

New Danish energy agreement

A massive expansion of wind power, reforms to promote biomass and an expansion of mandatory energy savings.

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Welcome to the golden age of fracking

Fracking, exploitation of gas from shale, is growing fast. This is game-changing both for energy policy and climate policy.

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Biggest environmental cause of mortality

A new OECD report says that by 2050 air pollution will become the biggest cause of premature death, killing an estimated 3.6 million people a year.

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The arrival of a new EU sulphur law

The sulphur content of ship fuels will be cut to 0.1% from 2015 in the Baltic Sea and the North Sea, and to 0.5% from 2020 in other EU waters.

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Ozone levels still much too high

In the summer of 2011, the threshold for protecting human health from ozone was exceeded on more than 25 days in a significant part of Europe.

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Pollution from traffic kills 5000 a year in UK

Premature deaths due to PM_{2.5} are estimated to cost the UK between €7.5-77 billion every year, corresponding to 0.4-3.5 per cent of the country's gross domestic product.

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New Gothenburg Protocol adopted

Between 2005 and 2020 the EU member states must jointly cut their emissions of sulphur dioxide by 59%, nitrogen oxides by 42%, ammonia by 6%, volatile organic compounds by 28% and particles by 22%.

After five years of negotiations, a revised Gothenburg Protocol was successfully finalised on 4 May 2012 at a meeting of the parties to the Convention on Long-range Transboundary Air Pollution (CLRTAP) in Geneva.

The Gothenburg Protocol dates back to 1999 and establishes mandatory emission reductions for four major air pollutants, to be achieved by 2010 and not exceeded thereafter (see Box on page 3).

Acid News

A newsletter from the Air Pollution & Climate Secretariat, 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 fulfil 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:

Air Pollution & Climate Secretariat
Box 7005, 402 31 Göteborg, Sweden
Tel: +46 31 711 45 15
Fax: +46 31 711 46 20
E-mail: info@airclim.org
Internet: www.airclim.org

Editor: Kajsa Lindqvist
Assistant editors: Reinhold Pape and Christer Ågren

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The Air Pollution and Climate Secretariat

The Secretariat has a board consisting of one representative from each of the following organisations: Friends of the Earth Sweden, Nature and Youth Sweden, the Swedish Society for Nature Conservation, and the World Wide Fund for Nature (WWF) Sweden.

The essential aim of the Secretariat is to promote awareness of the problems associated with air pollution and climate change, and thus, in part as a result of public pressure, to bring about the needed reductions in the emissions of air pollutants and greenhouse gases. The aim is to have those emissions eventually brought down to levels that man and 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 organisations, 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 organisations 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.

Editorial

In early May, after five years of negotiation, countries in Europe and North America agreed to take on new emission reduction commitments for the major air pollutants, by adopting a revised Gothenburg Protocol to the Convention on Long-range Transboundary Air Pollution.

The original protocol from 1999 is cleverly constructed with nationally differentiated undertakings that are designed to achieve commonly agreed interim environmental targets at least cost for Europe as a whole. It includes national caps for air pollutants (sulphur dioxide, nitrogen oxides, ammonia, and volatile organic compounds), to be achieved by 2010 and not to be exceeded thereafter.

By establishing that international agreements could be made to rest on an effects-based scientific foundation in accordance with the critical-loads approach, the Gothenburg Protocol certainly marked a significant step forward. However, the emission reductions that the signatories undertook to make by 2010 were clearly inadequate to achieve the long-term objective of not exceeding critical loads and levels.

A process of review and revision in which emission ceilings were to be progressively lowered was therefore foreseen, and the first stage of this process ended in May this year with the adoption of a new updated agreement, setting new targets to be achieved by 2020.

It is good that the revised protocol has been extended to include emission reduction commitments for particulate matter (PM_{2.5}). But it is also a great disappointment that the overall level of ambition is still far from sufficient to adequately protect health and the environment.

Air pollution by fine particles is estimated to cause nearly half a million premature deaths every year in the 27 EU member states, corresponding to almost 4.5 million years of life lost. Ground-level ozone is responsible for another 20,000 or so premature deaths each year.

**‘many
of these
problems
will still
remain in
2020’**

Deposition of airborne nitrogen compounds in the EU exceeds the critical loads for eutrophication (over-fertilisation) of vulnerable ecosystems over a total area of more than one million square kilometres, and the critical loads for acidification are also exceeded over vast areas of vulnerable forest and freshwater ecosystems.

The revised protocol is likely to contribute to some improvements, but unless further action is taken many of these problems will still remain in 2020.

Most EU member states are currently struggling to meet mandatory air quality standards for PM and nitrogen dioxide, and as it looks now, the Commission will most likely have to bring several countries to the Court of Justice for failing to comply with the legislation.

A proposal for a revised EU national emissions ceiling (NEC) directive is foreseen for next year, thus providing a new opportunity to spur further necessary emission abatement action across the EU, thereby also facilitating compliance with the air quality standards.

There are also close and important links between air pollution policies and climate policies, and these links can mainly be seen in the energy and transport sectors. Reducing fossil fuel use by improvements in energy efficiency and increased use of less- or non-polluting renewable sources of energy will result in significantly lower emissions of sulphur dioxide, nitrogen oxides and PM, as well as cutting emissions of the main greenhouse gas, carbon dioxide.

Clearly the ambition levels in Europe for both climate policy and air pollution policy must be significantly raised.

It is not acceptable that even after 2020, air pollution will still cause several hundreds of thousands of premature deaths among European citizens each year, and that millions of hectares of sensitive ecosystems will still be exposed to pollutant depositions in excess of their critical loads.

Christer Ågren

New Gothenburg Protocol adopted

Continued from front page

While the original protocol sets national emission ceilings for 2010 for each pollutant, the revised protocol specifies emission reduction commitments in terms of percentage reductions from base 2005 to 2020. It has also been extended to cover one additional air pollutant, namely particulate matter (PM_{2.5}), and thereby also black carbon as a component of PM_{2.5}.

Negotiations were guided by a similar scientific assessment and scenario analysis as was the case for the 1999 protocol. As reported in AN 1/11, the scenario analysis demonstrated that by aiming for a level of ambition in line with the so-called High* scenario, implementation of the new protocol could by 2020 bring annual health benefits valued at up to €110-290 billion in Europe, of which €50-150 billion in the EU, and the economic value of these health benefits were calculated to be up to 55 times higher than the estimated costs involved.

But these figures obviously did not impress national governments when they settled their countries' bids for what level of ambition to go for. At the end of the day most EU member states, as well as the non-EU countries that provided figures, went for national commitments at a much lower level of ambition.

In fact, most EU member states decided only to accept emission reduction obligations for 2020 that are even less ambitious than – or at best largely in line

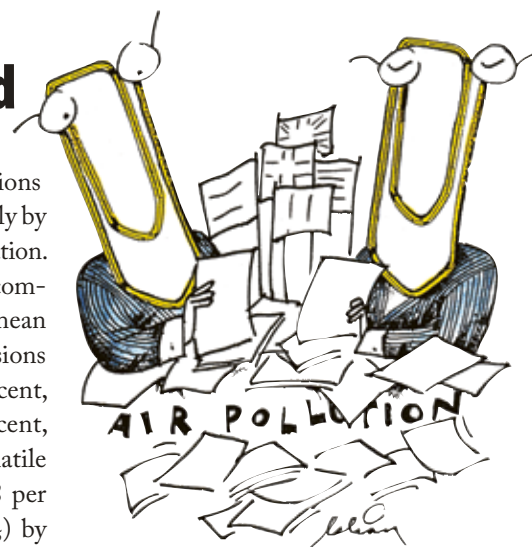
with – business-as-usual, i.e. reductions expected to be achieved anyway solely by implementing already existing legislation.

Overall, the EU member states' commitments to the revised protocol mean that they shall jointly cut their emissions of sulphur dioxide (SO₂) by 59 per cent, nitrogen oxides (NO_x) by 42 per cent, ammonia (NH₃) by 6 per cent, volatile organic compounds (VOCs) by 28 per cent and particulate matter (PM_{2.5}) by 22 per cent, from 2005 to 2020.

For comparison, the underlying scenario analysis showed that full implementation of existing legislation is expected to result in emission reductions in the EU of 66 per cent for SO₂, 50 per cent for NO_x, 4 per cent for NH₃, 36 per cent for VOCs, and 34 per cent for PM_{2.5} over the same time period.

In addition to adding commitments for one new pollutant, several of the protocol's technical annexes were revised with updated sets of emission limit values for a number of key source sectors of air pollution, and two new annexes were added, one on PM from stationary sources and one on the VOC content of products.

A novelty introduced is that – under certain special circumstances – parties may be allowed to make adjustments to their emission reduction commitments or to their base year emission figure. This so-called adjustment procedure is strictly limited to be applied in specified extraordinary cases, for example if new



emission source categories are identified that were previously not accounted for or if there are significant changes to emission factors.

So far, the new agreement involves the EU and its member states, Norway, Switzerland and the United States of America. The negotiations have however also involved other countries that are party to the Convention, such as Canada, the Russian Federation, Ukraine and Belarus, in view of their possible ratification in the coming years. As well as improving the environment, ratification by these non-parties to the Gothenburg protocol would create a more level playing field for industry across Europe and North America.

Percentage national emission reduction commitments and data on emission levels for the base year 2005 for the 27 EU member states as well as for Belarus, Croatia, Norway and Switzerland are already included in Annex II of the revised protocol. Other countries that intend to become parties to the revised protocol – notably Canada, the United States, the Russian Federation and countries in Southern and Eastern Europe, the Caucasus and Central Asia – will need to provide their respective 2005 data and percentage reduction commitments upon ratification of or accession to the amended protocol.

One of the Convention's priorities over the last few years has been to provide assistance to countries in Southern and Eastern Europe, the Caucasus and Central Asia (i.e. mainly countries that

The CLRTAP and the Gothenburg Protocol

The Convention on Long-Range Transboundary Air Pollution (CLRTAP) dates back to 1979 and covers 51 parties in Europe and North America. Cooperation under the convention includes development of policies and strategies to cut emissions of air pollutants through protocols with emission control obligations, exchanges of information, consultation, research and monitoring.

The original Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone was signed in 1999 and entered into force in 2005. It has been ratified by 24 European countries, as well as by the EU and the United States.

Based on a thorough scientific assessment of health and environmental benefits of pollu-

tion control, the costs and emission reduction potential of different abatement options, and an analysis of various least-cost solutions to achieve agreed interim environmental targets, varying national requirements in terms of emission reductions were established.

These are given as binding national emission ceilings for 2010 for four pollutants (SO₂, NO_x, VOCs and NH₃). Countries whose emissions have a more severe environmental or health impact and/or whose emissions are relatively cheap to reduce should make the biggest emission cuts.

The protocol also contains emission limit values for a number of specific emission source categories such as large combustion plants, industry and road vehicles, and requires the use of best available techniques.

Improvements from the revision

Emission cuts under the new Gothenburg Protocol are expected to reduce health damage in Europe from PM_{2.5} and ozone by 27 and 11 per cent, respectively, between 2000 and 2020.

Commitments under the revised Gothenburg Protocol will lead to significant reductions in the negative impacts of air pollution in Europe, according to a new analysis by IIASA. By 2020, mortality from exposure to PM_{2.5} and ground-level ozone will fall by 27 and 11 per cent respectively. Forest and freshwater ecosystem areas exposed to acid deposition above the critical loads will shrink by more than 55 per cent. Less improvement is however expected for eutrophication, where the ecosystem areas with nitrogen depositions

in excess of the critical loads will decline only by about 20 per cent.

Using the GAINS (Greenhouse gas – Air pollution Information and Simulation) computer model, the environmental improvements calculated to result from the emission reduction commitments of the revised Gothenburg Protocol have been compared to those previously estimated for the current legislation (CLE) baseline scenario and the maximum technically feasible reductions (MTFR) scenario.

As the revised protocol contains pro-

visions for possible adjustments of base year emission inventories and/or emission reduction commitments, there is some uncertainty about the expected levels of emissions in 2020.

For Europe as a whole, IIASA has estimated that the emission reduction commitments between 2005 and 2020 under the revised protocol imply a decrease in emissions of SO₂, NO_x, VOCs and PM_{2.5} of 41, 31, 33 and 22 per cent, respectively, while emissions of NH₃ are expected to remain at the 2005 level (Figure 1).

These numbers are clearly less ambitious than the ranges presented in 2011 to negotiators in the cost-effectiveness analysis (see AN 3/11, p. 12-14). In fact, the agreed commitments are even less ambitious than those estimated to result in 2020 solely from implementing already existing emission control legislation.

It is pointed out that several factors may contribute to explain these differences, including differing views about the underlying projections for energy use and economic development, different assumptions about the effectiveness of emission control legislation, and uncertainties in emission inventories. Moreover, countries may also have introduced a “margin of safety” to safeguard against unexpected developments.

To facilitate comparisons with the original Gothenburg Protocol and the targets established in the EU's Thematic Strategy on Air Pollution (TSAP) from 2005, changes in impact indicators were calculated using year 2000 as the reference year (in contrast to the emission reduction commitments in the revised protocol, which use 2005 as the base year).

It is estimated that the new agreed emission cuts will lead to significant reductions in the negative impacts of air pollution in Europe. By 2020, mortality from exposure to PM_{2.5} and ground-level ozone will fall by 27 and 11 per cent respectively. Forest and freshwater ecosystem areas where acid deposition will remain above the critical loads will shrink by more than 55 per cent.

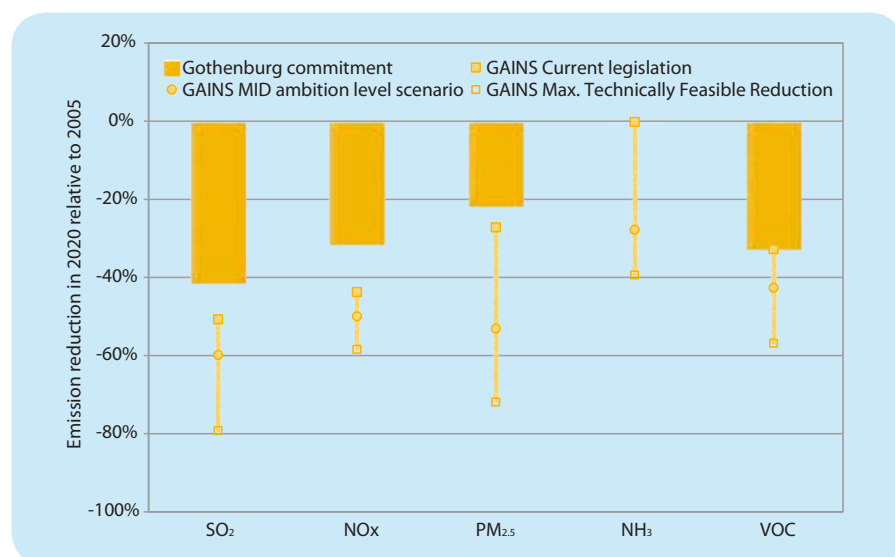


Figure 1: Changes in European emissions in 2020 relative to 2005. The commitments of the revised Gothenburg Protocol are indicated by the bars, while the lines indicate the ranges between the 'current legislation' and the 'maximum technically feasible reduction' cases estimated by the GAINS model.

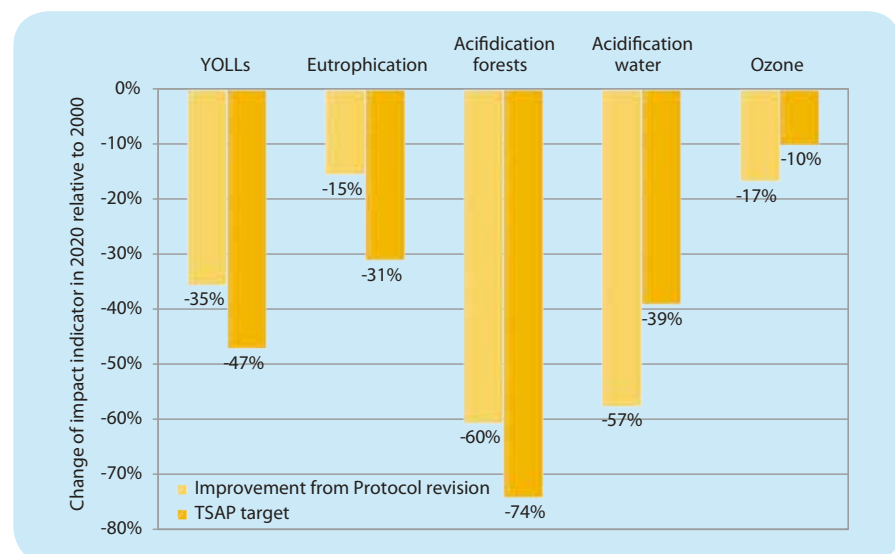


Figure 2: Changes in impact indicators from the emission reduction commitments of the revised Gothenburg protocol compared to the TSAP targets of the EU.

Less improvement is however expected for eutrophication, where the ecosystem areas with nitrogen depositions in excess of the critical loads will decline by about 20 per cent (Figure 2).

There are, however, significant regional differences across Europe. In most cases improvements will be bigger in the EU than in the non-EU countries, primarily because several non-EU parties did not provide emission reduction commitments. In particular, health damage from ozone is expected to further increase in the non-EU countries compared to 2000.

While the cost-effectiveness analysis presented to negotiators demonstrated a potential for cost-effective abatement measures beyond the current legislation, for which the benefits exceeded costs by a factor of ten or more, the current protocol commitments do not even achieve the improvements estimated for the current legislation case.

The protocol commitments also fail to achieve several of the targets set in the TSAP. The revised protocol is expected to reduce the years of life lost (YOLLs) from exposure to PM_{2.5} by 35 per cent in the EU, which means that additional measures will be necessary to meet the 47 per cent target of the TSAP. For eutrophication, the revised protocol is expected to deliver about half of the TSAP target (15 per cent improvement instead of 31 per cent) and for forest acidification 60 per cent improvement instead of 74 per cent. For water acidification and health damage from ground-level ozone, the TSAP targets are however likely to be achieved.

Christer Ågren

Environmental improvements of the revision of the Gothenburg Protocol. CIAM report 1/2012, preliminary version May 2012. By M Amann, et al. IIASA.

Note: For those (non-EU) parties that did not provide figures on reduction commitments to the Executive Body in May, the calculations by IIASA assume that emission levels in 2020 will remain the same as in 2005. For international shipping, emission levels in 2020 in line with implementation of the 2008 MARPOL Annex VI agreement of the International Maritime Organization were assumed. The calculations presented in the IIASA report are based on the emission reduction commitments relative to the emission levels for 2005 that have been estimated in GAINS based on the EMEP 2011 inventory.

New Gothenburg Protocol adopted

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were previously part of the then Soviet Union) in ratifying and implementing various protocols under the Convention.

In order to facilitate for these so-called SEECCA-countries to ratify and implement the revised protocol, a number of specific flexibility provisions have been introduced into the revised protocol. To take advantage of these flexibilities, a country that becomes a new party to the protocol may declare upon its ratification that it will extend any or all of the specified timescales for application of different obligations, especially those on applying emission limit values.

Depending on the emission source or pollutant, these time extensions may last for up to 15 years after the date of entry into force of the protocol for the party in question. For new stationary sources, however, the time limit is one year after entry into force for all parties.

Danish Minister for the Environment Ida Auken, who chairs the EU's Environment Council during the Danish presidency period, welcomed the agreement: "This is indeed an important step to reduce air pollution in Europe. We have managed to agree to further reduce emissions within the EU and in North America, and we have paved the way for further reduction of emissions from our eastern neighbouring countries. New multilateral environmental agreements are now quite

rare, so we have good reason to be satisfied with the outcome of the negotiations."

Environmental groups, however, expressed disappointment with the low level of ambition by the EU and its member states, and characterised the new protocol as a missed opportunity. They said that EU member states need to wake up before 2013, which has been announced by the EU as the "Year of Air", during which the Commission has promised to propose revisions to the EU's national emission ceilings directive.

"We ask EU leaders to substantially raise their ambition level next year. A strengthened air pollution policy will bring enormous benefits to society, and is required in order to fulfil the health and environmental objectives of the EU's 6th Environmental Action Programme," said Louise Duprez from the European Environmental Bureau.

Despite the resulting low level of ambition of the national emission reduction obligations, once these have been implemented in 2020 the revised protocol is expected to result in significant reductions in human health impacts from air pollutants as well as wider benefits to the environment as a whole.

Christer Ågren

For more information, see: <http://www.unece.org/env/lrtap/>

Ireland looks at extending 'smoky' coal ban

The Irish environment ministry is seeking to improve air quality and public health by extending restrictions on the use of bituminous coal to all urban areas. A ban on the marketing, sale and distribution of bituminous coal now covers 20 Irish towns and cities, where coarse particulate concentrations have halved as a result.

Residential emissions are the country's second largest source of particulate matter (PM) and have shown little improvement for years. The new plan should – if adopted – aid compliance with the 2008

EU air quality directive, which requires a reduction in PM_{2.5} exposure by 2020. New emission limits for PM_{2.5} may also be introduced under the forthcoming revision of the 2001 National Emission Ceilings (NEC) directive.

Source: ENDS Europe DAILY, 16 April 2012



KK/FOTOLIA



BLUE SQUARE THING / NIKOLAJ F. RASMUSSEN / CREATIVE COMMONS

New Danish energy agreement

A massive expansion of wind power, reforms to promote biomass and an expansion of mandatory energy savings are the main features of the Danish energy agreement. The measures combined are estimated to reduce carbon dioxide emissions by 34 per cent by 2020.

The energy agreement that was adopted by the Danish left-centre government and four opposition parties on 22 March 2012, is described by the climate-energy and construction minister Martin Lidegaard as the “greenest and the longest-lasting energy settlement ever in Denmark” and is expected to halve the use of coal and fossil gas to 2020. Consumption of oil is however projected to remain roughly on the same level, since transport is only marginally addressed in the deal (Figure 3).

One of the more prominent features of the deal is the extensive investment in wind power, which today covers 28 per cent of Danish electricity consumption. The ambition is to increase this share to

50 per cent by 2020 (Figure 2). The plan includes the development of two large offshore wind farms, Kriegers Flak and Horns Rev, with a joint capacity of 1 GW, an additional 500 MW from offshore wind in other locations and new planning tools that are expected to increase the onshore wind production capacity by another 500 MW. The total planned capacity increase is equivalent to the electricity consumption of 1.5 million households.

The deal also involves large-scale changes to the Danish electricity grid. To manage the increased share of wind power, a strategy for smart grids will be presented later this year. The development of Kriegers Flak

will also mean an increased integration with the German grid, since the wind farm will have power lines to both countries.

Increasing the share of biomass in the energy mix is another cornerstone of the deal. This will be carried out mainly through legislation against new oil-fired boilers and financial assistance to municipalities, power companies and households that want to convert from fossil to bio-energy. Reforms in order to facilitate enhanced biogas production are also going to be undertaken. In total it is estimated that 34 per cent of the energy supply will come from renewables by 2020 compared to the current 22 per cent.

Ella Maria Bisschop-Larsen, president

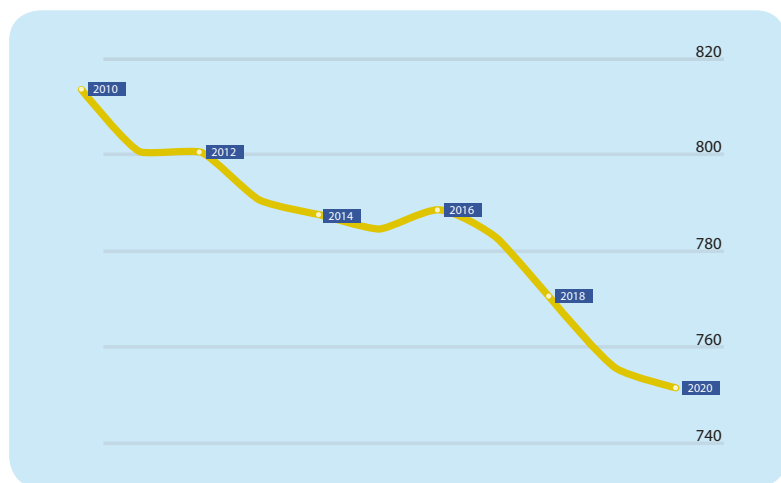


Figure 1: Development in gross energy consumption (PJ) 2010-2020

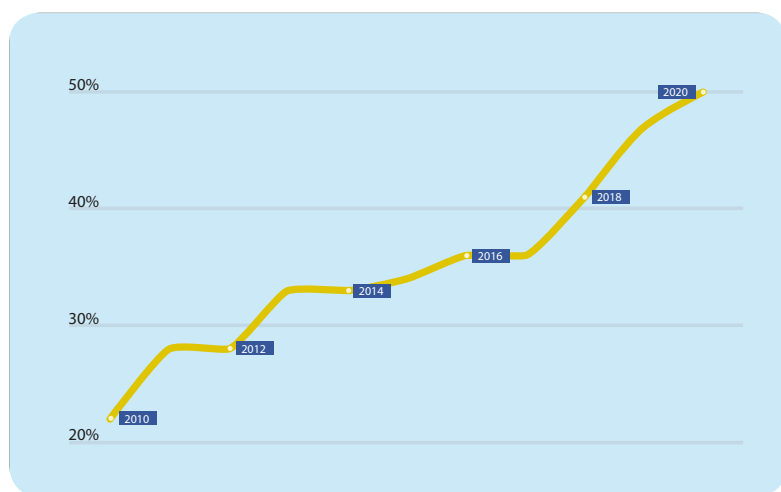


Figure 2: Share of wind power in electricity consumption 2010-2020

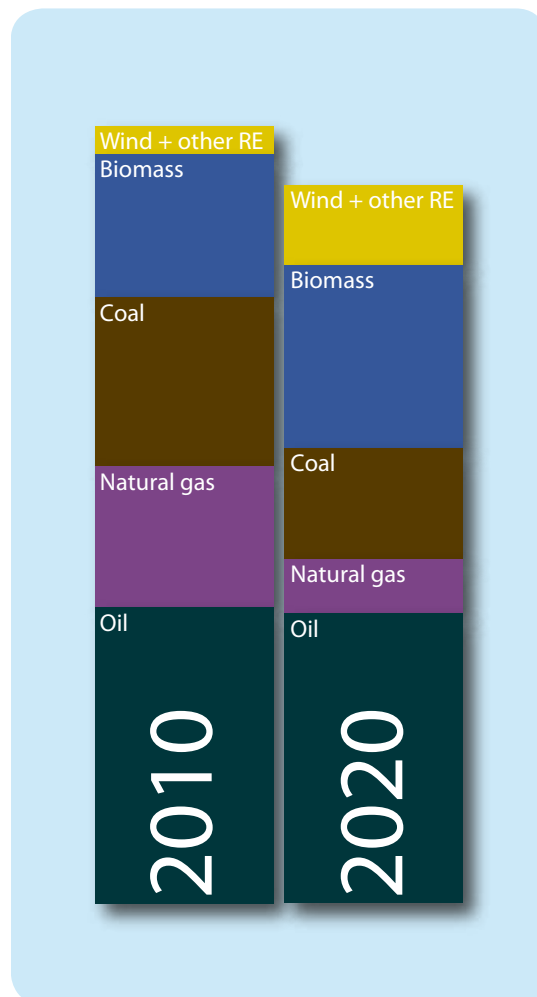


Figure 3: Consumption of fossil fuels and renewable energy in 2010 and 2020

of the Danish Society for Nature Conservation who otherwise is strongly in favour of the deal believes that there is reason for caution as regards bioenergy: “We look forward to contributing to an in-depth analysis of biomass resources in Denmark, since our land and not least our natural areas are limited and therefore there is competition for them. We must therefore strive to promote development that will provide energy without negative consequences for nature and the environment.”

The Danish Society for Nature Conservation also believes there should be more committed efforts to promote solar electricity. Under the plan, solar energy is treated as an experimental technology with grants for research and development, but there is no targeted assistance to businesses and individuals for solar panel installations.

Investments in renewable energy will also be followed by measures for energy savings of seven per cent by 2020 compared with 2010 (Figure 1). This will be done by increasing the existing savings requirements for energy companies by 100 per cent and by developing a coherent strategy for energy renovation of all Danish buildings.

The agreement also includes funding for all proposals:

- Increased efforts for energy savings by the energy companies are funded by the companies’ tariffs.
- The expansion of renewable electricity and the gas network is partly financed by so-called PSO (public service obligation) schemes, and thus the energy bill.
- A “security of supply tax” on space heating will cover state subsidies for biogas, industrial cogeneration and renewable

energy industries and the state tax loss resulting from a lower consumption of fossil fuels.

- Part of the “security of supply” tax is offset by an easing of energy taxes on electricity and fuel for the industry in order to maintain the Danish business sector’s competitiveness.
- Additionally, a number of efficiency improvements in the Danish energy sector, will together reduce the cost of measures by €240 million in 2020.

Kajsa Lindqvist

A short version of the agreement can be found on the website of the Danish Energy Agency: http://www.ens.dk/en-us/info/news/news_archives/2012/sider/20120328newdanishenergyagreement.aspx

Welcome to the golden age of fracking

Fracking, exploitation of gas from shale, is growing fast. This is game-changing both for energy policy and climate policy. There is now more, and dirtier fossil gas around. The resistance is also growing, and fracking is banned in some countries.

Fracking, short for “hydraulic fracturing”, is a way to get at deep natural gas pockets in shales. You drill a couple of kilometre-deep holes, force down a mixture of water, sand and chemicals under high pressure. The pressurised water opens up cracks. The chemicals are there to make the water more slippery so it can force itself through small cracks. The sand keeps the cracks open. Horizontal drilling is used to increase the surface attacked.

The problem, compared to conventional natural gas drilling, is that more of the gas leaks out. This includes its main constituent methane, a powerful greenhouse gas, and other volatile hydrocarbons. The chemicals and hydrocarbons cannot be collected entirely, so they may end up in the groundwater and drinking water.

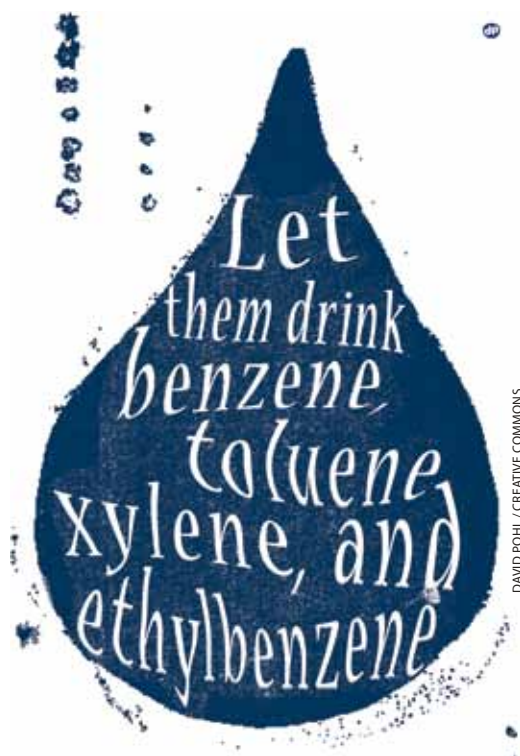
Fracking is not really new technology, but it became profitable in the US with the rising energy prices last decade, and has expanded very fast.

In 2011 a third of US natural gas production came from fracking, and the Energy Information Administration (EIA) expects this share to increase to 46 per cent by 2035 within the context of increasing gas use.

The EIA estimates the shale gas reserve in the US and another 32 countries (say half the world)¹ at roughly the same 6000 trillion cubic feet as the proven reserves of conventional natural gas.

Fracking has essentially doubled the gas reserve, adding more than 10 per cent to the carbon content of the total fossil reserves.

Until recently some NGOs in both the US and Europe have tended to accept or even embrace natural gas as the lesser evil compared to coal (and an ally against the



Not everyone appreciate the taste of shale gas.

coal industry), as well as being the simplest and cheapest way to balance intermittent renewables such as wind power and photovoltaic solar power.

Notably, the Sierra Club in the US accepted large donations (\$26 million) from Cheasapeake Energy, a big natural gas producer, as was reported by Time magazine in February 2012. Much of the money went to fund the very successful campaign against coal. When Carl Pope was succeeded as executive in 2010 by Michael Brune, the Sierra Club stopped this funding, and actually declined an offer of an additional \$30 million, because fracking has changed what natural gas is.

Much damage has been done, not least because the management of the Sierra Club did not tell its members where it had got its money. But Carl Pope was not alone:

“National groups such as the Sierra Club, the Environmental Defense Fund and the Natural Resources Defense Council have backed natural gas as a so-called bridge fuel that can help the country move away from coal and oil without waiting for renewable sources of energy, such as wind and solar power, to catch up,” wrote The Wall Street Journal on 22 December 2009.

The International Energy Agency

The IEA is the energy arm of the rich countries OECD, and was formed in 1974 in response to the first oil crisis. Its message has always been: less oil, more gas, more coal, more nuclear and to some extent also renewables and efficiency.

The IEA is best known for its annual World Energy Outlooks, in which it tries to look some 20 years ahead. The IEA has made a series of extremely inaccurate forecasts in areas such as oil prices (far too low), nuclear capacity (far too high) and renewables (too low).

Not only have they been proved wrong in the long run; they have often been wrong by large factors for just a few years ahead.

Nevertheless, the reports of the agency are treated with reverence by the media and politicians.

The usefulness of the IEA can be questioned, but they do produce a lot of data, and source this well (though the sources are not always peer-reviewed articles). Also, their reports usually give a good picture of how “conventional wisdom” looks at a certain time.

Their case was conditional on four assumptions:

1. Gas replaces coal for electricity (not renewables or efficiency improvements).
2. Greenhouse gas emissions from natural gas power are half those of coal power, or less.
3. Other environmental consequences aside from carbon dioxide emissions are not as bad as coal.
4. The reserves of natural gas are much lower than for coal, so if we use most of the gas but leave most of the coal in the ground we have a chance to save the world.

The first point has always been contested; for example why should it be supposed that 2050 is a better time than 2012 to build wind power, and that the present rate of wind power installation is as high as it can get. Also most gas (in the US) is used for heat, not for power.

Points 2 and 3 used to be true. The carbon emissions from a new gas power station are about 340 gram/kWh. Emissions from coal and lignite power are around 700–1200 grams/kWh, or even more. In a life cycle perspective, the difference is even more marked, because coal mining generally emits more methane than conventional natural gas production. Gas emits no particles, no sulphur and much less NO_x than coal.

Fracking may have changed all that.

According to the US EPA, conventional natural gas emits 0.38 grams of methane per MJ whereas shale gas emits 0.6 gram/MJ.

A pioneering study by Howarth et al ^{2,3}, claims that over a 20-year period shale gas is far worse than coal, and over a 100-year period about as bad as coal. The difference is explained by the fact that methane, leaking from the shale, is a much stronger greenhouse gas than carbon dioxide, but it does not stay so long in the atmosphere.

By convention, the warming potentials of greenhouse gases are indexed against carbon dioxide in a 100-year perspective. The IPCC has compiled the accepted values for 100 years, for 20 years, and for 500 years.

Also, recent research⁴ has shown that methane is an even more powerful greenhouse gas than thought. The 100-year value, which was 21 when the Kyoto protocol was written in 1997 and which was increased to 25 by the IPCC, is now about 33, due to interactions with the stratosphere and aerosols.

So there is more natural gas, it emits more methane and the methane causes more global warming than was supposed.

But Peak Oil? Security of Supply?

This is the point the Obama administration makes. Fracking in the US makes the US less dependent on fuel imports.

But wait a minute. The really difficult part of energy dependence is the supply of gasoline, diesel and jet fuel. They are made from petroleum, not from natural gas. Fracking solves the wrong problem.

Oil dependence cannot be helped by more natural gas.

That is, unless it is used for gas-to-liquid (GTL) methods of producing gasoline etc.

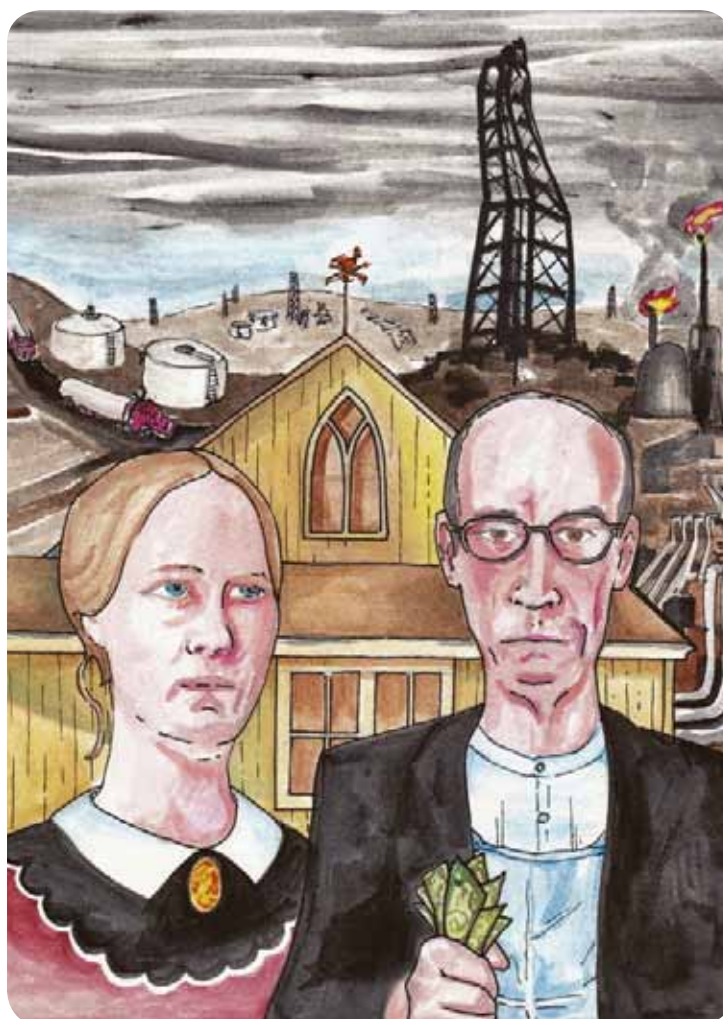
If so, it is at a still higher price for the climate. Even with conventional gas GTL diesel there is no greenhouse gas reduction⁵ compared to diesel from oil. Shale diesel or gasoline are worse.

The consequence of shale gas and other unconventional fossil fuels such as Canadian tar sand is that the connection between Peak Oil and climate is now broken.

Peak Oil can be averted in two ways: with more fossil fuels or with less fossil fuels.

Either through fuel efficiency, electric cars, biogas and other biofuels, less transport and modal shifts from road to rail. Or by using shale gas, tar sand, and coal as feedstock for liquids.

GTL looks very promising for investors, according to the Financial Times⁶. Gas is cheaper than for many years, thanks to fracking, but oil is still expensive. Shell invested \$19bn into the Pearl GTL in Qatar.



Shale gas - a game changer.

The frackers are moving fast, but so is resistance.

France has had a moratorium on fracking since 2011. Bulgaria banned it 2012. So did the state of Vermont in the US, Quebec in Canada (April 2012) and at least parts of Switzerland. Romania and the Czech Republic are preparing similar moves. In Sweden, exploration has stopped. The UK government recently⁷ adopted a negative stance.

The NGOs, at least in Europe, are hostile to fracking, and are getting more organised.

In April 2012 a large number of European NGOs, including FOE, Greenpeace, and EEB lobbied the European Parliament calling for a ban on fracking. This was motivated by an EP report by Polish MEP Boguslaw Sonik

Welcome to the golden age of fracking

Continued from page nine

for the environment committee⁸. The report makes no mention of “climate”, “warming” or even “methane”.

The International Energy Agency threw its weight behind shale gas with a report entitled “Golden Rules for a Golden Age of Gas”, issued late May.

This is how the IEA sets the scene in its summary: “Natural gas is poised to enter a golden age, but will do so only if a significant proportion of the world’s vast resources of unconventional gas ... can be developed profitably”..

The Golden Age means a more secure supply of energy for (rich) importer countries, greater energy diversity, and lower energy prices generally. This Golden Age is built on fracking.

There is however one big “but”:

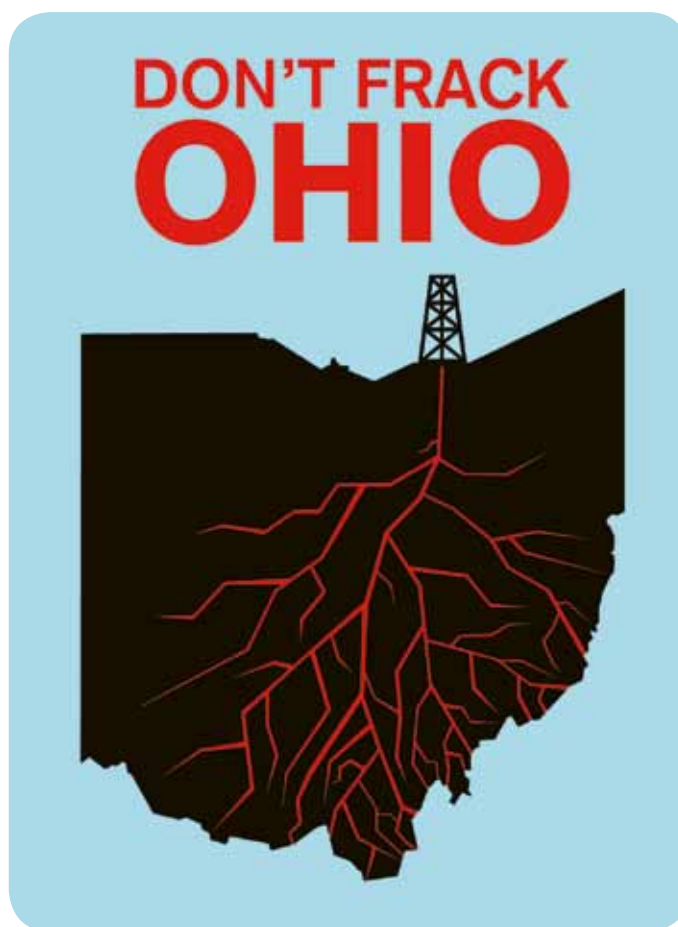
“The outlook for unconventional gas production around the world depends critically on how the environmental issues ... are addressed.”

In other words: if we can’t defeat the environmental NGOs and persuade the politicians and the environmental agencies to allow fracking, the Golden Age will not come.

The report admits that we don’t know the extent of the greenhouse gas emissions that will result from fracking. In fact they provide nothing more than a diagram on methane emissions with an unsourced “typical value” highlighted. And: “If current emissions are poorly known and the numbers above mere estimates, projecting future methane emissions is fraught with even more uncertainties.”

It is also mentioned that the Europeans have a precautionary principle in their legislation.

But instead of guessing what emissions will be or waiting for better data, the IEA recommends seven Golden Rules.



Frackers are moving fast - so is local resistance.

The rules are:

- Measure, disclose and engage.
- Watch where you drill (“minimise impacts on the local community, heritage, existing land use, individual livelihoods and ecology”).
- Isolate wells and prevent leaks.
- Be ready to think big (many small holes can make a big leak, unless coordinated).
- Treat water responsibly.
- Eliminate venting, minimise flaring and other emissions.
- Ensure a consistently high level of environmental performance.

If implementation of these safeguards is seen as a sure thing, there is one other issue, the IEA admits. Fracking gas will not only replace coal, it will also mean less renewables. Wind and solar will lose 5 per cent globally and 10 per cent in the US up to 2035, compared to the baseline. The cheaper gas can also “postpone the

moment at which renewable sources of energy become competitive without subsidies and, all else being equal, therefore make renewables more costly in terms of the required levels of support”.

On the other hand, says the IEA, gas can balance wind and solar. And lower electricity prices increase customer acceptance of more electricity, which can be supplied by wind and solar. (Do you follow?)

More electricity. The golden age will also come at the expense of efficiency, according to IEA models.

The United States and Canada are the pioneers of fracking, and have a big stake in its future. The IEA also sees a big future for fracking in China and India, otherwise projected as big importers, and Australia. They are less sanguine about Europe.

This could be construed as an effort at a strategic alliance, aimed at Middle East dominance, but with collateral damage for renewables and efficiency.

Fredrik Lundberg

For more analysis and comments from NGOs see Guardian <http://www.guardian.co.uk/environment/blog/2012/may/29/shale-gas-fracking-green-carbon>

¹ <http://www.eia.gov/analysis/studies/worldshalegas/>

² Howarth et al: **Methane and the greenhouse-gas footprint of natural gas from shale formations** Climatic Change (2011) 106:679–690 www.springerlink.com/content/e384226wr4160653/fulltext.pdf?MUD=MP

³ <http://216.250.243.12/HowarthIngraffeaarticleFINAL1.pdf>

⁴ <http://www.giss.nasa.gov/research/news/20091029/>

⁵ report for Shell and Conoco and Sasol at www.sydneypeakoil.com/davek/GTL_LCA_Synthesis_Report.pdf

⁶ <http://www.ft.com/intl/cms/s/0/6a365a54-71c5-11e1-8497-00144feab49a.html#axzz1vWpAQMNz>

⁷ <http://www.independent.co.uk/environment/green-living/government-backtracks-on-fracking-7768853.html?origin=internalSearch>

Biggest environmental cause of mortality

A new OECD report says that by 2050 air pollution will become the biggest cause of premature death, killing an estimated 3.6 million people a year.

Up-to-date projections of socio-economic trends up to 2050, and their implications for four key areas of concern: climate change, biodiversity, water and the health impacts of environmental pollution, are presented in a recent study by the OECD. It is foreseen that despite the recent economic recession, the global economy will nearly quadruple to 2050 and rising living standards are expected to be accompanied by ever growing demands for energy, food and natural resources – as well as more pollution.

Specifically as regards air pollution it is expected that in the absence of new policies air pollution is set to become the world's top environmental cause of premature mortality by 2050, overtaking dirty water and lack of sanitation. Air pollution concentrations in some cities, particularly in Asia, already far exceed the recommended air quality guidelines set by the World Health Organization (WHO), and air quality is projected to deteriorate further to 2050.

The number of premature deaths caused by exposure to particulate matter (PM) is projected to more than double worldwide, from the current figure of just over one million to nearly 3.6 million per year in 2050, with most deaths occurring in China and India.

Over the same time period, premature deaths from exposure to elevated concentrations of ground-level ozone are projected to more than double worldwide, from 385,000 to nearly 800,000. Most of these deaths are expected to occur in Asia, where ozone concentrations as well as the size of the exposed population are likely to be highest. More than 40 per cent of the world's ozone-induced premature deaths in 2050 are expected to occur in China and India. However, once adjusted for the size of the population, OECD countries – with their ageing and



MEENA KADRI / CREATIVE COMMONS

An Indian Jain monk wears a face mask to protect flies from a premature death and unintentionally also himself from the same due to air pollution.

urbanised populations – are likely to have one of the highest rates of premature death from ground-level ozone, second only to India.

Moreover, substantial increases in sulphur dioxide (SO₂) and nitrogen oxides (NO_x) emissions are likely to occur in the key emerging economies in the coming decades. Compared to the year 2000, emission levels of SO₂ and NO_x are projected to increase by 90 and 50 per cent, respectively, by 2050.

Currently only about two per cent of the global urban population are living in areas with PM₁₀ concentrations not exceeding the WHO's Air Quality Guideline of 20 µg/m³ as an annual mean for PM₁₀. Approximately 70 per cent of the urban population in the BRIICS and "rest of the world" countries are exposed to PM₁₀ concentrations above the WHO's highest interim target, which is set at 70 µg/m³.

In 2050, the baseline scenario projects that the percentage of people living in cities with concentrations above this highest WHO interim target will be even higher in all regions. This is despite the air quality improvements projected to 2050 in OECD countries and the BRIICS countries, as these improvements are expected to be eclipsed by population growth in urban areas.

To avoid the problematic future painted by the Environmental Outlook to 2050, the report recommends a cocktail of policy solutions, including using environmental taxes and emissions trading schemes to make pollution more costly than greener alternatives; valuing and pricing natural assets and ecosystem services like clean air, water and biodiversity for their true worth; removing environmentally harmful subsidies to fossil fuels or wasteful irrigation schemes; and encouraging green innovation by making polluting production and consumption modes more expensive while providing public support for basic research and development.

It is concluded that the costs of inaction could be colossal, both in economic and human terms. Without new policies world energy demand in 2050 will be 80 per cent higher and still 85-per-cent reliant on fossil-fuel-based energy. This in turn could lead to a 50 per cent increase in greenhouse gas (GHG) emissions globally.

Christer Ågren

Note: BRIICS is an abbreviation covering a number of today's new high-growth emerging economies, namely: Brazil, Russia, India, Indonesia, China and South Africa.

Environmental Outlook to 2050: The Consequences of Inaction. For more information see: www.oecd.org/environment/outlookto2050

The arrival of a new EU sulphur law

The sulphur content of ship fuels will be cut to 0.1% from 2015 in the Baltic Sea and the North Sea, and to 0.5% from 2020 in other EU waters. As a result, emissions of sulphur dioxide from shipping in Europe will come down by more than 80 per cent.

After several weeks of triologue negotiations EU member states, the European Parliament and the European Commission on 23 May arrived at a first reading compromise agreement on new air pollution limits for ships.

The main intention of the proposed revision of the EU's sulphur in fuels directive was to implement into EU law the global sulphur standards agreed by the International Maritime Organisation (IMO) back in 2008, thereby ensuring

their proper enforcement at EU level.

While the parliament's environment committee wanted to go further and adopt stricter and more wide-reaching standards than those originally proposed by the Commission (see AN 1/11 p. 6-7), several member states opposed the idea to implement any stricter sulphur limits than those adopted by the IMO in 2008.

The final agreement confirms the IMO sulphur limit of 0.1% for 2015 which applies to the designated Sulphur Emissions Control Areas (SECAs), i.e. the Baltic Sea,

the North Sea and the English Channel. It also confirms that the IMO global sulphur limit of 0.5% will apply in all other EU waters as from 2020. By establishing this date, the EU has now sent a clear signal that it wants cleaner fuels earlier rather than later.

Currently the global average sulphur content of ship fuel is around 2.7%, so the new 0.5% limit is expected to cut ship sulphur emissions by more than 80 per cent.

The Danish Presidency, who led the negotiations, concluded in its press release that ships are among the largest emitters of air pollution in Europe, that ship emissions lead to 50,000 premature deaths in Europe each year and cause acid rain which destroys ecosystems.

Danish Minister of Environment Ida Auken said: "This is a victory for environment and health in Europe. We have succeeded in getting an agreement, which secures substantially cleaner air for all Europeans. It's a crucial step, because all EU member states will now be required to enforce the strict regulation, which



addresses pollution that so far has been largely unregulated.”

The key elements of the agreement are:

- In line with Annex VI of the IMO's MARPOL Convention, the sulphur limit for marine fuels used in SECAs (the Baltic Sea, the North Sea and the English Channel) is set at 1.0% until 31 December 2014, to be lowered to 0.1% as from 1 January 2015.
- Outside SECAs the current global IMO limit is 3.5%. According to the IMO, this limit shall come down to 0.5% by 2020 (or possibly 2025 subject to a review in 2018). The new EU law will however make this 0.5% limit mandatory in non-SECA EU waters by 2020.
- The current EU regime for passenger ships in non-SECA waters of 1.5% sulphur will continue to apply until 31 December 2019, after which the 0.5% limit will apply.
- Marine fuels with a sulphur content of more than 3.5% will only be allowed in EU waters in vessels that are equipped with exhaust gas cleaning systems (scrubbers) operating in closed mode.
- Member states shall endeavour to ensure the availability of the required marine fuels.
- Member states may provide support to operators, such as aid for investment costs, in accordance with the applicable state aid rules. Moreover, the Commission should make full use of financial instruments that are already in place and promote the development and testing of alternative technologies to reduce emissions from ships.
- Member states shall take all necessary measures to check by sampling that the sulphur content of fuels complies with the obligations.
- As part of the penalties to be set by member states in implementing the directive, possible fines should at least be equivalent to the profits resulting from the infringements.
- The Commission shall make a report by December 2013 and consider the potential for further reducing air pollution by ships. In the review of the Commission's air quality policy scheduled for 2013, the Commission will consider the possibilities of further reducing air pollution from shipping, including the impacts of applying the 0.1% sulphur

limit to ships in the territorial seas of member states.

Commenting on the legislative agreement, the European Parliament's rapporteur Satu Hassi (Green Party), said: "These new rules are a boost for public health and the environment. Thankfully, the EU stuck to its guns in the face of heavy lobbying from polluting shipping companies, which wanted Europe to renege on its international commitments and adopt less ambitious legislation."

Hassi continued: "The European Commission has also been tasked with reviewing its air quality legislation, with a view to extending the current stricter requirements on ships in port to all ships in territorial waters. This would be a cost-effective way of reducing pollution from shipping and extending the health benefits in EU coastal areas outside SECAs."

While welcoming the agreement, environmental groups warned that lax enforcement may undermine the effectiveness of the new rules. Antoine Kedzierski of Transport & Environment said: "We are concerned that current enforcement of fuel quality standards for ships is very poor with as little as one check per day even in major ports. We urge the Commission and member states to ensure that these rules are strictly enforced in EU waters."

The first reading agreement will now have to be adopted at a plenary session of the European Parliament, after which the directive will be officially adopted by the Council. Member states will have 18 months after the entry into force of the directive to adopt the necessary national provisions.

Christer Ågren

Council press release: http://www.consilium.europa.eu/uedocs/cms_Data/docs/pressdata/en/envir/130351.pdf

Danish Presidency press release: <http://eu2012.dk/en/NewsList/Maj/Uge-21/Emissions-of-sulphur>

EEB and T&E joint press release: <http://www.transportenvironment.org/press/eu-backs-clean-shipping-air-pollution>

Satu Hassi press release: <http://www.greens-efa.eu/sulphur-rules-for-shipsair-pollution-7217.html>

NOx controls for the Baltic on the horizon

Baltic Sea nations have finalised their application to the International Maritime Organization (IMO) for a nitrogen oxides emission control area (NECA), but will not make a decision on when to submit it until June at the earliest. The application was agreed at a meeting of the Helcom commission in early March, but it cannot be submitted until Lithuania and Latvia have finished internal consultations on the proposal.

Designation of the Baltic as a NECA is expected to cut NOx emissions from ships by 60 per cent, but as the stricter emission standards will apply only to newlybuilt ships after 2016 the gradual phase-out of existing more polluting vessels means that the full effects will not be seen until 2045. Lower NOx levels would improve air quality and cut eutrophication in the Baltic.

Sources: ENDS Europe Daily, 8 March 2012, Helcom press release: http://www.helcom.fi/press_office/news_helcom/2012/en_GB/HELCOM33_outcomes

Largest ship sulphur scrubber

Dutch company Spliethoff has contracted Alfa Laval to retrofit an exhaust gas cleaning system on board one of its vessels. It is said to be the first retrofit to use just one scrubber to clean the exhaust gases for the main as well as the auxiliary engines. The vessel's engines have a combined rated output of 28 MW, which according to Alfa Laval will make the order the largest marine scrubbing system ever sold. Alfa Laval's PureSOx system is said to have a sulphur removal rate of more than 98 per cent. It is a hybrid system that can operate on either sea water or fresh water, giving the ability to operate as a closed loop system if required.

Source: Sustainable Shipping News, 13 February 2012

Europe's most polluting power plants

Eight of the twelve largest single sources of carbon dioxide in Europe are found in Germany.

The European Pollutant Release and Transfer Register (E-PRTR) has been updated with information on releases and transfers from industrial installations in 2010.

For carbon dioxide the list is more or less identical to the one for 2009, with only some minor changes in rank order and emission levels. Germany continues to dominate the emission league with eight lignite-fuelled plants on the top twelve list. But the individual plant that emits the most carbon dioxide in the whole of Europe is still Belchatów in Poland.

The greatest changes are seen for sulphur emissions, where total emissions from the ten most polluting plants in 2010 were 30 per cent less than the twelve most polluting plants in 2009. Almost all of the top polluters are to be found in the southeastern part of Europe. Maritsa 2 in Bulgaria is still the biggest sulphur polluter, but its 2010 emissions are now only a third of the level in 2007.

Power plants with high emissions of nitrogen oxides (NOx) are more scattered across the continent, although with Poland and the UK each having three facilities on the list. In comparison with the twelve most polluting plants in 2009,



Agios Dimitrios Power Plant in Greece is one out of two plants that is present on all three lists.

NOx emissions have dropped by almost 20 per cent in 2010.













These reductions in sulphur and NOx are primarily a result of the large combustion plants (LCP) directive from 2001, forcing more and more power plants to install emission abatement technology.








The E-PRTR is a service managed by the European Commission and the European Environment Agency (EEA). The online register contains information on emissions of pollutants released into the

air, water and land by industrial facilities throughout Europe (32 countries: EU27, Iceland, Liechtenstein, Norway, Switzerland and Serbia) and includes annual data for 91 substances released from nearly 30,000 facilities. The first data set is from 2007 and it has now been updated for the fourth time.

Kajsa Lindqvist

The European Pollutant Release and Transfer Register is found at <http://prtr.ec.europa.eu/>

CO ₂		
Plant		Thousand tonnes
1 (1)	Belchatów 	30,000
2 (2)	Niederaußem 	28,100
3 (3)	Jänschwalde 	23,500
4 (4)	Drax 	20,800
5 (5)	Eschweiler 	19,900
6 (6)	Neurath 	16,900
7 (8)	Boxberg 	15,100
8 (7)	Frimmersdorf 	14,400
9 (10)	Agios Dimitrios 	14,300
10 (11)	Lippendorf 	12,500
11 (14)	Schwarze Pumpe 	11,100
12 (13)	Kozienice 	11,100

NOx		
Plant		Tonnes
1 (1)	Belchatów 	41,900
2 (2)	Drax 	40,600
3 (6)	Kozienice 	21,700
4 (4)	Agios Dimitrios 	20,800
5 (9)	Jänschwalde 	18,700
6 (6)	Cottam 	18,700
7 (7)	Aberthaw 	18,400
8 (14)	Niederaußem 	17,900
9 (12)	Prunérov 	16,800
10 (17)	Rybnik 	16,400
11 (5)	Obrenovac A 	15,700
12 (20)	Varna 	15,600

SO ₂		
Plant		Tonnes
1 (1)	Martisa 2 	138,000
2 (2)	Obrenovac A 	105,000
3 (6)	Obrenovac B 	85,200
4 (3)	Turceni 	81,200
5 (13)	Belchatów 	73,500
6 (4)	Kostolac B 	58,800
7 (7)	Maritsa 1 	58,700
8 (9)	Rovinari 	54,800
9 (11)	Kostolac A 	53,000
10 (18)	Narva 	52,100
11 (2)	Megalopolis 	47,900
12 (10)	Agios Dimitrios 	46,400

First ever limits on GHG emissions from power plants

The U.S. Environment Protection Agency (EPA) has issued the first ever limits on how much carbon dioxide can be emitted by fossil-fuelled power plants.

The proposed rule which was described as “a common-sense step to reduce pollution in our air, protect the planet for our children” by the EPA Administrator Lisa P. Jackson, is set to limit the emissions of carbon dioxide to 1000 pounds (454 kg) per megawatt hour for all new fossil-fuelled power plants. The limit is set higher than the CO₂ emissions from a modern natural gas plant, which on average emits 800 to 850 pounds (363 to 386 kg) but lower than the average 1768 pounds (802 kg) emitted from coal-fired plants.

It will hinder new coal power plants from being built until the day safe and profitable methods of carbon capture and

storage (CCS) or similar technologies are developed. In practical terms, however, it will only have a limited impact on the development of the energy sector as natural gas is the more profitable alternative for new fossil-fueled power construction even before the rule comes into effect. For this reason the EPA does not expect the rule to cause any increased costs for the energy companies or for the end users.

The new legislation does not however apply to existing power plants, which today account for more than one third of U.S. emissions of greenhouse gases, nor for already permitted new plants that begin construction within twelve months from

Call for the EU to enforce air quality legislation

More than 200 European citizens' organisations from across the EU request that immediate action be taken against those member states that are in breach of the EU's ambient air quality legislation.

Member states can ask for a time extension to comply with the limits for some pollutants, under certain conditions. The groups conclude that they are pleased with the decisions adopted so far by the Commission, which are said to reflect a thorough technical assessment of member states' notifications and a strict application of the conditions required for obtaining an extension. They therefore encourage the Commission to continue working in this direction, in particular with regards to notifications for a postponement to comply with the NO₂ limit value.

Derogations must be limited to exceptional situations and only to those member states that can demonstrate they have taken all possible measures to comply with the limits, including evidence that ambitious actions aimed at reducing traffic-related

emissions in cities have been adopted.

Exceedance of the air quality limit values results in more costs for society and diminishes the quality of the life and health of EU citizens. According to the groups, there is no excuse for member states to fail to comply with the air quality standards, especially as the health of their citizens is at stake, and as the limits in question were negotiated and endorsed by member states themselves more than ten years ago.

One of the most effective ways to put an end to the breaching of the standards is by enforcing the EU air quality laws, and Environment Commissioner Potocnik is therefore requested by the organisations to make sure that those member states that are in breach of the directive are sent to the European Court of Justice without delay.

Source: Letter from environmental NGOs to the European Commission, 23 April 2012 Link: <http://www.eeb.org/?LinkServID=ED1AA8F5-5056-B741-DB6F7AB909759CC8&showMeta=0&aa>



GLENDIA POWERS / FOTOLIA

Limits will still be a piece of cake for modern gas fired power plants.

the introduction of the rule. There is also room for so-called flexibility, instead of calculating emissions as annual averages, it will be possible to use the average over a thirty-year period and emit more than the limit for the first ten years if emissions can be greatly reduced later.

Despite these limitations, the new rule is praised by Michael Brune, Executive Director of the Sierra Club: “These first-ever carbon pollution standards for new power plants mean that business as usual for the nation's biggest sources of carbon pollution, dirty coal-burning utilities, is over.”

A more critical view is given by the Washington Post, but they argue that the rule's limitations cannot be blamed on the agency: “You can't fault the EPA for not pursuing a more ambitious carbon tax or a cap-and-trade system, though: It's far from clear it has the statutory authority to do so, even on a sector-by-sector basis. The fault lies with Congress, which has failed to establish anything resembling a comprehensive energy policy.”

That EPA has been able to propose this rule is the result of a decision by the Supreme Court in 2007, which determined that greenhouse gases, including carbon dioxide, are air pollutants under the Clean Air Act and can be regulated if emissions threaten public health and welfare.

Kajsa Lindqvist

The rule is open for public comment until 25 June 2012. www.epa.gov/carbonpollutionstandard

Brown seaweed can be turned in to ethanol

The common intestinal bacteria *Escherichia coli* has been genetically modified to break down brown Kombu seaweed to produce ethanol. One problem has been that most bacteria are unable to digest one of the most common sugars in algae, alginate. But after two days at a temperature of 25–30°C the microbe was able to turn 80 per cent of the sugars into ethanol.

The potential yield for this technology, according to the researchers, is double that of sugar cane ethanol and five times that of corn ethanol. They estimate that if the algae were grown along three per cent of the world's coasts it could produce 227 billion litres of ethanol using this technique.

Source: Scientific American, 19 January 2012



SHAWN HEMPE / FOTOLIA

Fuel your car with some miso soup.

Dutch subsidy for Euro VI trucks and buses

In the Netherlands, heavy-duty vehicles (trucks and buses) that meet the new Euro VI standards will be subsidised by up to 4500 euro each in 2012 and 2013. The Euro VI standards will become mandatory for all new heavy-duty vehicles from 2014.

Tests by the Dutch environment consultancy TNO have shown that the new Euro VI engines can reduce emissions of nitrogen oxides (NO_x) by more than 90 per cent in real driving conditions, as compared to Euro V and earlier Euro-standard engines.

Source: Dutch government press release, 30 May 2012.
Link: <http://www.rijksoverheid.nl/nieuws/2012/05/30/subsidie-voor-schoonste-trucks-en-bussen.html>

Ozone levels still much too high

In the summer of 2011, the threshold for protecting human health from ozone was exceeded on more than 25 days in a significant part of Europe.

Despite efforts to mitigate ozone pollution, exceedances of EU ground-level ozone standards remained during summer 2011. The long-term objective for the protection of human health was exceeded in all EU member states and for more than 25 days in a significant part of Europe, according to the annual report on summer ozone levels by the European Environment Agency (EEA).

Ozone is a strong photochemical oxidant, which in elevated concentrations causes serious health problems and damage to materials and vegetation, including agricultural crops. Production of ground-level ozone is a result of chemical reactions between several air pollutants (ozone precursors) in the air and depends on weather conditions such as solar intensity and temperature. Precursor pollutants include nitrogen oxides, carbon monoxide, methane and non-methane volatile organic compounds. The main sectors that emit ozone precursors are road transport, power and heat generation plants, household (heating), industry, and petrol storage and distribution.

Ozone concentrations in Europe are also influenced by precursor emissions in other northern hemisphere countries and by emissions from international shipping and aviation. Consequently, ozone pollution is not only a local air quality issue but

also a hemispheric and global problem. The EEA reports that ozone levels exceeding target values in Europe were less frequent in summer 2011 than in previous years. However, the long-term objective (LTO) for the protection of human health (a maximum daily eight-hour mean concentration of 120 µg/m³) was exceeded in all EU member states and it is likely many of them will not meet the target value, applicable as of 2010.

The 2008 EU directive on ambient air quality and cleaner air for Europe (2008/50/EC) sets a long-term objective, a target value, an alert threshold and an information threshold for ozone (see Table) for the purpose of avoiding, preventing or reducing the harmful effects of ground-level ozone on human health and environment.

Main findings of the report:

- The information threshold and the LTO were both exceeded in the lowest proportion of air monitoring stations since the start of Europe-wide data reporting in 1997. This reduction was mainly due to unusually low temperatures and increased rainfall during the summer months, although there have also been some reductions in the emissions of ozone-precursor pollutants.
- As in previous years, the LTO for the protection of human health was exceeded

Table: Ozone threshold values, long-term objective and target value for the protection of human health, as set out in Directives 2002/3/EC and 2008/50/EC

Objective Level	(µg/m ³)	Averaging time
Information threshold (IT)	180	One-hour
Alert threshold (AT)	240	One-hour
Long-term objective (LTO)	120	8-hour average, maximum daily
Target value (TV)	120 (*)	8-hour average, maximum daily

(*) Not to be exceeded on more than 25 days per calendar year, averaged over 3 years; 2010 will be the first year for which the data are used in calculating compliance over the following 3 years.

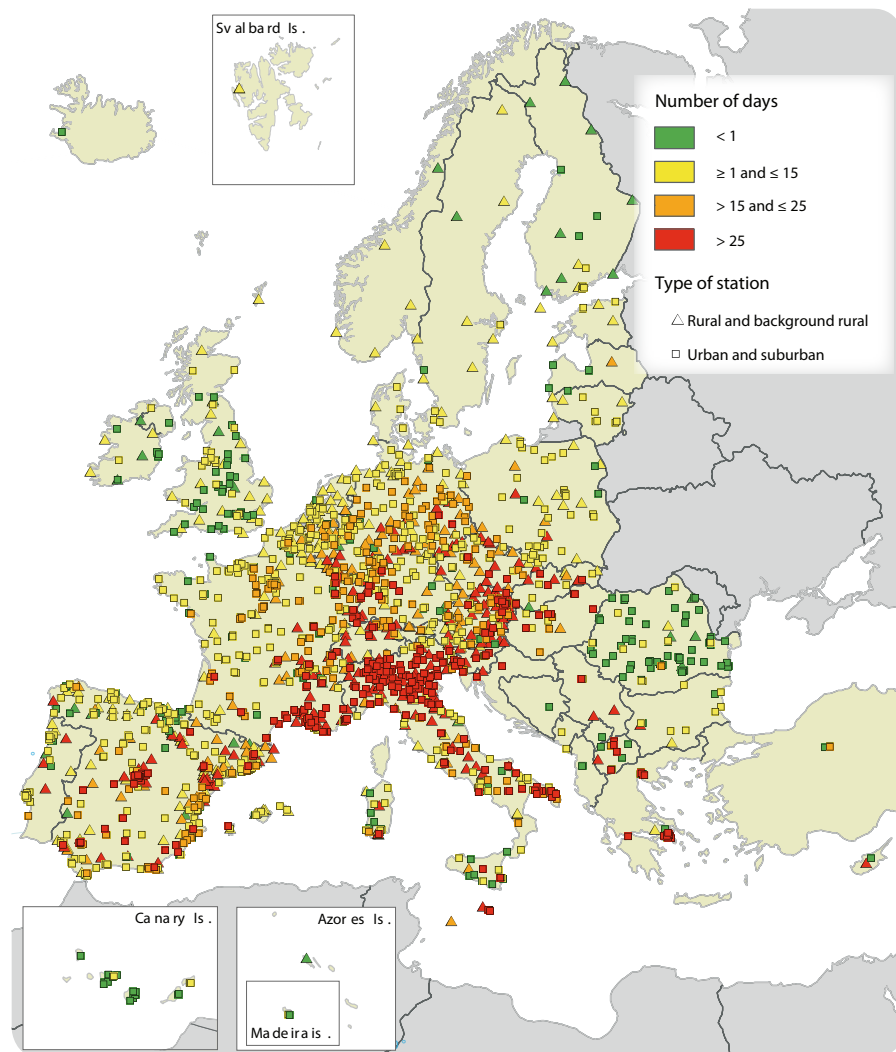


Figure: Number of days on which ozone concentrations exceeded the long-term objective for the protection of human health during summer 2011 (provisional data)

in all EU member states. Exceedances were registered at approximately 84 per cent of all stations, and the LTO limit was exceeded on more than 25 days in a significant part of Europe.

- The information threshold was exceeded at monitoring sites in 16 EU member states and four non-member countries. It was exceeded at approximately 18 per cent of all operational stations. Only northern Italy and several more isolated locations reported a substantial number of exceedances.
- The alert threshold was exceeded 41 times. Concentrations of $300 \mu\text{g}/\text{m}^3$ or more were measured three times in 2011, in Bulgaria, Italy and Spain.

The LTO threshold will be used to assess whether countries meet the directive's target value (TV) for protecting human health. A preliminary assessment by the EEA indicates that exceedances of the

target value occurred in 17 EU member states (Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, France, Germany, Greece, Hungary, Italy, Luxembourg, Malta, Poland, Portugal, Slovakia, Slovenia and Spain) and in five other countries (Croatia, Liechtenstein, the former Yugoslav Republic of Macedonia, Serbia and Switzerland). As in previous years, the most widespread concentrations occurred in the Mediterranean area.

Christer Ågren

Air pollution by ozone across Europe during summer 2011. EEA Technical report No. 1/2012. Can be downloaded at: <http://www.eea.europa.eu/publications/air-pollution-by-ozone-2011>

New LNG-powered ferries in Scandinavia

Norwegian ferry operator Color Line has announced plans to replace an ageing vessel operating between Sandefjord in Norway and Strömstad in Sweden with a new ferry that will be fuelled by liquefied natural gas (LNG). The plan is for the new ship to enter into service in the summer of 2014. The 160-metre vessel would be able to carry 2,000 passengers and about 500 cars.

Last year construction started on Viking Line's new LNG-fuelled ferry which will sail in the Baltic Sea between Turku in Finland and Stockholm in Sweden. The vessel is being planned for 2,800 passengers and will have a crew of 200. Its length will be about 214 metres and it will have a gross tonnage of about 57,000.

Calculate your "nitrogen footprint"

Now there is an online tool that can estimate your individual nitrogen footprint. By entering data on eating habits, energy use and travel patterns, users are given a value that can be compared to the annual national average in the Netherlands, Germany or the United States, which is 24–25 kg in the two European countries and 41 kg in the U.S. In all three countries, more than half the footprint can be related to food.

The scientists behind the project hope the tool will inspire users to reduce their footprint by reducing airplane travel, choosing renewable energy, and eating less meat, particularly beef and thereby sending a strong signal to politicians that the nitrogen problem should be taken seriously. James Galloway, one of the leading scientists behind the project, says he believes that there are readily available solutions and that it is only commitment that is lacking: "By connecting consumers, producers and policymakers, we can solve it."

The tool can be found at: <http://www.n-print.org/>



ADRIAN KENYON / CREATIVE COMMONS

Air pollution from traffic kills 5000 a year in UK

Premature deaths due to $PM_{2.5}$ are estimated to cost the UK between €7.5-77 billion every year, corresponding to 0.4-3.5 per cent of the country's gross domestic product.

UK combustion emissions cause around 13,000 premature deaths within the country every year, while an additional 6000 deaths in the UK are caused by non-UK European Union combustion emissions, according to a recent study by Steve Yim and Steven Barrett, pollution experts from MIT in Massachusetts.

Their analysis breaks down mortality rates from particulate matter ($PM_{2.5}$) according to emission sectors, showing that the leading domestic contributor is transport, with road transport causing 4900 early deaths per year and other transport causing 2600 early deaths per year. Power generation and industrial emissions result in 2500 and 830 early deaths per year, respectively, and other source sectors (e.g. commercial and residential) are responsible for 1600 early deaths per year. All figures are based on emissions data for 2005.

The nearly 5000 premature deaths each year caused by exhausts from cars, trucks and buses across the UK can be compared to the figure of 1850 early deaths from road traffic accidents in the UK in 2010.

The authors note that their road transport estimate in particular

is likely to be an underestimate, as the peaks in local roadside $PM_{2.5}$ concentrations may not be accurately represented by their modelling.

Overall, the study's findings are in line with an earlier report by the UK government's Committee on the Medical Effects of Air Pollutants (COMEAP), which found that air pollution by $PM_{2.5}$ in 2008 was responsible for about 29,000 premature deaths in the UK, corresponding to about 340,000 life-years lost per year (see AN 1/11, p. 12). The COMEAP study was based on a combination of modelling and measurements, while the MIT study is based solely on modelling.

In terms of economic impacts, the premature deaths caused by elevated

concentrations of $PM_{2.5}$ due to emissions from combustion sources are estimated to cost the UK between UK£6 and 62 billion (€7.5-77 billion) per year. This corresponds to 0.4-3.5 per cent of the UK gross domestic product in 2007.

International exchange in premature deaths due to $PM_{2.5}$ goes both ways, and more than 3000 premature deaths to non-UK European citizens can be attributed to UK emissions. According to the authors, this implies that on a per unit emission basis, the UK exports more public health damage to the rest of the EU than it imports, which is consistent with the prevailing south-westerly and westerly wind patterns over this part of Europe.

Christer Ågren

Table: Premature deaths per year from $PM_{2.5}$ in the UK split by domestic source sectors.

Sector	Early deaths/year
Road transport	4900
Other transport	2600
Power generation	2500
Commercial, institutional, residential and agriculture	1600
Industry	830
Sum UK sources	13,000
Imported pollution	6000
Sum	19,000

Public Health Impacts of Combustion Emissions in the United Kingdom. By Steve Yim and Steven Barrett. *Environmental Science & Technology*, 2012; 46 (8): 4291-4296; DOI: 10.1021/es2040416

Health effects of black carbon

Reducing people's exposure to PM_{2.5} containing black carbon should lead to a reduction in the health effects associated with PM.

Exposure to black carbon is linked to health impacts such as cardiopulmonary morbidity and mortality, and reducing people's exposure to particles containing black carbon will therefore also reduce such adverse health impacts, according to a recent report published by the World Health Organization (WHO).

Prepared for the Task Force on Health Aspects of Air Pollution under the Convention on Long-range Transboundary Air Pollution, the report was produced as input to the revision of the Convention's Gothenburg Protocol (see article on front page), and it presents the results of a systematic review of evidence of the health effects of black carbon in ambient air.

The report concludes that toxicological studies suggest that black carbon may operate as a universal carrier of a wide variety of chemicals of varying toxicity to the human body, and that reducing people's exposure to particulate matter containing black carbon should reduce its effects on their health.

Black carbon (BC) is said to be an operationally defined term, which describes carbon as measured by light absorption, and as such it is not the same as elemental carbon (EC), which is usually monitored with thermal-optical methods. As yet, there are no generally accepted standard methods to measure BC or EC in atmospheric aerosol, so there is a need for standardisation.

The main sources of black carbon emissions are diesel-driven combustion engines (in road vehicles, non-road mobile machinery and ships), residential burning of wood and coal, power stations using heavy oil or coal, field burning of agricultural wastes, as well as forest and vegetation fires.

Due to the location of these sources, the spatial variation of BC in ambient air is greater than that of PM_{2.5}, but in general ambient measurements or model estimates of BC are said to reflect personal exposures reasonably well and with similar precision as for PM_{2.5}.

The review was carried out by a number of experts selected by the WHO. After reviewing the available time-series studies, as well as information from panel studies, it was concluded that these provided sufficient evidence of an association of short-term (daily) variations in BC concentrations with short-term changes in health (all-cause and cardiovascular mortality, and cardiopulmonary hospital admissions). Furthermore that cohort studies provided sufficient evidence of associations of all-cause and cardiopulmonary mortality with long-term average BC exposure.

Studies of short-term health effects showed that the associations with BC are more robust than those with PM_{2.5} or PM₁₀, suggesting that BC is a better indicator of harmful particulate substances from combustion sources (especially traffic) than undifferentiated PM mass. The evidence from long-term studies was however inconclusive – in one of the two available cohort studies using multi-pollutant models in the analysis, the effect estimates for BC were stronger than those for sulphates, while an opposite order in the strength of relationship was suggested in the other study.

According to the report, there are not enough clinical or toxicological studies to allow an evaluation of the qualitative differences between the health effects of exposure to BC or to PM mass (for example, different health outcomes), or to allow quantitative comparison of the strength of the associations or identification of any distinctive mechanism of BC effects.

The review of the results of all available toxicological studies suggested that BC (measured as EC) may not be a major directly toxic component of fine PM, but it may operate in particular, as a universal carrier of a wide variety of combustion-derived chemical constituents of varying toxicity to sensitive targets in the human body such as the lungs, the body's major defence cells and possibly the systemic blood circulation.

Based on these findings, the Task Force on Health agreed that a reduction in exposure to PM_{2.5} containing BC and other combustion-related PM material for which BC is an indirect indicator should lead to a reduction in the health effects associated with PM. The Task Force therefore recommended that PM_{2.5} should continue to be used as the primary metric in quantifying human exposure to PM and the health effects of such exposure, and for predicting the benefits of exposure reduction measures. It also recommended that the use of BC as an additional indicator may be useful in evaluating local action aimed at reducing the population's exposure to combustion PM.

Christer Ågren

Health effects of black carbon. By Nicole AH Janssen, Miriam E Gerlofs-Nijland, Timo Lanki, Raimo O Salonen, Flemming Cassee, Gerard Hoek, Paul Fischer, Bert Brunekreef and Michal Krzyzanowski. Available from WHO: <http://www.euro.who.int/en/what-we-publish/abstracts/health-effects-of-black-carbon>



Warning - Black carbon can seriously damage your health.

ESTHER SIMPSON / CREATIVE COMMONS

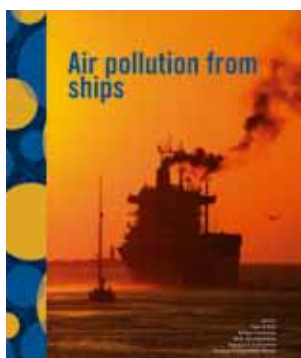
Recent publications from the Secretariat

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For Clean Air Everywhere

A new brochure from Transport & Environment, European Environmental Bureau and AirClim. Target readers are regional and local decision makers, local authorities, environmental organisations and the interested general public. It starts off with a short guide to the effects of major air pollutants on human health, recommended guidelines and current EU standards. Followed by twelve practical steps for cleaner air in our cities.



Ship emissions

Shipping is a major cause of harmful air pollution in Europe and by 2020 shipping emissions of SO₂ and NO_x could exceed the emissions of these pollutants from all other EU sources.

This pollution must be reduced dramatically to protect health and the environment and to make shipping a more sustainable form of transport.

Technical measures exist that could cut the level of pollution from ships by at least 80-90 per cent and doing so would be much cheaper than cutting the same amount from land-based sources.



Boreal Forest and Climate Change

The fate of the vast boreal forest belt of the northern hemisphere is crucial for global climate. Regional perspectives on this issue are given in "Boreal Forest and Climate Change - regional perspectives" (by Roger Olsson, April 2010). The expected rate of warming varies considerably within the Arctic region, as does the state of the forest. This means that the possible climate effects - and the possibilities to mitigate them - will be different.

Our possibilities to protect and manage these forests for climate mitigation are presented in "To Manage or Protect" (by the same author, October 2011). Turning old-growth boreal forest into managed forest has a negative impact on climate in the short and medium term. Reducing consumption of paper and using more of the harvested wood for timber and fuel would be one option.

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Coming events

4th MinNox Conference. Berlin, Germany, 12-13 June 2012. Information: www.iav.com/termine/iav-tagung/4-tagung-minnox

2nd Urban Environmental Pollution Conference. Amsterdam, Netherlands, 17-20 June 2012. Information: www.uepconference.com

RIO+20 United Nations Conference on Sustainable Development. Rio de Janeiro, Brazil. 20-22 June 2012. Information: www.uncsd2012.org/rio20/

11th World Wind Energy Conference & Renewable Energy Exhibition "Community Power - Citizens' Power". Bonn, Germany, 3-5 July 2012. Information: www.wwec2012.net/wwec2012/

4th International Symposium on Air Quality Management at Urban Regional and Global Scale & IUAPPA Regional Conference. Istanbul, Turkey, 10-13 September 2012. Information: <http://aqm2012.itu.edu.tr>

CLRTAP Working Group on Strategies and Review. Geneva, Switzerland, 11-14 September 2012. Information: www.unece.org/env/lrtap/

16th International Conference on Heavy Metals in the Environment. Rome, Italy, 23-27 September 2012. Information: <http://ichmet16.ii.cnr.it>

27th European Photovoltaic Solar Energy Conference and Exhibition. Frankfurt, Germany, 24-28 September 2012. Information: www.photovoltaic-conference.com/

IMO Marine Environment Protection Committee (MEPC). London, UK, 1-5 October 2012. Information: <http://www.imo.org/>

Worlds within reach - from science to policy. IIASA 40th Anniversary Conference. Luxembourg, Austria, 24-26 October 2012. Information: <http://www.iiasa.ac.at/conference2012/>

19th International Transport and Air Pollution Conference (TAP). Thessaloniki, Greece, 26-27 November 2012. Information: <http://tapconference.org/>

UN FCCC Conference of the Parties (COP) 18. Qatar, 26 November - 7 December 2012. Information: <http://unfccc.int/>

Better Air Quality. Hong Kong, 5-7 December 2012. Information: <http://www.baq2012.org/>

CLRTAP Executive Body. Geneva, Switzerland, 11-13 December 2012. Information: www.unece.org/env/lrtap/

Air Quality and Emissions 2013. Telford, United Kingdom, 13-14 March 2013. Information: www.aqeshow.com