient use, resulted in relatively low energy costs and hence reduced the incentive to save energy. The energy share of total production costs in some industries fell by as much as 50 per cent from the early 1980s until the late 1990s. Energy costs for domestic use fell by 20-50 per cent over the same period, while the fuel cost per kilometre driven by private cars fell by between 20 per cent and 60 per cent, depending on the country.

"We are concerned that despite the major improvements in energy efficiency, recent trends indicate that stronger efforts are needed to avoid an increasing dependency on oil and to reduce the environmental impacts from growing energy demand. It is still possible to obtain at low cost, a dramatic increase in energy efficiency in our economies," comments Claude Mandil, Executive Director of the International Energy Agency.

[1] **Oil Crises and Climate Challenges: 30 Years of Energy Use in IEA Countries**. International Energy Agency, 2004. 124 pp. 100 euros. Can be ordered from www.iea.org (A seven-page executive summary is available free of charge.)

[2] Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Luxembourg, The Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, UK, United States.

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Coming events

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International Conference for Renewable Energies. Bonn, Germany. June 1-4, 2004. In parallel to the conference there will be side events, NGO meetings, etc. *Information*: www.renewables2004.de.

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

EU Environment Council. June 28-29.

13th World Clean Air & Environmental Protection Congress & Exhibition. London, UK. August 22-27, 2004. *Information*: www.kenes.com/cleanair/

European Mobility Week. September 16-22, 2004. Topic: Safe streets for children. *Information*: www.mobilityweek-europe.org/thematic/safe_streets.html

Second International Ukrainian Conference on Biomass for Energy. Kiev, Ukraine. September 20-22, 2004. *Information*: www.biomass.kiev.ua

Third International Nitrogen Conference. Nanjing, China. October 12-16, 2004. *Information*: Dr. Zhengqin Xiong, P.O.Box 821, Chinese Academy of Sciences, Nanjing, 210008, China. Internet: http://n2001.esa.org/n2004.html.

3rd AIRNET Annual Conference. Prague, Czech Republic. October 21-23, 2004. *Information*: http://airnet.iras.uu.nl/

Workshop on Review and Assessment of European Air Pollution Policies. Gothenburg, Sweden. October 25-27, 2004. *Information*: asta.ivl.se/workshops

Instruments to reduce air pollution. Brussels, Belgium. November 10-11, 2004. Joint workshop under the EU CAFE programme and the LRTAP Convention.

Clean Air for Europe (CAFE) Steering Group. Brussels, Belgium. November 18-19, 2004.

Executive Body under the Convention on Long-range Transboundary Air Pollution (CLRTAP). Geneva, Switzerland. November 29-December 3, 2004.

COP10 – Tenth Conference of the Parties to the Climate Convention. Buenos Aires, Argentina. December 6-17, 2004. *Information*: unfccc.int/cop10