No agreement
Finding global solutions to reduce emissions of air pollutants from shipping has yet again shown to be a very slow process under the IMO’s lead.

Dispute over costs
The investments required to produce an additional 50 million tonnes of low-sulphur distillate shipping fuel in Europe could be only one third of the oil industry’s estimates.

New scenarios for future emissions
New projections show that air quality in 2020 is still inadequate, but also that the potential for further cuts in air pollutant emissions is significant.

Tougher emission limits proposed
In July the EU Commission presented a proposal for new emission requirements for heavy vehicles, known as the Euro VI standard.

Successful trial brings permanent charging
One in five cars disappeared when Stockholm re-introduced the congestion tax on 1 August. New plans also in London and New York.

Flattening trend in pollutant emissions
Air pollutant emissions from land-based sources in Europe are continuing to fall, but considerably slower than in the 1990s. Some of the reductions on land are also countered by rising emissions from international shipping.

Multiple benefits of low-CO₂ policies

A new study shows that reductions in carbon dioxide emissions in the EU of more than 30 per cent are feasible by 2020, and that much larger reductions are possible in the longer term. Additional benefits of the low-carbon option include lowered emissions of common air pollutants, and a reduction in the import of fuels into the EU, with an accompanying improvement in the security of energy supplies.

Energy scenarios for the twenty-five EU countries were produced showing that total carbon dioxide (CO₂) emissions from fossil fuel combustion can be reduced by at least 30 per cent for the EU as a whole by 2020 as compared to 1990. The scenarios assume the introduction of addition abatement measures for CO₂ from 2008. Decisions on which measures to introduce were based on technical feasibility, cost-effectiveness and speed of introduction.

Energy use is the major cause of emissions of the main greenhouse gas, CO₂, as well as a range of air pollutants that
Since 11 August ships in the North Sea and English Channel have been required to use fuel with a sulphur content of no more than 1.5 per cent. The same limit has applied for more than one year to ships plying the Baltic Sea.

This first step to lower marine fuel sulphur content stems from both EU legislation and from standards adopted under MARPOL Annex VI of the International Maritime Organisation (IMO). Outside of these two designated Sulphur Emission Control Areas (SECAs), the maximum allowed sulphur content of marine fuel is as high as 4.5 per cent.

By comparison, the EU standard for road vehicle fuels currently allows a maximum of 50 parts per million (ppm) of sulphur, to be lowered to 10 ppm as from 2009. In the US, the maximum sulphur content of road diesel fuel is 15 ppm. So compared to trucks, ships are allowed to burn fuel with up to 4,500 times more sulphur (up to 1,500 times more for ships in SECAs).

Not surprisingly, several studies have shown that enforcing emission controls for shipping is a very cost-effective way to cut air pollution. A recent Dutch study has now confirmed that this is also the case for the Netherlands. Shipping traffic in the North Sea currently contributes twenty per cent of acid deposition, ten per cent of nitrogen oxide levels, and four per cent of PM10 levels, as average figures for the whole country.

The Dutch report concludes that air pollutants emitted from marine diesel engines reach far inland, contaminating the air over nearly the entire country. Moreover, shipping’s relative contribution to air pollution is likely to grow steadily over the next 10–15 years as land-based emissions fall and shipping traffic continues to expand.

As shown in the article on p. 18, this situation is not in any way unique to the Netherlands – it is true for many European countries. In some countries, ship emissions already make up approximately one fifth or more of the total deposition of both sulphur and oxidized nitrogen compounds.

Surprisingly, neither the EU member countries nor the shipping industry seem to have realized yet that up-to-date environmental standards will be essential for the industry’s future competitiveness and development. Ships can make no claim to environmental responsibility as long as they go on polluting the air with such high emissions of sulphur and NOx.

Emission abatement measures could significantly reduce pollution from ships. But developments under IMO so far can best be described as “too little, too late”. In spite of twenty years of talks, very little has been delivered.

To lower emissions within a reasonable time, as well as bringing much-needed pressure to bear on the global negotiating machinery, moves will have to be made both at national and EU levels. Initiatives must be taken to strengthen legally binding EU rules to set minimum emission standards. And to bring about sufficiently large reductions more quickly, economic instruments, such as emission charges, will be needed to supplement these rules.

If the environmental targets agreed within the EU are to be attained, the emissions of sulphur and NOx from European shipping will have to be brought down by at least 80–90 per cent.

Several studies, including the Commission’s analyses for the NEC directive, have clearly demonstrated that reducing ship emissions would be cost-effective in itself, as well as economically profitable for society.

Christer Ågren

No agreement on ship emission controls

MEPC meeting in July decided to initiate a study to help evaluate options to reduce emissions.

Finding global solutions to reduce emissions of air pollutants from shipping is yet again proving to be a very slow process under the leadership of the International Maritime Organization (IMO).

Two years ago, the IMO decided to review existing agreements and create tougher international standards for air pollution from international shipping. The revision was to be finalized and adopted before the end of 2007.

Instead, the IMO is now considering a new schedule that will not produce a final decision on any new limits until 2008 at the earliest – in fact, even further delay is possible.

At a meeting in London in July, the IMO’s main environment policy decision-making body, the Marine Environment Protection Committee (MEPC), decided to initiate a study to help evaluate options to reduce emissions (AN 2/07).

The study will focus specifically on the effects of the proposed fuel options to reduce emissions of sulphur dioxide (SO₂) and particulate matter (PM). It should also address possible consequential effects, such as impacts on emissions of carbon dioxide (CO₂).

The study is to be finalized by December, and a report should provide input to the next MEPC meeting, which is scheduled for March 2008.

Other air pollution issues, such as strategies for reducing emissions of nitrogen oxides (NOx), will continue to be discussed by the Working Group on Air Pollution under the Bulk Liquids and Gases (BLG) Sub-Committee.

The working group is scheduled to meet once more this year – in Berlin from 29 October to 2 November – to finalize its recommendations in time for the next MEPC meeting.

Action by IMO to reduce emissions of greenhouse gases from shipping appears to be even slower than that aimed at air pollution. A group of experts was established this summer to discuss and compile possible measures to reduce greenhouse gas emissions from ships, and is due to present a report by early next year.

Moreover, the MEPC agreed to update an earlier IMO study on greenhouse gas emissions from ships. The updated study should ready by 2009, if possible, but at the latest in 2010.

Christer Ågren

MARPOL Convention


Annex VI sets limits on the sulphur content of marine heavy fuel oils (with a global cap of 4.5 per cent) and on the emissions of NOx from new ship engines. These standards are however so weak as to be hardly likely to have any appreciable effect.

However, it also sets a limit of 1.5 per cent sulphur for fuel oil used by ships sailing in Sulphur Emission Control Areas (SECA), which should lead to reductions in the two designated areas, the Baltic Sea and the North Sea.

At its first meeting after the entry into force of Annex VI, in July 2005, the IMO’s Marine Environment Protection Committee (MEPC) agreed to review and strengthen the Annex.

The review should be completed by 2007, and in order to result in real reductions in ship emissions it needs to include, among other things, stricter emission limits for NOx and sulphur, for new as well as existing ship engines.
Multiple benefits of low-CO$_2$ policies

damage human health and ecosystems. Energy scenarios are therefore a key input for projections of pollutant emissions and for formulating policies and strategies to reduce pollution and achieve environmental objectives. At the outset of this study in the summer of 2006, a 30-per-cent reduction in CO$_2$ emissions from the EU by 2020 seemed very ambitious in comparison with political intent. In early 2007, however, EU leaders agreed targets to reduce greenhouse gas emissions by 20–30 per cent and to supply 20 per cent of demand from renewable energy sources by 2020.

The main focus of this study is on the energy scenarios used to revise the 2001 EU directive on National Emission Ceilings (NECs). Here, energy scenarios contribute to integrated assessment modelling and cost-effectiveness analysis. (The NEC directive was originally scheduled for review and revision by 2004, but the process has suffered significant delay and a proposal from the Commission is now expected by early 2008—see article on p. 8).

Alternative energy strategies, including behavioural change, demand management, energy efficiency, and low-carbon fuels are explored in the report. In addition to abating greenhouse-gas emissions, these strategies can facilitate cheaper and greater abatement of other atmospheric pollutants as compared to higher carbon scenarios. This interaction between strategies to limit global warming and strategies for achieving other environmental objectives, such as reduced acidification and improved air quality, has high policy relevance.

As the marginal costs of applying end-of-pipe (EOP) emission control technologies have risen and concern about global warming has grown, there has been a greater emphasis on developing integrated policies that address the multiple environment problems of global warming and air pollution. This is particularly important because measures to control greenhouse gases generally also reduce air pollutants, so stringent targets for both can be achieved at a lower total cost than addressing each separately.

Non-end-of-pipe (NEOP) solutions, with the exception of switching between fossil fuels, reduce dependence on fossil fuels and improve security of supply. The depletion of European gas and oil fields raises concerns over energy supply security because of the need to import, and causes pressure to increase the use of indigenous fuels with environmental disadvantages, such as coal.

Non-end-of-pipe options include:

- Behavioural change (e.g. smaller cars, lower speeds).
- Demand management (e.g. building insulation, low energy appliances).
- Fuel switching (from coal and oil to gas and renewables).

Percentage reductions in air pollutant emissions and emission control costs for the EU25 resulting from moving from a “business-as-usual” energy scenario to the main low-carbon energy scenario (-30% CO$_2$, 1990-2020).

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Emission reduction</th>
<th>Reduced control costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOx</td>
<td>20%</td>
<td>6%</td>
</tr>
<tr>
<td>SO$_2$</td>
<td>16%</td>
<td>23%</td>
</tr>
<tr>
<td>VOCs</td>
<td>4%</td>
<td>4%</td>
</tr>
<tr>
<td>PM</td>
<td>7%</td>
<td>17%</td>
</tr>
<tr>
<td>Total</td>
<td>-</td>
<td>11%</td>
</tr>
</tbody>
</table>

Improved energy conversion (e.g. condensing boilers, combined heat and power).

For this report a model called SEEScen (Society, Energy and Environment Scenario) was used to develop energy scenarios that have a greater and more detailed implementation of NEOP measures than other energy scenarios used by the European Commission. The new scenarios are then input into the GAINS model, and certain environmental and economic consequences assessed.

The Figure above shows the carbon emissions for the EU25 countries in the main scenario analyzed. The black squares show the Kyoto target for 2010 (but note that this does not just apply to CO$_2$) and the 30-per-cent target for 2020.

In this scenario, the EU fails to meet the Kyoto target in 2010, but then emissions fall steeply such that the 30-per-cent target in 2020 is met with good margin—a reduction achieved is actually 36 per cent. One notable feature is that EU25 carbon emissions are still falling steeply after 2020; this is because the measures take time to fully affect the stock of technologies. This means that the scenarios are quite robust.

Apart from the main scenario, a series of five variant scenarios in which NEOP
measures are implemented to differing degrees, were explored. These show that emissions are still declining after 2020, which underlines the importance of the early introduction of measures.

**The variant scenarios** also show that reductions significantly larger than 30 per cent are possible. It is possible to eliminate CO₂ emissions altogether, but this would not necessarily be desirable on social, economic or even environmental grounds. Investigation of various scenarios also illustrates that technological development may radically change our current view of the near future – for example the development of cheap solar cells and electricity storage could radically transform energy and environment policy.

Running the main new scenario through the GAINS model, and comparing the outcome with that of a traditional “business-as-usual” energy scenario, showed 30 per cent less CO₂ emissions in 2020.

Moreover, the new scenario results in 20 per cent lower SO₂ and NOₓ emissions, and about five per cent lower PM emissions, as well as accompanying reductions in EOP emission control costs (see Table).

The report demonstrates that in addition to abating greenhouse gas emissions, non-end-of-pipe options generally decrease the emissions of air pollutants such as sulphur dioxide, nitrogen oxides and fine particles, because fossil fuel combustion is reduced.

**Consequently,** implementing NEOP solutions facilitate greater emission abatement than is possible with end-of-pipe measures alone, and the total combined cost of meeting greenhouse gases and air pollutant targets is generally less than in scenarios which do not include the extensive use of non-end-of-pipe measures.

Christer Ågren

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**Trading emission rights requires greater emission controls**

The existing Swedish climate target is to be re-examined, in accordance with last year’s budget proposal, in favour of an “allowance target”, as this is regarded as the most effective socioeconomic method of achieving Sweden’s climate target. The allowance target takes into account industry’s allocated emission rights, but not traded emission rights.

A report from the National Institute of Economic Research shows, however, that although such an approach makes it easier to achieve the climate target, it will also lead to increases in emissions of sulphur dioxide and nitrogen oxides. These emissions would increase by 8 and 12 per cent, respectively, in comparison with the currently formulated climate policy target, based on projected economic growth. This would place greater pressure on environmental policy initiatives to improve air quality and to reduce acidification and eutrophication.


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**Parliament weak on air quality**

Several amendments aimed at relaxing key elements of the EU directive on air quality were tabled by the European Parliament’s rapporteur, Holger Krahmer, when the proposal was put before the environment committee for its second reading.

Surprisingly and uncharacteristically, the Parliament’s first reading last year resulted in an environmentally weaker position than that taken by the Council (see AN 3/06).

For example, the Parliament wanted to allow member states to postpone compliance with air pollution limits for PM₁₀ for up to nine years (i.e. until 2014, while the Commission proposed 2009 and the Council 2011). In an attempt at compromise, the rapporteur is now prepared to reduce the allowed time extensions by one year, to 2013.

The rapporteur also wants to reintroduce requests to weaken proposed new PM₂.₅ exposure reduction targets, and to broaden the range of places where limit values do not apply.

On the other hand, he wants to tighten the limit value for PM₁₀ from 25 μg/m³ (suggested by the Council and the Commission) to 20 μg/m³. It should be noted, however, that the value of 20 μg/m³ is still twice as high as that recommended by the WHO.

At a debate by the environment committee on 11 September, several MEPs made reference to the new greenhouse gas emission reduction targets for the EU. It is clear that climate policies will have a positive effect on air pollution – the air quality objectives can be met more easily and at much lower cost than previously expected.

The environment committee will vote on this report on 9 October, and a vote in plenary session is likely to take place in December.

Christer Ågren
Dispute over costs for cleaner shipping fuel

The investments required to produce an additional 50 million tonnes of low-sulphur distillate shipping fuel in Europe could be just one third of the estimates given by the oil industry.

Commissioned by the Netherlands Ministry of Transport, the Energy Research Centre (ECN) has studied the economic impact on the Netherlands that would result from a fuel switch in international shipping, from the current high-sulphur residual fuels to low-sulphur distillate fuel.

Such a fuel shift was proposed last October by the International Association of Independent Tanker Owners (Intertanko) to the International Maritime Organization (IMO). The proposal involves a switch by 2012 from the currently used residual fuel to distillate fuel with a sulphur content of one per cent, to be lowered to 0.5 per cent by 2015 (see AN 4/06, pp 5–7).

Worldwide, international shipping is estimated to use approximately 200 million tonnes of residual fuel per year, and the current global average sulphur content of this type of fuel is about 2.7 per cent.

Each year the Dutch refinery industry produces about eight million tonnes of refinery residues, the main component of the shipping fuel that is used now. Because domestic industry and power plants no longer burn heavy fuel oil, Dutch refineries have no domestic market in which to sell residual heavy fuel oil, which is why they mainly concentrate on the market for shipping fuel.

It is technically possible to convert all residues into lighter products, although this process will require additional energy use, which in turn will result in higher emissions of carbon dioxide ($\text{CO}_2$) from the refineries.

In the case of the Netherlands, replacing eight million tonnes of residual fuel with distillate fuel containing 0.5 per cent sulphur could – according to model calculations – mean additional energy use of about one million tonnes of crude oil and related $\text{CO}_2$ emissions of about 3.5 million tonnes.

Model calculations also indicate that desulphurization of the same amount of residual oil (a possible alternative to switching to distillate shipping fuel) would emit some 1.9 million tonnes of carbon dioxide.

Extrapolation of the calculations for the Netherlands to the European scale (i.e. conversion of 50 million tonnes of residual oil) indicates an extra 22 million tonnes of $\text{CO}_2$ emissions. This figure is significantly lower than the additional 35 million tonnes of $\text{CO}_2$ that would be emitted according to calculations by the European Petroleum Industry Association (Europia).

Last year, the European oil industry claimed that production of an additional 50 million tonnes of low-sulphur distillate in Europe would require an investment of 30 billion euro. Assuming that the estimates for the Netherlands...
case – as calculated by the ECN – are applicable to the whole of Europe, the resulting investment requirement would be around nine billion euro, i.e. less than one third of the oil industry estimate.

**According to the study**, there will be substantial investment in additional refining capacity globally in the coming years, but it is highly unlikely that in the short term sufficient distillates can be produced to supply all sea-going vessels in addition to current sales.

It is also stated that the pace of implementing the Intertanko proposal could greatly affect pricing on the oil-market, the oil products market, and the market for sea transport, but that a gradual introduction over a period of about six years, preceded by a preparation phase for the refineries of approximately six years, could limit the negative effects.

**Obversely there is** great uncertainty regarding the costs and possible additional CO₂ emissions for switching from residual to distillate fuels and for fuel desulphurization. There are also strongly diverging views on the practicality and timing of the measures.

In an annex to the report, Intertanko argues that the total amount of additional distillate fuel production needed globally is less than 200 million tonnes. This is because the residual fuels are already blends between residuals and distillates – unfortunately there appears to be no consensus on the proportion of distillates that are currently being added.

Regardless of this mix, Intertanko estimates that – to satisfy the demand of the world shipping fleet for distillates – current global distillate production would only need to increase by 8–13 per cent. The lower figure is based on the assumption that the current share of distillates is 40 per cent, and the higher figure assumes a share of 10 per cent.

**Regarding the increase** in CO₂ emissions, Intertanko questions the figures produced by the oil industry and also points out that switching to distillates can reduce CO₂ emissions from shipping by at least four per cent.

Intertanko concludes that the three options available to cut ships’ sulphur emissions (switching to distillates, desulphurization of residuals, and onboard flue-gas scrubbing) will all entail additional costs and will all need some transition time. But in their view the switch to low-sulphur distillates is the most practical, simplest and fastest solution.

As reported in the article on page 3, the IMO decided in July to designate an expert group to study the effects of the various options to reduce emissions of sulphur, including possible impacts on emissions of carbon dioxide.

**Christer Ågren**


**Technology for refining residual oil**

Bunker or heavy fuel oil (HFO) consists largely of the residues that remain after distilling crude oil in refineries. Around eight million tonnes of residual oil is produced annually in the Netherlands, which could be reduced, primarily by subjecting all atmospheric residues to vacuum distillation. In the Netherlands, this would decrease residues to five million tonnes.

It is technically possible and economically feasible to convert the heavy and viscous residues that cannot be distilled further into lighter (distillate) products through deep conversion. This conversion can be achieved by either separating carbon in processes such as flexicoking, as done by Exxon Mobil, or by adding hydrogen, as done in Shell’s HYCON process.

The remaining five million tonnes of residual fuel could be processed by building two or three flexicokers. (As an alternative to deep conversion, residual fuels can be gasified for power generation with gas turbines, and possibly combined with the production of hydrogen and/or heating.)

If no investments are made in processing capacity for residual fuel, the industry’s competitiveness will decline in the long term, particularly if there is a return to a situation with overcapacity and the margins for the refineries start diminishing again.

**Shipping is Denmark’s largest GHG emitter**

Danish government research institute Danmarks Statistik has released a report which shows that the shipping sector has become the country’s largest greenhouse gas producer. According to the report, global emissions from Danish-registered merchant and container ships account for 25 per cent of Danish companies’ combined carbon dioxide emissions. The institute said in a statement that Denmark would not reach its 2012 Kyoto goals if shipping companies were included in overall emission figures. “CO₂ emissions from the Danish economy grew by 33 per cent in the period 1990 to 2005,” the statement said. “The main reason for this development is shipping, which has become more and more significant to the economy. Ships’ energy usage has more than trebled since 1990.”

Source: Car Lines 2007-3.

**US EPA sued over ship smokestack pollution**

On 5 September Friends of the Earth, represented by lawyers from Earthjustice, sued the US Environmental Protection Agency (EPA) for failing to meet a deadline to regulate air pollution from large ships. EPA recently postponed indefinitely its commitment to set emissions standards for ship engines.

“The EPA promised to act months ago to rein in ship smokestack pollution, but instead they have delayed regulations. Port communities are fed up and suffering, that’s why we went to court today,” said Teri Shore of Friends of the Earth in San Francisco.

“In Los Angeles alone, the ships in port spew more pollution than the metro area’s six million cars combined. Residents of nearby neighbourhoods have high rates of respiratory illness and the region’s highest cancer risk,” said Sarah Burt of Earthjustice.

The Clean Air Act requires EPA to establish regulations to reduce air pollution from non-automobile engines that significantly contribute to pollution in areas with poor air quality, and in response to a previous lawsuit by Friends of the Earth and Earthjustice, challenging the lack of agency action on pollution from large ocean-going vessels, EPA committed to regulate ocean-going vessel emissions by April 2007.

New scenarios for future emissions

New projections show that air quality in 2020 is still inadequate to protect health and the environment, but also that the potential for further cutting air pollutant emissions is significant, especially if agreed climate policies are implemented.

Two years ago, on 21 September 2005, the European Commission presented its proposal for improving air quality in the EU – the thematic strategy on air pollution. This strategy established interim environmental objectives for 2020, and thus also set the level of ambition regarding air quality in the EU until that year.

Complaints from industrial interests meant that the strategy had been delayed for several months, but even worse was that the Commission eventually decided to opt for an ambition level between the “low” and “medium” of the policy scenarios analyzed under the Clean Air For Europe (CAFE) programme (see AN 4/05, pp. 1–4). Earlier drafts aimed at a higher level of ambition, but were watered down under pressure from EU commissioners for industry, agriculture and domestic markets.

Regarding the emission abatement measures required to attain the interim objectives of the strategy, no specific proposals for new or revised EU legislation were presented with the strategy. The Commission did however announce its intention to review the national emission ceilings (NEC) directive (see Box), and in 2006 propose revised emission ceilings that would be based on the level of ambition set out in the strategy.

In order to provide technical assistance and expert advice to the Commission, a working group was formed to revise national emission ceilings and policy instruments (NECPI), made up of experts from member states, industry and environmental organisations, as well as other experts. The first NECPI meeting took place in November 2005, and this was followed by another six meetings, the latest one in June 2007.

The analysis underpinning the NEC directive is fairly complex and uses
computer models to identify the least-cost solution for the EU as a whole to meet environmental targets. In essence, the methodology is intended to attain agreed targets for the protection of health and the environment, and achieve the same minimum relative environmental improvements everywhere in the EU, while at the same time ensuring extraordinary improvements in the worst affected areas.

The aim of the general relative improvement is expressed in the form of a gap closure towards the long-term objective: zero exceedance. Gap closure means a stepwise gradual closing of the gap between the current environmental situation and the “ideal” situation, i.e. no exceeding of critical loads. The extraordinary improvements are achieved by adding absolute limits for exposure to pollutants to the gap-closure procedure. A computer model for integrated assessment was used to carry out a joint optimization process to find the most cost-effective way for the EU as a whole to achieve its environmental aims. This enables the Commission to propose differentiated national emission ceilings, which largely reflect the polluter-pays principle and should maximize the environmental benefits of emission reductions.

Policies and strategies for greenhouse gas reductions have a big impact on energy use and on air pollutant emissions. At present there is still a great deal of uncertainty as to how the member states will fulfil their commitments to reduce emissions of greenhouse gases. Their actions will greatly affect the extent to which fossil fuels will be used in the EU, and thus emissions of air pollutants. Consequently, various energy scenarios have been analyzed, illustrating the impacts of different assumptions regarding future use of fossil fuels within the EU.

For its latest analyses earlier this year, the Commission’s consultant, IIASA, used two different sets of energy projections:

- The national energy projections scenario (NAT), which reflects the member states’ current national expectations for future energy use and agricultural activities. These projections are not however compliant with the Kyoto protocol and certainly go against EU targets for 20 to 30-per-cent reductions in greenhouse gas emissions by 2020. For the EU27 as a whole they even imply an increase in CO2 emissions as compared to the protocol base year (mostly 1990).
- The coherent energy scenario (COH), which was developed for the Commission using the PRIMES computer model, and is largely in line with the agreement reached by the European Union’s Heads of State in March 2007 to reduce greenhouse gas emissions by at least 20 per cent by 2020 (from 1990) and increase the share of renewables to 20 per cent by 2020.

The baseline projections for air pollutant emissions under the NEC directive should in principle include the effects of full implementation of all existing national and EU-wide legislation and measures. For various reasons, however, the analysis by IIASA so far has ignored further measures that might be needed to meet the national emission ceilings in 2010. It also failed to consider measures that may be required to comply with EU air quality limit values for NO2 and PM10.

Based on these baseline projections, only about half of the member states will achieve their NOx emission ceilings by 2010, and some countries will also have problems achieving their ceilings for volatile organic compounds (VOCs) and ammonia (NH3). Even by 2020 some member states are projected not to attain their 2010 NECs for NOx and NH3, unless additional measures are taken. (See AN 2/07, pp. 6–7.)

The combination of lower energy use and fuel switching in the coherent energy scenario results in lowered emissions of air pollutants in the energy and transport sectors, especially for SO2 and NOx, and thus to more member states achieving their ceilings.

Much has happened over the last couple of years, i.e. since the Commission adopted its thematic strategy on air pollution, including:

- Methodological changes in computer modelling;
- Improvements in emission data and forecasting;
- Two more countries are now members of the EU;
- Adoption of Euro 6 standards for passenger cars;
- Agreement on a new, tougher EU greenhouse gas policy.

In order to account for these, and other, developments, IIASA has updated its analysis of what measures will be needed to attain the interim 2020 environmental targets of the thematic strategy. For this purpose, a new benchmark baseline scenario was developed, which also includes some additional assumptions, namely that new Euro VI standards for heavy duty vehicles will be introduced as from 2013, and that the 2010 NECs will not be exceeded by any member state in 2020.

Starting from the benchmark scenario, the GAINS computer model optimization mode was used to identify the least-cost set of emission reduction measures to achieve the environmental targets of
the thematic strategy (see Table 1).

Using these assumptions, the resulting optimized emission reductions for \(\text{SO}_2\) in the EU27 range from 79 per cent for the energy scenario without ambitious climate policies (NAT) to 93 per cent for the COH energy scenario, i.e. the one reflecting a 20-per-cent reduction in \(\text{CO}_2\) emissions. Most, but not all, of this divergence is linked to the different baseline emission levels of the two energy scenarios. For the NAT, current legislation is estimated to lead to a 62-per-cent cut in \(\text{SO}_2\) emissions by 2020. The cost-effectiveness analysis results in a further fall of up to 79 per cent. For the COH scenario, however, the baseline already suggests 92-per-cent lower emissions, mainly due to lower coal consumption, so essentially no further measures would be necessary to meet the environmental targets.

Regarding \(\text{NO}_x\), optimized emissions should be reduced by 60 per cent and 62 per cent respectively, under NAT and COH scenarios. In contrast, the significantly larger reductions in \(\text{SO}_2\) emissions for the COH scenario relieve the pressure on \(\text{NH}_3\) and – to a lesser extent – on PMs and VOC, compared to what would be required for the NAT scenario. For \(\text{NH}_3\), the 31-per-cent reduction for the NAT scenario could be relaxed to a 24-per-cent cut in case of the COH scenario. The differences are smaller for PMs (from 53 to 56 per cent) and VOCs (49 instead of 52 per cent).

The scenario analysis also includes estimates of some health and environmental impacts expected to result from the projected levels of future emissions (see Table 2). For PMs, the GAINS model estimates changes in the loss of statistical life expectancy that can be attributed to changes in anthropogenic emissions. It should be noted that these calculations only refer to impact on the population over 30 years of age, thus underestimating the total impact.

Using the pollution levels for the year 2000, it is estimated that PMs results in an average shortening of life expectancy in the EU of approximately eight months. In the benchmark baseline scenarios, this figure comes down to 4.3–5.1 months by 2020, and in the optimized scenarios to 3.8 months.

When it comes to the impact on health from ground-level ozone, the GAINS model estimates the number of premature deaths associated with ozone levels above a cut-off level of 35 parts per billion (ppb). The number of premature deaths estimated as above will gradually decrease up to 2020 as a result of decreased emissions of the ozone precursors \(\text{NO}_x\) and VOCs.

**The analysis of environmental impact** includes ozone damage to vegetation, and acidification and eutrophication of various types of sensitive ecosystems.

For the year 2000, more than 20 per cent of the forest area in the EU, or approximately one quarter of a million square kilometres, received acid deposition above the critical loads. By 2020 this is calculated to drop to 5–9 per cent in the benchmark baseline scenarios, and to four per cent in the optimized scenarios.

Not surprisingly, there are great variations in the costs for the additional emission reduction measures beyond the current legislation that are required to meet the targets of the strategy. For the optimized coherent scenario, costs are estimated at 1.85 billion euro per year in 2020, while the national energy scenarios would result in additional costs of 10.5 billion euro per year (excluding costs for Euro VI in both cases).

**For comparison**, costs given in the thematic strategy on air pollution for an energy baseline with an eight-per-cent \(\text{CO}_2\) reduction have been recalculated for the EU25 at 5.2 billion euro per year.

However, climate policies do not only influence the costs of additional meas-

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**Table 1: Emissions of air pollutants from land-based sources in EU27 under various scenarios (ktonnes).**

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<thead>
<tr>
<th></th>
<th>National energy scenario</th>
<th>Coherent energy scenario</th>
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<tr>
<td></td>
<td>2020</td>
<td>Change</td>
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<td><strong>Sulphur</strong></td>
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<td>Baseline</td>
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<td>Benchmark</td>
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</tr>
<tr>
<td>MRR</td>
<td>2,194</td>
<td>-79%</td>
</tr>
<tr>
<td></td>
<td>2,023</td>
<td>-80%</td>
</tr>
<tr>
<td><strong>Nitrogen oxides</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>7,011</td>
<td>-43%</td>
</tr>
<tr>
<td>Benchmark</td>
<td>6,578</td>
<td>-47%</td>
</tr>
<tr>
<td>Optimized</td>
<td>4,909</td>
<td>-60%</td>
</tr>
<tr>
<td>MRR</td>
<td>4,579</td>
<td>-63%</td>
</tr>
<tr>
<td><strong>Ammonia</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>3,975</td>
<td></td>
</tr>
<tr>
<td>Benchmark</td>
<td>3,594</td>
<td>-10%</td>
</tr>
<tr>
<td>Optimized</td>
<td>2,746</td>
<td>-31%</td>
</tr>
<tr>
<td>MRR</td>
<td>2,488</td>
<td>-37%</td>
</tr>
<tr>
<td><strong>Volatile Organic Compounds</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>6,321</td>
<td>-43%</td>
</tr>
<tr>
<td>Benchmark</td>
<td>6,060</td>
<td>-45%</td>
</tr>
<tr>
<td>Optimized</td>
<td>5,250</td>
<td>-52%</td>
</tr>
<tr>
<td>MRR</td>
<td>4,172</td>
<td>-62%</td>
</tr>
<tr>
<td><strong>PM2.5</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>1,782</td>
<td></td>
</tr>
<tr>
<td>Benchmark</td>
<td>1,171</td>
<td>-36%</td>
</tr>
<tr>
<td>Optimized</td>
<td>780</td>
<td>-56%</td>
</tr>
<tr>
<td>MRR</td>
<td>593</td>
<td>-67%</td>
</tr>
</tbody>
</table>

Baseline = Baseline scenario assuming full implementation of existing air quality legislation.
Benchmark = Baseline scenario including implementation of Euro VI for heavy-duty vehicles.
Optimized = New optimized scenario achieving the environmental targets of the thematic strategy.
MRR = Maximum reductions in the RAINS model, i.e. only so-called end-of-pipe technical measures.
The total difference in air pollution control costs between the non-climate policy (NAT) and the climate policy (COH) situation thus amounts to almost 77.4 to 66.1 billion euro per year by switching from the NAT scenario to the COH scenario, i.e. by 11.3 billion euro per year.

Moreover, when comparing the costs of additional emission reductions associated with moving from the baseline scenario (which reflects current legislation in 2020) with the monetized health benefits, it is clear that the benefits far outweigh the costs. Assuming the lowest figures for health damage valuation, the benefits are nearly five times higher than the costs, and assuming a higher health damage valuation, benefits are estimated to exceed costs 15 times.

It should be noted that this comparison of costs and benefits does not include all the benefits that would result from improved air quality – notably it excludes benefits to ecosystems and cultural heritage as well as some health benefits.

As reported in AN 2/07, the European Commission decided in May to again postpone its planned proposal for a revised NEC directive, the main reason being that the adoption in March of new climate and energy policies for the EU should be fully accounted for when developing the proposal.

Since the new scenario analysis can only be done once the Commission has adopted its proposal for burden sharing between member states on the 20-per-cent reduction target for greenhouse gas emissions and the target for a 20-per-cent share of renewable energy, the NEC proposal is not expected until February 2008 at the earliest.

Christer Ågren

The key points of the EEA report are:

**EU15:** Emissions of GHGs fell by 0.8 per cent (35.2 million tonnes CO2 eq.) between 2004 and 2005. Emissions of GHGs decreased by 1.5 per cent between 1990 and 2005.

**EU27:** Emissions of GHGs fell by 0.7 per cent (37.9 million tonnes CO2 eq.) between 2004 and 2005. Emissions of GHGs decreased by 7.9 per cent compared to 1990 levels.

Germany, Finland and the Netherlands contributed most to the EU15 reduction in absolute terms. Other EU15 countries that saw emissions decrease between 2004 and 2005 were Belgium, Denmark, France, Luxembourg, Sweden and UK.

In absolute terms, among the EU15, Spain increased greenhouse gas emissions the most between 2004 and 2005. The increase by 3.6 per cent or 15.4 million tonnes CO2 equivalents came mainly from public electricity and heat production. Other EU15 countries that saw emissions increase between 2004 and 2005 were Austria, Greece, Ireland, Italy and Portugal.

Spain will exceed two of four national air pollutant emissions ceilings set for 2010 in the NEC directive, according to a revised national implementation programme. The cap on NOx is predicted to be exceeded by 37.5 per cent and on VOCs by 33.9 per cent. On the other hand it will “very probably” comply with ceilings on sulphur dioxide and ammonia. The government blames unpredicted economic and population growth for persistently high NOx and VOC emissions.

Source: ENDS Europe DAILY, 10 September 2007.

Table 2: Summary of air pollution effects in EU27 under various scenarios.

<table>
<thead>
<tr>
<th>Year 2000</th>
<th>Benchmark NAT 2020</th>
<th>Benchmark COH 2020</th>
<th>Optimized strategy NAT 2020</th>
<th>Optimized strategy COH 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deaths due to PM2.5</td>
<td>350,000</td>
<td>272,000</td>
<td>230,000</td>
<td>204,000</td>
</tr>
<tr>
<td>Monetized health damage (billion euro/yr)</td>
<td>280-790</td>
<td>191-609</td>
<td>162-516</td>
<td>144-457</td>
</tr>
<tr>
<td>Acidification: Unprotected forest area (km²)</td>
<td>259,000</td>
<td>119,000</td>
<td>70,000</td>
<td>50,000</td>
</tr>
<tr>
<td>Eutrophication: Unprotected ecosystem area (km²)</td>
<td>1,020,000</td>
<td>896,000</td>
<td>858,000</td>
<td>682,000</td>
</tr>
</tbody>
</table>

Note: When evaluating chronic mortality from exposure to PM2.5 two alternative values are shown here, the lower one is based on value of life years lost (VOLY) and the higher one on value of a statistical life (VOSL).
Tougher heavy vehicle emission limits proposed

Strict emission standards could be met at reasonable cost and need not require a trade-off with fuel economy and CO₂ emissions, according to an ICCT response to EU consultation.

In July the EU Commission presented a proposal for new emission requirements for heavy vehicles, known as the Euro VI standard. However, the Commission chose not to make a recommendation itself, but to put forward four different suggestions for stakeholder consultation until 5 September.

The pollutants from heavy vehicles that the Commission primarily aims to regulate more tightly are nitrogen oxides (NOₓ), hydrocarbons (HC) and particles (PM), since they contribute to significant air quality problems throughout the EU.

The proposal sets different standards for vehicles fuelled with diesel (and ethanol) and those fuelled with gas. Only the proposed diesel engine standards are given in the figure opposite, as gas-fuelled heavy vehicles currently represent less than one per cent of the heavy vehicles on the EU market.

Scenario A is the one closest to the forthcoming US standards. According to the Commission, it will however entail a slight increase in fuel consumption, and hence an increase in carbon dioxide emissions.

In response to the consultation exercise the International Council on Clean Transportation (ICCT), reports that it strongly favours Scenario A:

“That scenario would provide the maximum level of protection for human health and environment, while also bringing Europe more closely in line with Japanese and US requirements for heavy-duty vehicles.”

Scenario A can, according to ICCT, be met at a reasonable cost and need not require a trade-off with fuel economy:

“We note that the Commission is concerned that stringent NOₓ and PM standards could entail a slight carbon dioxide penalty. While this may be true for some of today’s emission control technologies, the ICCT believes that continuing technical refinement will eliminate fuel economy impacts by 2012.”

The ICCT also recommends incorporating a number-based standard for particulate matter as a complement to mass-based standards into Euro VI. A number-based standard is impor-
tant to ensure control of ultrafine and nano-particles, which have come under increasing scrutiny for what is believed to be their disproportionate impact on human health.

Research for the Commission says the scenarios would add between 1,000 and 6,000 euro to the cost of a vehicle. ICC comments that research shows that the health and environmental benefits of the US 2010 requirements for heavy-duty diesel vehicles far outweigh the costs. Technical advances since then have further reduced costs, and it is now possible to limit emissions of PM (including ultrafine particles) and NOx by 90 per cent or more at a very low cost, generally less than one per cent of the total cost of a conventional heavy-duty vehicle.

No date has been proposed for the new standards to come into force. Draft legislation is expected around the end of the year.

Per Elvingson

Note. The first EU directive to regulate emissions from heavy vehicles, i.e. road vehicles heavier than 3.5 tonnes, came in 1988. The current regulations, Euro IV, came into effect in 2006, and the next stage, Euro V, which imposes stricter requirements on nitrogen oxide emissions, comes into force in September 2008. (The Euro standards for HDV are distinguished from Euro standards for passenger cars by the use of roman numerals.)

Further information: EU Commission, ec.europa.eu/enterprise/automotive

Germany aims for 40-per-cent emission cut

The German government has adopted a national strategy aimed at cutting greenhouse gas emissions by 40 per cent against 1990 levels by 2020 and improving energy efficiency by three per cent per year.

The 30-point strategy was formally approved by Chancellor Merkel’s cabinet in August. It envisages renewable energy accounting for 25–30 per cent of electricity production by 2020 against 13 per cent today.

Support for combined heat and power (CHP) will be increased to 750 million euro annually. Support for green renovation of old buildings will also be continued at the current level of 700 million euro per year until 2011. For new buildings, 15 per cent of their heating will have to come from renewable sources.

Other measures include a requirement that by 2020, the share of biofuels in the transport sector must equal 20 per cent. Motorway tolls on heavy lorries are to be linked more closely to their emissions.

Source: ENDS Europe DAILY 28 August 2007.

EU pleasure boat pollution law reviewed

A recent review by the EU Commission shows that further cuts in pollution emissions from recreational craft beyond the limits introduced in directive 2003/44/EC are possible. The directive was adopted four years ago to regulate pollution and noise from motorboats between four and 24 metres in length.

Four scenarios for further reducing emissions of hydrocarbons, nitrogen oxides and particulate matter were evaluated, showing emission reduction potentials of up to 33 per cent for all three pollutants, as compared to estimated baseline emissions.

The review does not provide any benefits-to-cost ratios for the options investigated, but it is stated that the “figures indicate that the compliance costs for emission reduction ... do not outweigh the monetary environmental benefits.”

The Commission says it aims to further explore the possibilities for maximizing the emission reduction potential of recreational craft, and that an impact assessment would be carried out before any proposals for further regulation are made.


Current standards and proposed scenarios

Limit values in scenario A are considered to be equivalent to the future US standards. Compliance with the emission limits of this scenario would require a higher rate of cooled exhaust gas recirculation, EGR (in addition to the use of a more efficient selective catalytic reduction (SCR) system). The higher rate of cooled EGR would, according to the Commission, lead to higher fuel consumption and hence to higher CO2 emissions in the range of 2–3 per cent.

Scenario D could also be considered, to a certain extent, as equivalent to the US standards. Higher fuel consumption with higher CO2 emissions is not foreseen in this case.

Scenario B is stricter than scenario A in terms of NOx for diesel engines but less stringent in terms of PM. This scenario requires a rate of cooled EGR that is considerably higher than that of scenario A. In order to achieve such a high ratio of EGR, scenario B requires an improved cooling system. As a result, higher fuel consumption and thus higher CO2 emissions of 5–6 per cent are anticipated.

Finally, scenario C is the least stringent in terms of NOx emissions; no negative impact is anticipated in terms of fuel consumption/CO2.

Source: ENDS Europe DAILY 28 August 2007.
A recent report by the Danish Environmental Protection Agency estimates that particle (PM) emissions from wood burning in Denmark can be reduced by 96 per cent between 2005 and 2020 if effective filters are installed on all wood-burning units.

Old wood-burning stoves and boilers generally have higher emission factors than new installations, and it is estimated that almost 90 per cent of the emissions come from installation types with high emission factors. Consequently, there is a great potential for reducing emissions by switching to installations with more efficient combustion, for example new boilers with storage tanks, automatically fired stoves and boilers, modern wood-burning stoves, and masonry stoves.

The report only looks at technological reduction possibilities. However, there is also good potential to reduce emissions by running awareness campaigns to inform people about the appropriate use of wood-burning stoves and boilers.

The projected emissions were analyzed for four different scenarios:

- A baseline scenario, where the replacement of stoves and boilers is assumed to be the same as assessed for 2005, however with some technological development for stoves;
- A Statutory Order scenario, where maximum emission standards for stoves and boilers are imposed to direct the development;
- A filter scenario, where over a ten-year period electrostatic filters are installed on all wood-burning units; and,
- A sub-scenario where filters are only installed on wood-burning units located in cities of a certain size.

In the baseline scenario emissions are estimated to come down by 16 per cent by 2020, in spite of an expected increase in wood consumption by 22 per cent over the same time period. Scenarios 2 and 4 both resulted in emission reductions of 35–40 per cent, while scenario 3 – the filter scenario – reduced emissions by 96 per cent.

The economic analysis shows that the filter scenario clearly offers the largest socioeconomic gain overall, which results from a reduction in costs of damage from emissions of PM$_{2.5}$ valued at DKK 16.4 billion, minus the consumer-borne additional costs of DKK 4.5 billion, as compared to the baseline scenario. So even if the filter scenario is more than twice as expensive as the baseline scenario, the net socioeconomic gain is estimated at DKK 11.9 billion spread over fifteen years.

Christers Ågren

Ten times cheaper than fossil-fuelled future

Investing in a renewable electricity future will save ten times the fuel costs of a “business as usual” fossil-fuelled scenario, saving US$180 billion annually and cutting carbon dioxide emissions in half by 2030, according to a joint report by Greenpeace and the European Renewable Energy Council (EREC).


Huge potential for increased efficiency

Industrial energy efficiency could be improved by up to 26 per cent, even without introducing new technologies, according to a study published by the International Energy Agency (IEA). Areas where further improvements can be achieved immediately are “conventional factory systems” such as motor and steam systems, combined heat and power generation, and materials efficiency and resource use, it says.

Manufacturing industries use nearly a third of world energy production while releasing 36 per cent of the global emissions of greenhouse gas carbon dioxide. Chemicals, petrochemicals, iron and steel, cement, paper and pulp, along with other minerals and metals, account for more than two thirds of this amount.


Downward trend for Danish emissions

Between 1985 and 2004, emissions of ammonia from Danish agriculture decreased by nearly 30 per cent, primarily as a result of improved utilization of nitrogen in animal feedstuffs, a fall in the number of cattle, and changed manure storage and application techniques.

In line with the 1999 Gothenburg Protocol under the Convention on Long-Range Transboundary Air Pollution (CLRTAP) and the 2001 EU directive on national emission ceilings, Denmark is committed to maximum ammonia emissions of 69,000 tonnes (equivalent to 56,800 tonnes of NH3-N) in 2010.

In a new study, the National Environmental Research Institute has made projections on future emissions showing that by 2010 Danish emissions are expected to come down to 53,600 tonnes NH3-N, i.e. well below the emission ceiling, representing a 40-per-cent reduction as compared to 1990.

By 2020, emissions are expected to have fallen further to about 45,000 tonnes NH3-N, a reduction of 50 per cent since 1990.

The projection includes all implemented and planned measures, such as the third Danish action plan for the aquatic environment, the reform of the EU Common Agricultural Policy, and newly launched legislation on animal husbandry in Denmark. Expected technological developments are also taken into account. Moreover, stricter environmental requirements, especially in relation to expansion of livestock farming, are expected to result in the implementation of various technical measures to reduce ammonia emissions, such as air treatment or floor drainage systems.


Cutting emissions cheaper than expected

The cost of reducing emissions of greenhouse gases in the Nordic Region will be lower than expected, according to a new report commissioned by the Nordic Council of Ministers. A 60-per-cent reduction from the 1990 level by 2050 will cost just over 11 billion euro, or approximately one per cent of total Nordic GDP.

The report by the COWI Research Institute calculated the potential for reductions in emissions in the energy and transport sectors. The calculations assume cuts of approximately 80 per cent by 2050 in energy-sector emissions by reducing reliance on fossil fuels and increasing the use of renewables. The report envisages a far smaller cut in the transport sector, approximately 40 per cent.

Successful trial brings permanent charging

One in five cars disappeared when Stockholm re-introduced a congestion tax on 1 August.

A congestion charging trial took place in Stockholm in the first half of 2006. The number of vehicles passing the charging points fell by over 20 per cent, queuing was significantly reduced and the number of people using public transport increased.

The trial ended on 31 July 2006 and was followed by a local referendum during the local and national elections in September. A small majority of residents of the city of Stockholm voted yes to continued congestion charging, while the residents of surrounding municipalities mostly voted no.

Public referenda in Sweden are only advisory, and political debate at government level took place in autumn. The decision was taken to continue with congestion charging. Those parties that were originally opposed to the scheme accepted it on condition that the revenues generated would go towards the construction of a future bypass to the west of the city.

“Public transport users and the environment were the main losers when the government refused to use the congestion charge as a locally governed incentive to reduce traffic congestion and improve the environment. Instead, the government has imposed an additional tax on motorists in Stockholm in order to build more roads and so increase the environmental burden,” commented Magnus Nilsson, traffic expert for the Swedish Society for Nature Conservation.

The system was re-introduced on 1 August and is now permanent. The scheme works in much the same way it did during the trial period from January to June 2006, and the effects are similar – roughly one in five cars has disappeared.

The charges apply on weekdays from 6.30am to 6.30pm, and the charge ranges from SEK 10 to 20 (1–2 euro) depending on the time of day. The maximum cost per vehicle per day is SEK 60 (just under 6 euro). In contrast to the trial period, the charges are now tax deductible for companies and individuals.

Magnus Nilsson from the Swedish Society for Nature Conservation points to a number of weaknesses in the current system, which must be rectified if it is to be effective in the long term:

“The charging zone has to be bigger. Otherwise the charge-exempt road that runs through the western side of the zone is likely to become a bottleneck; we can already see such a trend.
The region itself must have control over the revenues. Under the Swedish constitution, Parliament has to decide over the money, since technically the charge is a tax, but a more reasonable approach would be to give the county council decision-making responsibility. If decisions were made at regional level it would be easier to adjust the level of charging as required to eliminate congestion.

“There should also be more freedom to decide how surplus revenue can be used. At the moment some politicians are worried that congestion could disappear, as this would make it difficult to gain acceptance for the planned bypass.

“Exemption for ‘green cars’ has to be removed. At present, cars that can run on renewable fuels are exempt from the congestion charge until 2012. There are proposals to extend this exemption to include cars with low fossil carbon emissions. The problem is that under current tax rules, the number of ‘green cars’ is growing, so a large part of the effect on congestion is lost. But green cars clearly contribute just as much to congestion as other vehicles.”

Per Elvingson

Further information: The Swedish Road Administration, www.ve.se (select English, and then “Congestion tax Stockholm” in the left-hand column).

Sharp increase in charges for the worst offenders

Since congestion charging was introduced in 2003, traffic in central London has decreased by around 15 per cent. In February this year the area covered by charging was doubled. In 2006 the latest report from Transport for London (TfL) stated that congestion was down around 26 per cent in comparison with the pre-charge period and traffic delays had also been reduced.

The criticism that was initially levelled at congestion charging soon abated, as air quality improved and the number of traffic snarl-ups fell. For the first 10 years of congestion charging in London, all revenues will go towards improving the traffic situation, such as extending public transport.

At the start of August, Ken Livingstone, Mayor of the city, announced a proposal that would make it considerably more expensive to drive vehicles with high carbon dioxide emissions into the heart of the city, as part of measures to reduce the climate impact of the city.

The current daily charge is £8 (12 euro), which is what most people would also pay under the new proposal. Owners of cars producing more than 225g CO₂/km will however be charged £25 (37 euro) to drive into the city centre, as will drivers of vehicles registered before March 2001 with engines bigger than 3000 cc.

Vehicles that emit less than 120g/km and meet Euro 4 emissions criteria will on the other hand be congestion charge exempt. The Mayor is also proposing to drop the 90-per-cent residents discount for those who live inside the zone, if the car in question falls into the top 225g/km-plus tax bracket.

The proposal will undergo public consultation from 10 August to 19 October. It is intended that the new charges should be introduced in 2008.

Nationwide road pricing schemes are also being discussed in the UK to fight congestion and reduce emissions of greenhouse gases from road transport.

A report issued in December last year under the lead of Rod Eddington, a former head of British Airways, stated that road pricing could halve congestion by 2025 and bring environmental and economic benefits worth 41 billion euro a year. Eddington said there was “no attractive alternative” to road pricing. He also recommended investment in rail, buses and cycle paths.

Flattening trend in pollutant emissions

Air pollutant emissions from land-based sources in Europe are continuing to fall slightly, but considerably slower than in the 1990s. Some of the reductions on land are also countered by rising emissions from international shipping.

Since the early 1980s, total European emissions of sulphur dioxide (SO₂) – the most significant acidifying pollutant – from land-based emissions sources have fallen by three-quarters, from around 53 million tonnes in 1980 to 12.5 million tonnes in 2005.

Emissions of nitrogen oxides (NOₓ), volatile organic compounds (VOCs) and ammonia in Europe have also fallen since the early 1990s, although not by as much as emissions of SO₂. While the first two dropped by about 30–40 per cent since 1990, emissions of ammonia fell by less than a quarter.

Since the late 1990s, emissions of fine particles (PM₉.₅) have been gaining increasing attention. However, these emissions are not as well documented as those of other air pollutants, and many countries lack emission data for the 1990s. Between 2000 and 2005 it is estimated that emissions of PM₂.₅ have fallen slightly, from 3.3 to 3.2 million tonnes.

Although SO₂ emissions continue to fall, the downward trend for the other three pollutants appears to have more or less flattened out over the last few years. In the case of NOₓ, small reductions in most countries were negated by an increase in Russian emissions of 600,000 tonnes over the same period.

Emissions from international shipping in European waters show a steady increase. Since 1990, ship emissions of SO₂ have gone up from 1.8 to 2.7 million tonnes, and those of NOₓ from 2.6 to 3.8 million tonnes – in both cases an increase of more than 40 per cent.

The data in the table on the opposite page is taken from figures reported by the countries themselves to the Convention on Long-range Transboundary Air Pollution, and was compiled by EMEP.

The Convention’s EMEP programme is not confined to keeping track of emissions. Its main task is to model the ways in which emissions from one country affect the environment in others. The EMEP report also provides an overview of calculations for source-receptor relationships, covering acidifying, eutrophying, photo-oxidant, and particle pollution.

The source-receptor relationships calculated by EMEP show the transboundary movements of air pollutants across Europe. They also quantify the “export” and “import” between countries of these pollutants.

It is true for most European countries that the biggest share of depositions of sulphur and oxides of nitrogen emanates from outside their own territory. Another similarity is that an increasing share of depositions originates from international shipping.

For 2005 it was estimated that ship emissions were responsible for ten per cent or more of the total deposition of both sulphur and oxidised nitrogen compounds in at least twelve European countries (see Table 2). In a few countries, such as Denmark, Sweden, the Netherlands, Ireland, and the United Kingdom, ship emissions already make up approximately one fifth or more of total pollutant depositions.

Table 2. Examples of European countries where the proportion of air pollutant depositions of sulphur and oxidized nitrogen coming from ships is most marked. Source: EMEP, 2007.

<table>
<thead>
<tr>
<th>Country</th>
<th>Sulphur</th>
<th>NOx-nitrogen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>46%</td>
<td>27%</td>
</tr>
<tr>
<td>Sweden</td>
<td>23%</td>
<td>22%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>21%</td>
<td>22%</td>
</tr>
<tr>
<td>UK</td>
<td>19%</td>
<td>21%</td>
</tr>
<tr>
<td>Ireland</td>
<td>18%</td>
<td>20%</td>
</tr>
<tr>
<td>France</td>
<td>12%</td>
<td>19%</td>
</tr>
<tr>
<td>Finland</td>
<td>12%</td>
<td>19%</td>
</tr>
<tr>
<td>Belgium</td>
<td>12%</td>
<td>18%</td>
</tr>
<tr>
<td>Italy</td>
<td>11%</td>
<td>17%</td>
</tr>
<tr>
<td>Germany</td>
<td>10%</td>
<td>16%</td>
</tr>
<tr>
<td>Spain</td>
<td>9%</td>
<td>13%</td>
</tr>
<tr>
<td>Norway</td>
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<td>10%</td>
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<tr>
<td>Portugal</td>
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<tr>
<td>Italy</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Germany</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>France</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Switzerland</td>
<td>1%</td>
<td>1%</td>
</tr>
</tbody>
</table>
### Table 1. European emissions of sulphur dioxide, nitrogen oxides (as NO₂), VOCs, and ammonia (thousand tonnes).

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Austria</td>
<td>346</td>
<td>246</td>
<td>432</td>
<td>52</td>
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<tr>
<td>Belgium</td>
<td>828</td>
<td>442</td>
<td>399</td>
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</tr>
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<td>2 050</td>
<td>416</td>
<td>309</td>
<td>144</td>
</tr>
<tr>
<td>Cyprus</td>
<td>28</td>
<td>13</td>
<td>14</td>
<td>8</td>
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<tr>
<td>Czech Republic</td>
<td>2 257</td>
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<td>Denmark</td>
<td>451</td>
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<td>Estonia</td>
<td>287</td>
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<td>Finland</td>
<td>584</td>
<td>295</td>
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<td>1 989</td>
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Comparison between the vehicle emission requirements of different countries has been difficult until now because they each use different test cycles to determine fuel consumption and emissions. Thanks to the International Council on Clean Transportation (ICCT), comparisons are now available for a string of countries, based on the emission standard that is used in the EU, which is measured in grams of carbon dioxide equivalent per kilometre, and on the fuel-economy based standard that is used in USA, which is measured in terms of CAFE-adjusted miles per gallon.

In each case it is assumed that the sale of new cars on average exactly meets adopted or anticipated future standards for the given year.

The chart compares national standards in terms of grams of CO₂-equivalent per kilometre adjusted to the EU test cycle.

Europe and Japan lead the world in reducing greenhouse gas emissions from their vehicle fleets. For most years up to 2015, Japan’s fuel efficiency targets translate as the most stringent passenger vehicle emission standards in the world, with Europe in close second place. At the end of their regulatory periods, Japan’s new passenger fleet CO₂ emissions are estimated to be equivalent to 125 g/km in 2015. Europe is projected to achieve 130 g/km three years earlier, in 2012.

California is notable for its sharp improvement in GHG emission standards, particularly in the early years of the programme, from 2009 to 2012.

China, Canada, and Australia have adopted substantively equivalent regulations, with the carbon intensities of new vehicles sold in each country in the 2009–2010 time frame projected to be 168, 178, and 176 grams of CO₂-equivalent per kilometre, respectively.

When comparison is based on the US calculation method the results are somewhat different, since the unit of measurement is miles per gallon. Petrol and diesel contain different amounts of carbon per unit of volume, and the proportion of diesel vehicles therefore affects the rankings. From the climate viewpoint the EU calculation method (g CO₂/km) is therefore most relevant.

Per Elvingson


Around the world

In 2006, Japan increased the stringency of its fuel economy standards. As a result, Japan’s standards are expected to lead to the lowest fleet average emissions for new passenger vehicles in the world: 125 g CO₂/km in 2015.

The new standards in California are expected to achieve the greatest absolute emission reductions from any policy in the world. The standards cover all GHG emissions related to vehicle operation and use, not only tailpipe emissions. The target for 2016 means emissions that are equivalent to the average in the EU15 in the mid-1990s. The California standards have been adopted by eleven other states in the US.

Passenger vehicle standards in the United States continue to lag behind. According to a bill that was approved by the Senate in June, the average consumption for each manufacturer should be reduced to 6.7 litres/100 km by 2020, which corresponds to a reduction of 40 per cent from the current CAFE standards. However, the bill must first be considered by the House of Representatives and then put before the president.

The standards in China set up maximum fuel consumption limits by weight category. Phase 1 took effect in 2005 for new models and a year later for continued models. Phase 2 is due to take effect in 2008/09. China has recently revised its taxation to strengthen incentives to buy vehicles with smaller engines.
EU Commission drafts new bill for cars and CO₂

The EU Commission is currently drafting a new bill, under heavy lobbying from the automotive industry, which will use binding standards to forcibly reduce carbon dioxide emissions from new cars. The level proposed by the Commission in a communication issued in February is 130 g CO₂ per km by the year 2012 (see AN 1/07, p.3). A public consultation was held in spring. The bill is expected to be ready next year.

Environment ministers meeting in June confirmed their support for the Commission’s 130 g/km limit by 2012. When Parliament’s environment committee considered the matter in September they called for a limit of 120 g/km by the same year. Parliament as a whole will debate the issue in October.

One important question right now, aside from the specific limit and deadline, is whether the standard will apply across the board, or if cars in different size classes will be allowed different emission limits. The European Automobile Manufacturers’ Association (ACEA) is in favour of a weight-based standard that allow heavier vehicles higher emissions.

However, the European Federation for Transport and Environment (T&E) believes that making cars lighter is one of the most important and most straightforward ways of cutting CO₂ emissions. But linking CO₂ standards to weight removes the main incentive to make a car lighter, because doing so would result in that model receiving a tougher CO₂ standard.

T&E says there should be a single standard for CO₂ emissions that applies to the average of the fleet of all cars sold in a given year. If a range of standards for different classes is used as a temporary measure, T&E says the vehicle’s “footprint”, the area between the four wheels, should be used to define them, instead of weight. Parliament’s environment committee also supported this line during a vote in September.

T&E has also published a report1 showing that boosting the existing trend towards heavier cars by introducing weight-based CO₂ targets would lead to more road fatalities than if a single CO₂ standard for all cars was used.

Reducing carbon footprint in the fuel chain

Reducing carbon dioxide emissions during the fuel life cycle is more important than increasing the use of biofuels.

This view forms the basis for the proposed amendment to the fuel quality directive presented by the EU Commission in January, which recommends giving fuel suppliers responsibility for reducing the carbon footprint of their road fuels by 10 per cent by 2020. Specifically, they must cut the life-cycle greenhouse gas emissions of their fuels by one per cent per year from 2011 onwards. The market will then decide for itself if the fossil fuel chain or biofuels offer more cost-effective emission reductions.

The Commission’s proposal has won favour, not least from the environmental movement, which has long been critical of biofuel initiatives that take no account of the real benefit they deliver – sustainable biofuels can be part of the solution, but unsustainable biofuels are even worse for the environment than not producing them. The use of “well-to-wheel” calculations and sustainability criteria ensure that the most appropriate fuels are given priority.

The revised proposal is now being considered by the Council of Ministers and by Parliament.

In September, Portugal, which currently holds presidency of the EU, presented a proposal for political agreement by the Council of Ministers, hopefully by December. The wording generally backs the Commission’s proposal, although the ten-per-cent target remains in square brackets, reflecting reluctance by some governments to agree to a reduction target before finalizing emission calculation methods and biofuel sustainability criteria.

Portugal’s draft text also states that only biofuels conforming to sustainability criteria should count towards the reduction target. It does not, however, suggest any criteria or guidelines for them.

The European Parliament’s environment committee will consider the proposed directive at a first reading in November, and Parliament as a whole will consider it in January 2008.

The EU also has individual targets for the proportion of biofuels used by the transport sector. In March, EU leaders agreed to a legally binding ten-per-cent biofuel target by 2020. The binding nature of the target is subject to sustainable, second-generation biofuels being available. It is not yet clear how this volume target will work with the target to “decarbonize” fuels, but if decarbonization is to be achieved solely through an increased share of biofuels, it will require a higher proportion than 10 per cent by 2020.


1 Danger ahead: why weight-based CO₂ standards will make cars dirtier and less safe. Can be downloaded from the T&E website: www.transportenvironment.org/Downloads-req-getit-lid-468.html. See also T&E position paper on cars and CO₂ www.transportenvironment.org/Article454.html

ACID NEWS NO. 3, SEPTEMBER 2007
Nearly 200 policymakers, scientists, experts and stakeholders from 35 countries participated at the Gothenburg workshop, the aim of which was to elaborate scientific and policy needs in order to solve air pollution problems in both the short and long term. In particular the workshop considered:

- Links between air pollution and greenhouse gas policies.
- Interactions between climate change and air pollution effects.
- Intercontinental transport of air pollution.
- Emissions from international shipping.
- The nitrogen problem.
- Further development of international air pollution control regimes, with the main focus on the Convention on Long-Range Transboundary Air Pollution.

After a few initial plenary presentations, the participants were split into eight parallel working groups, and each working group was given the task of coming up with conclusions and recommendations on ways forward. The following are some selected excerpts from these conclusions and recommendations on the theme: “Air pollution and greenhouse gas policies”.

At present there is a small but growing number of initiatives in the world aimed at combining air pollution and climate change. The benefits of combined emission abatement policies are obvious in terms of achieving improvements at less cost. It is important to look at policies beyond 2020, since decisions taken today will influence emissions of air pollution and greenhouse gases for several decades.

Recommendations:

- Focus on early identification of synergies and trade-offs between air quality and climate change policies and measures.
- Use combined air pollution/climate change policies at local, national and EU levels. Combined strategies should be considered with some caution at regional and global levels.
- Promote the development of integrated assessment tools for combined strategies.
- Investigate possibilities to use innovative solutions (e.g. urban planning and agricultural practices), in particular in the developing countries.
- Promote further investigations and exchange of experience from the use of economic instruments in combined strategies.
- Consider other aspects, such as energy security, competitiveness, public health, etc., in relation to the environmental drivers.

A summary report was prepared covering the main conclusions and recommendations from the workshop. This report, as well as the reports from each of the working groups and other material from the workshop, can be found at http://asta.ivl.se.

Christer Ågren

1 The conference Air pollution and its relationship to climate change and sustainable development – Linking immediate needs with long-term challenges “Saltsjöbaden 3”, was held in Gothenburg, Sweden, on 12–14 March 2007. It was the third in a series – the previous ones were held in 2000 and 2004, and it was organized by the Swedish research programme ASTA in collaboration with the Convention on Long-Range Transboundary Air Pollution (CLRTAP), the European Commission and the EU ACCENT Network of Excellence.

Check the ozone level where you live

The European Environment Agency (EEA) provides a map that makes it possible to check current concentrations of ground-level ozone throughout Europe:

www.eea.europa.eu/maps/ozone/map

How green is your car?

The British Ministry of Transport has ranked all new cars by carbon dioxide emissions on a new website. Cars can be selected by size class, fuel type and gearbox type. By choosing a car with the most fuel-efficient engine in its class, buyers can reduce fuel costs and carbon dioxide emissions by a quarter. The best vehicle in all categories is the Volkswagen Polo Blue Motion (109g/km).

www.dft.gov.uk/ActOnCO2/
Criticism of one-sided biofuel initiatives

Stop subsidizing biofuels and concentrate on eliminating fossil carbon use instead. This is the main message of an OECD report that was published in September.

The OECD considers that biofuels have limited potential to reduce fossil carbon emissions, and that the benefits that arise are achieved at a very high cost. The study estimates that the US alone spends $7bn (5bn euro) a year helping to make ethanol, with each tonne of carbon dioxide avoided costing more than $500. In the EU, the cost can be almost ten times that.

It also says biofuels could lead to damage to the environment. “As long as environmental values are not adequately priced in the market, there will be powerful incentives to replace natural ecosystems such as forests, wetlands and pasture with dedicated bio-energy crops.”

The report recommends that governments phase out biofuel subsidies, using “technology-neutral” carbon taxes instead to allow the market to find the most efficient ways of reducing greenhouse gases. “Such policies will more effectively stimulate regulatory and market incentives for efficient technologies,” it said.

A book published by the Worldwatch Institute in August also points to the risks associated with a massive increase in the production and use of biofuels, including increased deforestation and biodiversity loss.

A report issued in summer by the German Advisory Council on the Environment (SRU) also warned that biomass is “not an inexhaustible resource”, and says that if broad environmental and nature protection goals are taken into account, the role of biomass will only cover a small percentage of primary energy needs.

In its paper the SRU says using biomass for transport fuels risks wasting a valuable resource on the wrong priorities. “Biomass can be used up to three times more efficiently in heating and combined heat and power than in producing the currently used biodiesel and bioethanol.”


Recent publications

Transboundary Air Pollution, Scientific Understanding and Environmental Policy in Europe
Ed. H. Pleijel. Describes current scientific understanding of European transboundary air pollution. The way science has become a driving force for policy action is dealt with in some detail. The book closes by looking at expected future trends, including the accumulating evidence of intercontinental transport of air pollutants and the globalization of air pollution management related to its strong links with climate change.


Ammonia emissions in agriculture
Gives an overview of current knowledge about ammonia emissions and how this knowledge can be implemented in current agricultural systems.


Reactive Nitrogen in the Environment – Too Much or Too Little of a Good Thing
Examines the impacts of reactive nitrogen on the environment, human health and economies from local to global scale.


Developments in deriving critical limits and modeling critical loads of nitrogen for terrestrial ecosystems in Europe
By W. de Vries et al. Presents an overview of adverse effects of nitrogen deposition in terrestrial ecosystems, a review of currently used critical limits of nitrogen concentrations in soil solution, and the current state of knowledge in the modelling of critical loads.

206 pp. Alterra-report 1382. Available at www.alterra.wur.nl

Critical loads of acidity for alpine lakes

Impacts of air pollution on alpine lakes and rivers
By S. Steingruber and L. Colombo. 74 pp. Published by the Federal Office for Environment, Switzerland. Report UW-0619-E. Available at www.bafu.admin.ch/?lang=en

Urban Planning for Reduced Car Use
Slow progress in negotiations

The Vienna Climate Change Talks failed to produce agreement on important conclusions – contrary to media reports.

At the end of August representatives of most nations gathered in Vienna to discuss climate change in two parallel sessions within the climate convention:

The dialogue group, which includes all nations, held general discussions on topics that included a new UN report on the financial aspects of climate change.

The ad hoc working group, which is only open to those countries that have ratified the Kyoto Protocol, began preparing for the negotiations that are to be held in Bali in December, when the nations are expected to stake out a timetable for the successful conclusion of the negotiations within the climate convention:

The ad hoc group manages to agree on a formulation that refers to the IPCC’s fourth assessment report and implies that emissions from industrialized countries need to be reduced by 25–40 per cent by 2020, compared with 1990 levels.

Most media sources reported this as meaning that the nations have now agreed on a reduction of 25 to 40 per cent as a target for future negotiations, although there is nothing in the records of the meeting to support this conclusion. Several nations were also reluctant to mention any figures for emission reductions, including Canada, Japan, Switzerland, New Zealand and Russia.

On 24 September, the UN is scheduled to host a high-level ministerial meeting on climate change. US President Bush has separately called a meeting of major emitters in Washington on 27–28 September.

Per Elvingson


Two degrees is too much!

The Alliance of Small Island States (AOSIS) said in a submission to the dialogue group that under international law, states have the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states.

As a consequence they believe that all nations have a duty to ensure that climate change is slowed down, and that the frequently mentioned target to limit temperature rise to 2°C is set too high to protect the most vulnerable countries:

“Even a 2°C increase compared to pre-industrial levels would have devastating consequences due to resulting sea level rise, coral bleaching, coastal erosion, changing precipitation patterns and the impacts of increasingly frequent and severe weather events.”

“A temperature rise of just 1°C above 1980–99 levels implies significant coral bleaching, increased losses from flooding, and substantial species extinction,” write the AOSIS members in reference to the latest IPCC report, and therefore argue that such scenarios must be developed and highlighted.

The AOSIS group clearly identify where responsibility lies for reducing emissions: “Consistent with the polluter pays principle and the principle of common but differentiated responsibilities and respective capabilities, the largest historical emitters must now take aggressive action under the Convention to facilitate the reduction of...